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SHORT COMMUNICATION

BREEDING SUCCESS OF NEW ZEALAND PIGEONS (*HEMIPHAGA NOVAESEELANDIAE*) IN RELATION TO CONTROL OF INTRODUCED MAMMALS

Summary: A 55 ha remnant of coastal native forest at Wenderholm Regional Park (near Auckland) was selected as the site for a pilot experiment to test if rat control could yield measurable benefits in increased productivity of New Zealand pigeons. Talon 50WB poison baits were used to reduce rat numbers over the summer of 1992-93. Pigeon breeding success was significantly higher (5 fledglings from 11 nests) than in preceding summers without rat control (no fledglings from 27 nests).

Key words: Nest predation; poisoning; *Rattus rattus*; ecological restoration.

Introduction

New Zealand pigeons (*Hemiphaga novaeseelandiae* Gmelin) are large (*c*. 650 g) fruit pigeons, endemic to the New Zealand archipelago. Like most fruit pigeons, they lay a single egg and have extended incubation periods (28 - 29 days) and fledging periods (30 - 45 days).

Recent research in three mainland areas of native forest has revealed low breeding success of New Zealand pigeons (Clout *et al*., 1995). Losses of eggs and chicks to introduced mammals were the main causes of nest failure. At Wenderholm Regional Park, near Auckland, all 20 pigeon nests located between 1988 and 1990 failed at the egg stage, with rats and stoats being the main presumed predators. With this background, Wenderholm was selected as the site for a pilot study to test if rat control could yield measurable benefits in increased productivity of New Zealand pigeons.

Study Area

The 55 ha remnant of lowland native forest at Wenderholm Regional Park (36 ∞32'S, 174 ∝42'E) is bounded by sea or estuary on three sides and on the other by pastoral farmland (Fig. 1). It extends from sea level to 100 m a.s.l. and contains a wide range of fruiting species (Clout *et al*., 1995).

Wenderholm normally supports a resident population of *c*. 50 - 100 New Zealand pigeons, but others visit to feed on seasonal fruits (Clout *et al*., 1995). Several other native and introduced bird species are present. The Wenderholm forest also contains a variety of introduced mammals, including ship rats (*Rattus rattus* L.), house mice (*Mus musculus* L.), stoats (*Mustela erminea*, L.), ferrets (*M. furo* L.), feral cats (*Felis catus* L.), hedgehogs (*Erinaceus europaeus* Barrett-Hamilton), rabbits (*Oryctolagus cuniculus* L.), and brushtail possums (*Trichosurus vulpecula* Kerr). Possums have been controlled by annual trapping and cyanide poisoning in winter since 1986, but a drop in the annual number taken since 1992 may reflect a recent decline in their density (James, 1995).

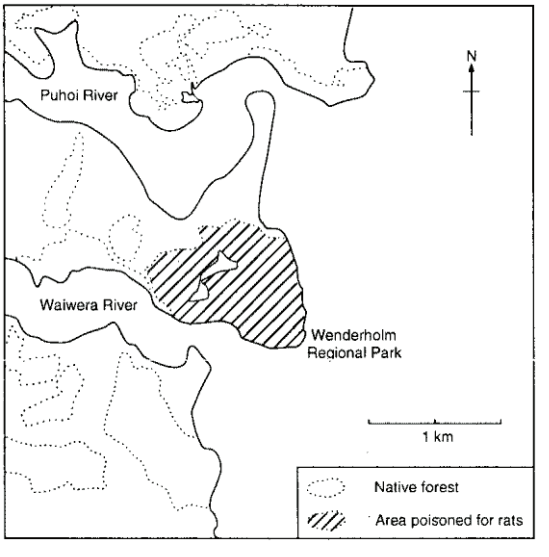

Figure 1. *Location of Wenderholm Regional Park, showing the extent of the native forest area in which rat poison was laid.*

Methods

Rodent abundance

The relative abundance of ship rats at Wenderholm was measured by standardised trapping at the same 36 sites in late November each year from 1990 to 1993. The trapping sites were spaced at *c*. 50 m intervals along a forest track running through the northern and central section of the patch. At each site two breakback "Ezeset" rat traps were baited with peanut butter and set for three consecutive nights, with daily checking. All rodents caught were identified and the catch per 100 trap-nights was calculated according to the method of Nelson and Clark (1973). The standardised trapping was repeated over four consecutive nights from 21-24 July 1993 to index rat numbers in that winter.

Further indirect indication of trends in rodent abundance was obtained from the pattern of removal of poison baits from bait stations.

Rat control

The timing of rat control was chosen to protect New Zealand pigeon nests through the peak of the nesting period, in late spring and early summer (Clout *et al*., 1995). In the week beginning 18 October 1992, rodent poison (Talon 50WB pellets, manufactured by ICI Crop Care, Nelson, N.Z.) was laid in 217 bait stations placed at 50 m intervals along lines spaced *c*. 100 m apart throughout the forest patch. The bait stations were 50 cm lengths of corrugated plastic drainpipe, pinned to the ground with wire hoops. Each station was baited with six Talon pellets, which were regularly replenished until early February 1993. Bait stations were checked (and rebaited as necessary) at twice-weekly intervals for the first fortnight (when bait take was highest), weekly intervals for the next eight weeks and fortnightly intervals for the last six weeks.

Nest checks

Nests were located at the incubation stage either by radiotracking individual pigeons fitted with radio transmitters (Karl and Clout, 1987; Clout *et al*., 1995), by following untagged pigeons seen collecting nesting material, or by searching the subcanopy in areas of apparent courtship or nesting activity. When a nest was found it was observed from the ground only. Care was taken to avoid approaching close to the nest tree, to reduce disturbance and risks of attracting predators. Nest trees were not climbed unless it was suspected that the nest had failed or a well-grown chick was present. The cause of failure for unsuccessful nests was assessed by searching for abandoned or fallen eggs or evidence of predation (egg or chick remains) in or beneath the nest. A particular predator was blamed only when there was positive evidence (e.g., toothmarks in eggshell). Otherwise the cause of failure was classed as "unknown predator" or merely "unknown".

Results

Rodent abundance

Snap-trapping in late November of 1990 and 1991 yielded 10.8 and 15.2 ship rats per 100 trap-nights respectively. In late November 1992, approximately 5 weeks after rodent poisoning began, snap-trapping yielded no rodents, despite fine weather throughout the trapping session.

Bait take peaked in the second week of poisoning (Fig. 2) and declined steeply thereafter, although some poison baits continued to be taken through until the beginning of February, especially around the forest margins. Possums and mice were suspected of being responsible for much of the later bait take, based on evidence such as removal of wire hoops and movement of bait stations (attributed to possums) and baits partially eaten *in situ* with small tooth marks (attributed to mice). The discovery of some recently dead possums indicated that rat poisoning directly reduced their numbers also. The possibility of some secondary poisoning of other predators (e.g., stoats) cannot be discounted either (E. C. Murphy, *pers. comm.*).

Rodent trapping in late July 1993, five months after poisoning ceased, revealed that ship rat abundance was still low, at 0.8 per 100 trap-nights.

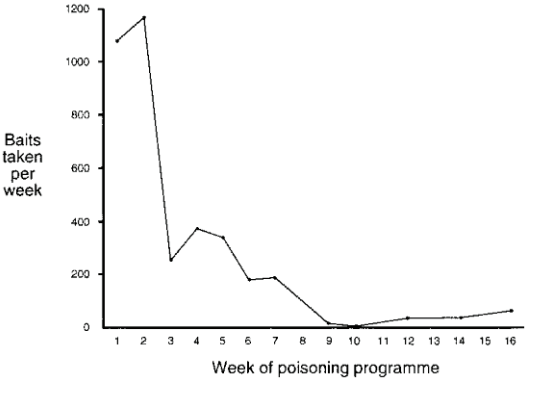

Figure 2. *Bait take throughout the poisoning programme at Wenderholm Regional Park, 1992-1993. (Week 1 = 18-24 October 1992, week 16 = 1-6 February 1993).*

However several mice (9.3 per 100 trap-nights) were caught in the rat traps. Mice had not been caught in any of the previous rat-trapping sessions.

New Zealand pigeon breeding success

Pigeons nested at Wenderholm in every summer from 1988-93, with a peak of nesting from November to January each year. In addition to the 20 nests from 1988-90 described by Clout *et al*. (1995), seven further nests were found from 1990 to 1992, before rat poisoning commenced. All 27 nests found from 1988-92 failed at the egg stage, with 17 eggs apparently taken by predators. Seven egg predations were assigned to rats, four to stoats and six to unknown predators.

Eleven New Zealand pigeon nests were found in the late spring and early summer of 1992-93, after rat poisoning began. Five of these produced fledglings: a significantly higher rate of breeding success ($P<0.001$, Fisher's exact test) than the zero production from 27 nests found in the preceding seasons. Plant phenology data for Wenderholm show that 1992-93 was not an unusual year for pigeon food supplies (*unpubl. data*).

Discussion

Rodent control

The poisoning programme at Wenderholm was apparently successful in reducing rat abundance to very low levels in the 55 ha forest patch. We conclude from the results of our pilot experiment that it is feasible to use poison bait stations to control ship rats in patches of mainland forest. The pattern of bait take and the snap-trapping results from November 1992 suggest that the decline was relatively rapid. Similar results have been obtained with anticoagulant poisons used against rats on islands around New Zealand (Taylor and Thomas, 1989) and in other forest areas on the mainland (Innes *et al*., 1995).

The success of the rat control at Wenderholm was probably enhanced by its geographic position on a peninsula. The rodent trapping indices from Wenderholm show that little rat reinvasion or population recovery had taken place by July 1993, five months after poisoning ceased. The numbers of mice apparently increased after poisoning ceased, reaching 9.3 per 100 rat trap-nights in July 1993. Mice had not been captured in rat traps set at Wenderholm before, although winter trapping had not been conducted previously. Innes *et al*. (1995) also noted apparent increases in mouse abundance after rat poisoning. It is possible that mouse numbers increase after poisoning because of reduced competition and/or predation by ship rats: a hypothesis worth testing through further research.

Breeding success of New Zealand pigeons

The production of five fledglings from 11 nests found during the period of rat control is a similar level of nesting success (*c*. 50%) to that achieved by New Zealand pigeons on islands containing no predatory mammals apart from kiore (*Rattus exulans* Peale) (R.J. Pierce, *pers. comm.*).

Our results suggest that rat control may benefit breeding success of New Zealand pigeons. However, caution is necessary in interpreting these results because the pilot study lacked spatial controls and other predators (e.g., possums, stoats) may also have declined in numbers at the same time as the rats. Further research, involving spatial controls and close monitoring of the fate of individual nests, is needed to test and separate out the specific benefits of rat control for improving productivity of New Zealand pigeons and other native birds.

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