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Dispersal by juvenile North Island weka (*Gallirallus australis greyi*)

G. N. BRAMLEY

Department of Ecology, Massey University, Private Bag 11-222, Palmerston North, New Zealand
Present address: P.O. Box 785, Kerikeri 0470, Northland
garyandcarey@hotmail.com

Abstract Reports of dispersal by juvenile weka (*Gallirallus australis greyi*) on the North Island are rare. Estimates of the distance dispersed and the rate of survival of dispersers are important factors to be considered for weka conservation. I captured 20 young weka during a 2-year study and attached radio transmitters to 4 of them. In addition, I was able to measure the distance travelled by 3 banded weka that were either recaptured or seen again, and 1 weka that was recovered dead. Newly independent weka used a part of their parental home range at first, then moved up to 3.5 km. Two-stage dispersal, where young weka leave their parents but remain close by and move away later, has been reported on offshore islands: my results are consistent with that type of dispersal. More research is needed on weka dispersal because it is likely to be linked to factors important for their conservation and management.

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INTRODUCTION

The North Island weka (*Gallirallus australis greyi*) is a flightless, indigenous rail formerly found throughout the North Island of New Zealand (Marchant & Higgins 1993). The range of the North Island weka has contracted since at least 1900 coinciding with a marked decrease in numbers (Beauchamp *et al.* 1999). Weka are now limited to small areas on the East Coast of the North Island, Mokoia Island in Lake Rotorua, and to 4 offshore islands. North Island weka will probably become extinct on the North Island mainland unless they are managed to increase both the number of birds and the range of current populations. Predators have been implicated in the failure of weka to recover from former declines (Bramley 1994, 1996; Bramley & Veltman 2000a), and in the failure to establish new populations (Bramley & Veltman 1998), but the original agent of decline remains unknown.

In early 1992, I began a study of the ecology of North Island weka at a 105 ha study area which formed part of the Waikohu river valley at Rakauroa, between Gisborne and Opotiki, North Island, New Zealand. The study area, a mosaic of farmland and small forest patches, is described elsewhere (Bramley 1996; Bramley & Veltman 2000a). The productivity of weka at Rakauroa appeared to be very low, but it was not clear whether the productivity appeared low because young weka were being killed or they were undetected because they were leaving the study area as soon as they became independent.

Begon *et al.* (1990: 166) defined dispersal as "the process by which individuals escape from the immediate environment of their parents and neighbours" and identified 2 types of dispersal – "exploratory", where individuals explore many sites before returning and settling in 1 of the sites, and "non-exploratory", where individuals visit a succession of locations but eventually stop (with no element of return). The mode of dispersal adopted by North Island weka is unknown.

Weka are about the size of a domestic hen. Being flightless, their dispersal ability should be limited in comparison to that of most flighted species. Spurr (1979) described the dispersal abilities of weka as "moderate" based on their physical and ecological traits, level of sub-speciation, presence on offshore islands (not introduced by humans), and abundance and distribution on the mainland. Few records of weka dispersal have been published, the most recent account being that in Marchant & Higgins (1993), which considers some previously unpublished data from island

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Table 1 Dispersal of juvenile North Island weka (*Gallirallus australis greyi*) from their parental home range. Based on radio-tracking (R) and trapping (T) or sightings (S) of banded birds at Rakauroa, North Island, New Zealand.

Weka	Sex	Age at first capture	Age at last sighting	Dispersal
B-A	male	6 weeks	23 months (S)	none
A-GY	female	13 weeks	13 weeks (T)	none
R-GA	female	8 weeks	16 weeks (T)	none
A-RG	female	12 weeks	11 months (R)	680 m
R-RA	male	9 weeks	12 weeks (R)	270 m
A-GB	male	6 weeks	18 weeks (R)	220 m
BR-A	male	9 weeks	17 weeks (T)	1.5 km
YG-A	male	4 months	2 years (S)	3.5 km

populations of weka (not just the North Island subspecies, A.J. Beauchamp, pers. comm.). Dispersal by individual weka has not been studied on the main islands of New Zealand. By radio-tracking and analysing resightings and retrappings of banded birds, I was able to estimate the distance young weka moved from their parental area and to obtain more information on their fate at Rakauroa.

METHODS

The study lasted from March 1992 until January 1994, but the area was also searched for banded birds over 2 days in January 1995. Weka were caught using possum cage traps (300 × 300 × 700 mm deep) baited with cheese. Dependent chicks were caught either alone or with 1 of their parents. Weka chicks were banded with 1 metal band (New Zealand Banding Service) and either 1 or 2 coloured plastic bands in unique combinations.

Three chicks caught between October 1993 and January 1994 were each fitted with a back-mounted transmitter (mean weight 11.4 g; Sirtrack Electronics, Havelock North, New Zealand) designed to be shed with feather moult. A small area of feathers on the back was cut short and the transmitter was bonded by Superglue® (Selleys Home Products, Auckland, New Zealand) to a piece of chiffon that was then attached to the shortened feathers using Vetbond® body cement (Smith & Nephew Ltd, Wellington, New Zealand). Each transmitter was powered by a 9-week Li-battery cell and had an external whip aerial 15 cm long. Transmission frequencies were set at intervals between 160 and 162 MHz. Signals were followed using a TR-4 (Telonics) receiver combined with a hand-held 3-element Yagi antenna.

I determined the location of the juveniles daily to measure how far they had moved from the nest. All 3 chicks had been raised in home ranges from which ferrets and cats had been removed. Removal of these predators resulted in significantly lower predator sightings in the weka home ranges compared to either home ranges from which predators had not been removed or the same home ranges before predator control began (Bramley 1996).

In 1992 and 1993, 20 weka were banded as juveniles and 1 female (A-RG) was fitted with a 19.3g, 10-month-battery radio transmitter. In addition, a young adult male weka (YG-A), aged by eye colour (Beauchamp 1998), was also trapped and banded. Subsequent live-trappings and resightings of these birds augmented the data on dispersal gained from radio-tracking data.

RESULTS

Radio-tracking

One radio stopped working within 24 h of being put on the bird. Two transmitters remained attached and operational for 42 and 23 days respectively. Male A-GB, first caught at about 6 weeks of age, remained in an area of 0.5 ha over 42 days, and was then recaptured once after removal of the radio transmitter. Male R-RA, first captured at about 9 weeks old, had a home range of 5.0 ha over the 23 days its transmitter was attached. Neither of these radio-tracked weka was found more than 270 m from the nest site where they hatched (Table 1). Both remained exclusively in dense scrub or under fallen trees overgrown with vines and weeds in areas of their parental home range. Both were separated from their parents, who had begun to use other areas of their home range.

Female A-RG was trapped as a juvenile (≤ 12 weeks old). During the months after her capture in January 1993, she moved ≤ 680 m from her parental home range. In July 1993, she appeared to have paired with a male in an area adjacent to her natal area (720 m from where she was first trapped).

The total distance dispersed by these young weka, and the banded birds, was generally low (Table 1).

Recapture and sightings of banded birds

Male B-A was seen again as an adult with 3 chicks on the 21 January 1995. He had not been seen since soon after fledging nearly 2 years before and had paired with an unbanded female and taken over his parental home range. There was no sign of either of his (banded) parents. Male YG-A from an unknown parental home range was banded as a young adult in November 1992 and had moved 3.5 km from where he was trapped by October 1994, when he was observed with 2 chicks and reported to the Department of Conservation Field Office by a member of the public. Two days later he was collected from the same area, dead, having been hit by a car (A. Bassett, Department of Conservation, Gisborne, pers. comm.).

DISCUSSION

Although the study area was relatively large, the short life and range of the radio transmitters meant that I could

not have found young weka that had moved long distances (>1.5 km) from their trap point. Nonetheless the available evidence suggests that dispersal was limited. Young weka may show limited dispersal because of habitat saturation (i.e. a shortage of suitable openings for breeding), because the benefits of philopatry outweigh the gains of dispersal, or because of some interaction between these two factors (Emlen 1991). Because there are now few weka on the North Island, especially compared to historic levels, habitat saturation is extremely unlikely. Weka distribution in my study area was clumped around scrub-covered, damp areas (Bramley 1994), and there were still unoccupied patches of habitat that appeared, at least superficially, to be suitable for weka. Why weka did not invade those patches is unknown, but it suggests that they may gain some benefit by not dispersing.

Weka may have chosen to stay near other weka because there was more chance of finding a mate there than in areas with few or no weka, especially in this population, where I caught more males than females (Bramley & Veltman 2000a). The characteristic weka calling (Beauchamp 1987; Bramley & Veltman 2000b) may serve to identify potential mates to other weka and to locate habitat patches in which these birds reside.

Previous observations of banded birds have suggested that weka move away from their natal area in 2 stages at least on Kapiti and Kawau Islands (Marchant & Higgins 1993). Previous authors have suggested that birds move away slowly over the first 4 months of life, after independence is achieved at 9-12 weeks of age (Beauchamp 1987). They may use part of their natal area but feed independently of their parents, who may be feeding other chicks (Beauchamp 1987; Marchant & Higgins 1993). This initial drift is followed by a more rapid movement further away from the parental area (mean 1.3 km, max. 5 km (Marchant & Higgins 1993)). Two-stage dispersal also appeared to be shown by radio-carrying and other birds at Rakauroa, with similar distances involved, despite weka on islands being probably limited in their movements by the size of the island itself. The limited distances moved by young weka from their parental home range in this study suggests most other juveniles disappeared because they had been killed rather than moved away.

The historic declines of weka, their anecdotal "mass migrations" (Marchant & Higgins 1993), and their historic episodic appearance and disappearance in different areas have puzzled ornithologists for many years (Guthrie-Smith 1910; Turbott 1967; Taylor & van Perlo 1998), and there has been much speculation as to their cause (Beauchamp *et al.* 1999). I suggest that a better understanding of dispersal by juvenile weka is necessary before these phenomena can be understood. If juveniles in some areas experienced high levels of mortality (perhaps from predation) in some years, then the anecdotes of "mass migration" may be attributable to sudden declines in areas where mortality is temporarily elevated and population increases in areas where mortality is temporarily low, rather than movements by site-attached adult weka. More work is needed to discover the frequency and distance of dispersal by juvenile weka, what triggers that dispersal, and to measure the survival and productivity of dispersers versus non-dispersers in different areas. If, as this small study suggests, most young weka are killed in or near their natal area then that will provide a clear indication of the management required in areas of the North Island where weka populations persist. Such information will be important for the management and protection of weka, where mortality during dispersal may serve to reduce the pool of local weka in a patch without subsequent recruitment in or from other patches.

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