Western weka (*Gallirallus australis australis*) monitored before and after an aerial application of 1080 baits in the Copland Valley, Westland National Park

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A B S T R A C T

The effect on western weka (*Gallirallus australis australis*) of possum (*Trichosurus vulpecula*) control using aerially applied cereal baits containing the toxin sodium monofluoroacetate (1080) was investigated in the Copland Valley. Radio transmitters were attached to 15 weka and these birds were monitored before and after the possum control. Five weka died before the control operation. Mammalian predators (probably stoats) killed three, and two died of unknown causes, although one of these was possibly also preyed upon. Of the remaining 10 weka, eight were definitely exposed to 1080, all of which survived the two months following the 1080 operation.

Keywords: weka, *Gallirallus australis australis*, 1080, sodium monofluoroacetate, mammalian predators, Copland Valley

1. Introduction

In New Zealand, bait containing compound 1080 (sodium monofluoroacetate) has been widely used by the Department of Conservation (DOC) for controlling possum (*Trichosurus vulpecula*) numbers to reduce the damage they cause to indigenous forest ecosystems. The use of aerially applied 1080 baits for possum control has resulted in the poisoning of non-target wildlife including birds and invertebrates (Spurr & Powlesland 1997). Weka (*Gallirallus australis australis*) have occasionally been found dead following 1080 operations (Spurr 1994), and 1080 has been identified from carcasses of North Island weka (*Gallirallus australis greyi*). The 1080 in poisoned weka may have been the result of eating baits or indirectly from eating poisoned prey (Spurr 1979).

Weka are a high priority for further research into their susceptibility to 1080 poisoning (Spurr & Powlesland 1997) despite having been monitored during three 1080 operations (Walker 1997; Spurr 1988; C. Miller pers. comm.). Further investigation is needed for several reasons. Western weka are listed as being in serious decline (Hitchmough 2002). Also, because they are known to eat carrot and cereal baits, and to scavenge dead possums and other poisoned animals, they are susceptible to both primary and secondary poisoning (Spurr 1993). Monitoring has been carried out with an adequate number of radio-tagged weka in only one previous study. Walker (1997) monitored 24 radio-tagged weka in Northwest Nelson and the Marlborough Sounds, following two possum control operations in 1994 using cereal baits (5 kg/ha, 0.15% 1080). A study at Rotomanu in 1994 had a sample of only eight weka that were monitored following a possum control operation using cereal baits (5 kg/ha, 0.15% 1080) (C. Miller pers. comm.). Spurr (1988) undertook 5-minute bird counts in the Copland Valley before and after a 1080 operation in 1986 using carrot baits (20 kg/ha, 0.2% 1080), but an insufficient number of weka were present in the counts for the effect of 1080 to be determined. In 1996, a second possum control operation in the Copland Valley was carried out using cereal baits (5 kg/ha, 0.15% 1080), but the effect of the operation on bird populations was not monitored.

During June 2000, the Copland and Karangarua valleys were part of a possum control programme undertaken in South Westland by DOC. This provided an opportunity to monitor weka through a 1080 operation. This paper reports the results of this monitoring.

2. Methods

2.1 1080 POSSUM CONTROL

On 14 June 2000, green-dyed, cinnamon-flavoured cereal baits with a 1080 concentration of 0.15% weight for weight were aerially distributed over the Copland Valley block at a rate of 3 kg/ha. No bait was distributed above the sub-alpine scrub line, within 50 m of major waterways, within 20 m of the Copland track, or within 100 m of the Welcome Flat and Douglas Rock huts. Possum control was undertaken in the buffer areas using Victor leg-hold traps raised on Scot boards and ground-laid cyanide paste with a flour-based lure.

2.2 WEKA CAPTURE

Using baited cage traps, hand nets and hand nooses, 15 weka were captured within the Copland Valley possum control area in December 1999. Amplified weka calls played through a Sony tapedeck were used to lure birds into the open for capture. The date and location of capture, band combination, transmitter frequency, weight, measurements, and sex of each weka caught were recorded (Table 1).

Metal bands (size M) were fitted to either leg and wrapped with coloured reflective tape to provide individual identity from a distance. Transmitters and harnesses were supplied by Sirtrack Ltd. The transmitters had a battery life of 12.9 months, and a pulse rate of 30 pulses per minute, doubling to 60 pulses per minute after 27 hours of inactivity to indicate mortality. Flying-bird harnesses were used to attach the transmitters to the weka because they were able to remove transmitters attached with non-flying bird harnesses when moving through thick vegetation. The harnesses did not have a weak link, which also helps alleviate the problem of weka dropping their transmitters.

The measurements taken (bill length and depth, tarsus length and width, mid-toe length, mid-toe plus claw length and spur length) were used to build on the morphological data for western weka on the West Coast. Sex was assessed by mid-toe and mid-toe plus claw measurements, and the relationships of other measurements.

2.3 WEKA MONITORING BEFORE AND AFTER THE POSSUM CONTROL OPERATION

The weka were checked approximately monthly from when the transmitters were attached in December 1999, until two months following the 1080 operation. Most monitoring was done using ground-based observers tracking the birds with a Telonics TR-4 receiver and hand-held three-element Yagi aerial. Some tracking was done from a helicopter, using the receiver and aerial while observers were flown by helicopter up the valley.

TABLE 1. WEKA CAPTURE, BANDING AND TRANSMITTER DETAILS, COPLAND VALLEY. (DETAILS FOR SOME BIRDS ARE MISSING AS THEY WERE PROCESSED QUICKLY TO ALLOW THEM TO RETURN TO CHICKS.)

DATE	NAME	GRID REF	BAND	TX	SEX	WEIGHT (g)	BILL (mm)		TARSUS LENGTH (mm)		TARSUS WIDTH (mm)		MID-TOE (mm)		MID-TOE PLUS CLAW (mm)		SPUR (mm)	
							LENGTH	DEPTH	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
7 Dec 1999	Flash	698 234	M-38412	72 (-1)	M	1300	51.9	19.4	68.0	70.8	14.3/11.4	13.8/11.4	64.3	61.8	79.9	75.4	5.2	5.1
7 Dec 1999	Prism	695 234	Orange M-63431	88 (-1)	M	1200	52.0	12.5	61.4		11.7/10.6		60.0	57.8	74.5	75.5	6.2	6.5
7 Dec 1999	Clyde	696 240	M-38413	86 (-1)	M	950	51.9	18.0	57.9		12.1/10.6	10.6	60.8		71.0			3.7
7 Dec 1999	Bonny	696 240	Red M-38414	96 (-3)	F	950	46.7	14.6	58.2		12.0/8.5		53.6		66.2		7.0	gone
9 Dec 1999	Houdini	672 254	Blue M-38418	82 (-3)	M	1200	50.2	16.4	61.6	61.7	12.3/10.5	13.1/10.3	64.0	61.1	75.5	73.0	6.1	5.8
10 Dec 1999	Bock	636 263	White M-38416	66 (-1.5)	M	1100	53.9	12.2	65.6	63.2	12.4/10.9	13.5/10.6	62.3	62.9	77.9	78.2	11.4	9.1
11 Dec 1999	Raj	636 263	Yellow M-63432	90 (-2)	M	1300	51.7	18.8	64.8	66.6	14.0/12.3	13.5/10.9	61.9	60.1	76.7	75.1	7.9	6.0
11 Dec 1999	Cyclops	636 263	Green M-38417	98 (-3)	M	1250	54.3	19.6	67.5	63.0	10.7	10.5	62.2	60.6	82.1	78.4	8.2	8.2
12 Dec 1999	Pres	667 255	Red M-38418	70 (-2)	M	1200	52.1	18.7	61.0	62.1	10.1	9.8	59.6	56.7	75.2	70.9	6.2	5.0
12 Dec 1999	10	643 257	Orange M-38419	92 (-1)	M	1100	51.8	19.9	63.7	62.6	10.6	10.7	60.9	64.3	74.6	74.8	9.2	gone
13 Dec 1999	Daphne	638 259	White M-63421	78 (-2.5)	F	700	45.2	14.5		58.0		9.5		87.5		69.2		9.9
13 Dec 1999	Noddy	635 263	Blue M-38420	68 (-2.5)	M	1050	55.1	17.6	68.6	70.1	10.7	10.7	65.9	63.3	80.1	79.1	7.0	5.3
14 Dec 1999	Caravagio	636 263	Yellow M-63422	94 (-1.5)	F	1050	47.7	19.9		58.5		8.3		56.6		70.2	4.3	4.2
15 Dec 1999	Purr	633 267	Green M-63423	84 (-1.5)	M	1100	52.1	18.5	62.3	61.6	10.8	10.8	62.8	64.0	74.3	80.2	9.4	9.8
16 Dec 1999	Tutu	638 259	Blue Yellow M-63424		M	1050	52.5	18.0										

The weka were checked daily during and immediately after the 1080 operation (14–16 and 19–21 June). The weka were checked again in July, and in August–September 2000 when eight were recaptured for band and transmitter removal. Two weka were unable to be captured, one of which later died while the other was never located.

3. Results

3.1 DEATH OF BIRDS BEFORE THE POSSUM CONTROL OPERATION

In the period between fitting the transmitters (December 1999) and the possum control operation (June 2000), five weka were found dead (Table 2). Three of these were confirmed to have been preyed on by mammalian predators, probably stoats, whereas the causes of the other two deaths were undetermined. The three weka killed by predators all had wounds to the back of the head, although these were obvious in only one case. The back of 'Purr's' head was eaten and the teeth marks were consistent with a mammalian predator, most likely a stoat. 'Bock' had been dead for some time, and was partially covered by silt in a stream. The skull of 'Bock' showed puncture marks consistent with the canines of a mammalian predator, probably a stoat. 'Bonny' had probably died within a few days of its recovery and was intact. No cause of death was immediately obvious. An autopsy found puncture wounds on the back of the head and a large cavity in the brain showing that a mammalian predator, probably a stoat, had killed the bird. 'Caravagio' was found in a cavity under a log and had been dead for some time. The bird was decomposed with mostly skin and skeleton remaining. Its head and neck skin were either missing or remained wedged under the log. The cause of death was not determined due to the decomposed and incomplete remains. Stoats often cache prey (King 1990), and it is possible that the carcass was cached under the log by a stoat. The transmitter on 'Noddy' was found on mortality mode immediately before the possum control operation on 14 June 2001. The carcass was not recoverable as the signal indicated it was buried in river gravel under a large rock.

3.2 SURVIVAL OF BIRDS EXPOSED TO 1080 BAITS

Of the 10 radio-tagged weka surviving at the time of the operation, only eight were definitely exposed to 1080 baits. None of these birds died during the 2-month period after the possum control operation (Table 2). Two weka were living in hut and river buffer zones and so could not be considered to have been exposed to 1080 baits (Table 2). It is likely that both birds were exposed to 1080 baits, because western weka home ranges are generally in the region of 4.5 ha (Coleman et al. 1983) while the buffer zone round the huts was 1 ha and the river buffer was 50 m. However, on all occasions they were tracked during

the week immediately following the possum control operation, 'Clyde' and 'Raj' remained in the buffer zones.

In July and August 2000, the 10 weka were confirmed to be alive, and in August five were recaptured for band and transmitter removal. In September 2000, three of the five remaining weka were recaptured for band and transmitter removal (Table 2). There was no signal from '10', and 'Cyclops' evaded capture. In February 2001, 'Cyclops' was found dead. The bird was in a decomposed state and its head was missing, so while no definite cause of death was established, predation is likely. No signal was detected from '10' in February nor since.

TABLE 2. FATES OF 15 RADIO-TAGGED WEKA BEFORE AND AFTER A 1080 POSSUM CONTROL OPERATION IN THE COPLAND VALLEY ON 14 JUNE 2000.

NAME	DATE	FATE	EXPOSED TO 1080
Caravagio	4 Apr 2000	Dead (probable predation)	
Bock	4 Apr 2000	Dead (predation)	
Purr	25 May 2000	Dead (predation)	
Bonny	25 May 2000	Dead (predation)	
Noddy	14 Jun 2000	Dead (unknown cause)	
	1080 possum control		
Clyde	22 Aug 2000	Alive, transmitter and band removed	No (in Douglas Rock Hut buffer)
Flash	23 Aug 2000	Alive, transmitter and band removed	Yes
Prism	23 Aug 2000	Alive, transmitter and band removed	Yes
Tutu	25 Aug 2000	Alive, transmitter and band removed	Yes
Daphne	25 Aug 2000	Alive, transmitter and band removed	Yes
10	22 Sep 2000	Alive, transmitter not recovered	Yes
Houdini	23 Sep 2000	Alive, transmitter and band removed	Yes
Pres	24 Sep 2000	Alive, transmitter and band removed	Yes
Raj	24 Sep 2000	Alive, transmitter and band removed	No (in Welcome Flat Hut buffer)
Cyclops	26 Sep 2000	Alive, dead on 10 Feb 2001 (probable predation)	Yes

4. Discussion

This study supports the findings of Walker (1997) that aerially applied 1080 is not a significant threat to weka. However, mammalian predators, probably stoats, were found to kill at least three, and probably five of the 15 radio-tagged weka (Table 2). All of the weka preyed on, or possibly preyed on by stoats, were lighter than the 1200 g 'safe weight' applied to kiwi sub-adults by Basse et al. (1999) (Table 1). However, weka may sometimes be able to repel stoat attacks because 'Flash' had a wound on the back of its head when captured and two other live birds have been seen with similar wounds (S. Robson, pers. comm.). While the wounds to the back of the birds' heads may or may not have been caused by stoats, this type of wound was characteristic of the weka killed by

mammalian predators. More data are needed to determine whether the 1200 g safe weight applied to kiwi also applies to weka.

Aerial 1080 possum control could be beneficial to weka, as a large proportion of stoats are killed by secondary poisoning following 1080 operations (Murphy et al. 1999; Alterio 2000). A low proportion of weka killed by 1080, as found by Walker (1997) is defensible if the majority of individuals are protected from stoat predation by secondary poisoning of stoats. As Spurr & Powlesland (1997) pointed out, it is not individual weka deaths that are important, but rather population trends. While there is currently no validated technique for monitoring weka populations, an investigation into the impact of stoat predation on weka before and after 1080 possum control would determine whether the use of 1080 baits is beneficial to weka populations through secondary poisoning of stoats. Weka are also likely to benefit indirectly from 1080 possum control from increased invertebrate supply following reduced rodent, mustelid, and possum consumption of invertebrates (Walker 1997).

The lower 1080 bait sowing rate in this study compared with Walker's (1997) (3 kg/ha and 5 kg/ha respectively) would have reduced the chance of weka encountering bait and may have accounted for the lack of poisoned weka; by contrast Walker (1997) found one of 24 radio-tagged weka dead and one sick non-radio-tagged weka. The enforcement of buffer areas in the Copland Valley would have further reduced the availability of 1080 bait, because the home ranges of most of the study birds partly overlapped buffer areas. The lack of a negative effect may also be explained by Walker's (1997) theory that few weka die during possum control operations because weka peck off and eat small bits of 1080 bait, thus obtaining a sublethal dose which causes subsequent bait avoidance.

It is unfortunate that the original sample of 15 weka was reduced to only eight that were definitely exposed to 1080 baits, by the death of some birds prior to possum control and the exclusion of others that did not have any opportunity to take bait. While transmitter loss was a major problem in the Nelson study (Walker 1997) it is pleasing to note that no weka dropped their transmitters during this study.

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