ENVIRONMENTAL IMPACT AND POST-CONTROL ASSESSMENTS ON RANGITOTO ISLAND, AFTER POSSUM AND WALLABY CONTROL, NOVEMBER 1990

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EXECUTIVE SUMMARY (FINAL)

INVESTIGATION TITLE: Environmental impact and post-control assessments on Rangitoto Island, after possum and wallaby control, November 1990.

STUDY VENUE: Rangitoto Island

INVESTIGATION LEADER: C.T. Eason

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CLIENT: Department of Conservation

INVESTIGATION SUMMARY:

Sodium monofluoroacetate (1080) analyses were undertaken by the Forest Animal Ecology section, Forest Research Institute, Christchurch, on samples taken from Rangitoto Island after the possum and wallaby control operations conducted in November 1990 for the Department of Conservation, Auckland.

OBJECTIVES:

- To provide information on the persistence of 1080 in baits and poison carcasses.
- To monitor bait integrity after aerial sowing.
- To determine whether surface or ground waters were contaminated with 1080.
- To monitor the post-operation quarantine period for hazard to humans.

METHODS:

- Samples from poisoned animals were collected on two occasions during the first month after the operation and analysed by gas-chromatography.
- Bait-size distribution was assessed after aerial sowing of baits and compared with bait size before sowing.
- Samples of bait were collected on five occasions and analysed by an alkali digestion - fluoride ion electrode method.
- Surface and ground water samples were collected for 6 months after the operation and analysed by gas chromatography.

RESULTS:

- Possum stomachs contained the highest concentration of 1080 (up to 26.4 µg/g). However, 13 days after the operation this was substantially reduced, but significant concentrations were present in the livers of dead animals (e.g., 8.4 µg/g).
- Bait size was unaffected by sowing indicating that fragmentation on impact was not significant.
- The mean concentration of 1080 in baits was 10% of the original 'loading' after 1 month.
- No 1080 was detected in surface or ground water over 6 months of sampling.

CONCLUSIONS:

- High concentrations of 1080 in possum stomachs are to be expected shortly after a control operation. Even after 13 days the carcasses represented a hazard, e.g., a dog eating 100 g of liver from a dead possum (with a liver concentration of 8.4 µg/g) would receive a lethal dose.
- Bait size and integrity were unaffected by aerial sowing.
- The risk from 1080 baits to non-target species, humans, and pets was minimal after 1 month.
- There was no measurable contamination of surface or ground water on Rangitoto Island after the sowing of 1080 possum baits.

RECOMMENDATIONS

- Public concern over the use of 1080 was highlighted by this operation. Analysis of baits from the control area was obviously essential to ensure the safety of the public. Analysis of biological samples or water will not be necessary for all future operations. However, they should be considered if there are unique environmental features or special concerns are raised by the public in an area designated for large-scale control.
- It is recommended that the care and attention to detail shown by DOC staff, which were the hallmark of both the Rangitoto and Waipoua (1990) operations, become standard for all large-scale possum control. Careful planning, quality assurance, environmental impact assessment, and the anticipation of public concerns contributed to overall success, both in terms of % kill and the high standard of DOC's accountability to the public in the Auckland region.
- FRI has applied for Ministry of Research and Science Technology (MORST) funding to investigate more thoroughly the fate of 1080 in soil and water. We recommend that this research be done in conjunction with DOC possum management control operations during 1991-92.
- Bait-size distribution after sowing does not warrant routine assessment unless the integrity of the bait is suspect or new methods of aerially sowing bait are being used.

2. INTRODUCTION

As a check on the safety of the 1080 possum and wallaby control operation on Rangitoto Island, undertaken in November 1990, the Toxicology Laboratory, Forest Animal Ecology section of the Forest Research Institute, Christchurch was engaged by the Department of Conservation, Auckland to analyse 1080 concentrations present in baits, biological samples, and surface and ground water samples.

The wide-scale use of 1080 raises fears of the environmental contamination seen with the older insecticides. However, there is an extensive database on the fate of 1080 in the environment, and sodium monofluoroacetate residues are readily metabolised and eliminated by micro-organisms, plants, and animals.

Despite this, and because of the unusual features of the Rangitoto landscape, special emphasis was placed on the assessment of water samples to address concerns about 1080 percolating through to the water table below Rangitoto.

3. OBJECTIVES

- To provide information on the persistence of 1080 in baits and poison carcasses.
- To monitor bait integrity after aerial sowing.
- To determine whether surface or ground waters were contaminated with 1080.
- To monitor the post-operation quarantine period for hazard to humans.

4. MATERIALS AND METHODS

4.1 Concentrations of 1080 in dead poisoned animals

Samples of stomach, liver, and leg muscle were taken from four animals on the day after the bait drop, and from another four 13 days after the operation.

After extractions and derivatisation, 1080 concentrations were measured in the samples using gas-chromatography with an electron capture detector (GC-ECD).

4.2 Bait-size distribution after sowing

Samples of bait were collected from the ground soon after aerial sowing. Each bait was individually weighed on a Sartorius balance, linked to an IBM computer for direct analysis of group mean weights (± SD) and bait-size distribution.

4.3 Persistence of 1080 in baits

Baits were collected from three sites on five occasions over a period of 1 month following the operation.

Approximately 150-g sub-samples of bait from each sample were homogenised. Sub-samples (1 g) of these were assayed for 1080 concentration using the alkali digestion-fluoride electrode method (C.L. Batcheler and D. Batcheler unpubl. data). Assessments were in duplicate, and a 1080 reference standard of known concentration was included in all the assays.

4.4 Ground and surface water analysis

Water samples were taken before and twice during the first month after the bait drop. Further samples were collected monthly for a total of 6 months (November 1990 to May 1991). Four sampling points on Rangitoto Island (Causeway, Raupo Swamp, a drinking fountain, and Wharf bore) were sampled. Water samples from the causeway and Raupo Swamp were representative of surface water. Samples from the drinking fountain and the wharf bore were ground water from the water table beneath Rangitoto Island.

After derivatisation, 1080 concentrations were assessed using GC-ECD.

5. RESULTS

5.1 Concentration of 1080 in poisoned animals

The highest concentrations of 1080 were found in the stomach of animals immediately after the control operation (Table 1). Animal tissues were still highly toxic 13 days after the operation. Extrapolating from the highest concentration found on day 13, a medium-sized dog (approx. 10 kg) would only have to eat 100 g of liver to receive a lethal dose.

TABLE 1. 1080 concentration in poisoned carcasses (µg/g).

Date, species, and source of sample	Concentration of 1080		
	Stomach	Liver	Leg
Day 1 (7/11/90)			
1) Possum, Yankee Wharf	9.1	1.5	0.5
2) Possum, Whites Beach	26.4	6.6	1.5
3) Possum, Whites Beach	18.1	3.7	0.9
4) Wallaby, Coastal Road	13.3	1.8	2.3
Mean	**16.7**	**3.4**	**1.3**
Day 13 (19/11/90)			
1) Possum, bush	5.4	8.4	0.3
2) Possum, bush	2.0	1.5†	0.2
3) Possum, open scoria	*	*	
4) Possum, open scoria	0.5	-	-
Mean	**2.6**	**5.0**	**0.25**

* The only material obtained from this possum was skin and a leg bone so no analysis was carried out.

† Kidney sent instead of liver

After the first 28 days, the carcasses had significantly decomposed and consisted of pelts and bone, so no further samples were taken.

5.2 Bait-size distribution after sowing

Mean weights for each of the three samples collected from the ground ranged from 5.4 to 5.9 g. There was no significant difference between pre- and post-drop bait size distribution (Fig. 1). The mean weight after sowing was 5.7 g ± 1.1 versus 5.8 g ± 1.0 before sowing.

5.3 1080 persistence in baits

The mean concentration of 1080 in the baits from the three sites on the day after the operation was 0.772 mg/g (0.772%). There was a steady decline during the monitoring period. Concentrations of 1080 in baits from Site 1 were consistently higher than those of the other two sites.

After 29 days the mean concentration of 1080 in the baits from the three sites was less than 10% of the original concentration at the time of manufacture (approx. 0.8 mg/g). However, at Site 1, the baits contained a concentration of slightly greater than 10% of the original 1080 concentration (Table 2).

TABLE 2. 1080 concentration in baits mg/g

	Site 1	Site 2	Site 3	Mean
Day 1 (7/11/90)	0.819	0.770	0.728	0.772
Day 6 (12/11/90)	0.235	0.190	0.217	0.214
Day 13 0.149	0.149	0.081	0.087	0.106
Day 20 (26/11/90)	0.183	0.078	0.076	0.112
Day 29 (5/12/90)	0.103	0.057	0.058	0.073

Days counted from 6/11/90

5.4 Surface and ground water

There was no 1080 present in any of the water samples examined. The limit of detection for 1080 in water was 0.001 µg/ml. A total of 39 samples were analysed.

6. CONCLUSIONS

- Bait size and integrity were unaffected by aerial sowing.
- The risk from toxic baits to non-target species, humans, and pets was minimal after 1 month.

- High concentrations of 1080 in possums and wallabies are to be expected immediately after a control operation. Even after 13 days the carcasses represented a hazard, e.g., a dog eating 100 g of liver from a dead possum (with a liver concentration of 8.4 µg/g) would receive a lethal dose.
- There was no measurable contamination of surface water or ground water in the water table beneath Rangitoto after the sowing of 1080 possum baits. Since 1080 is degraded by soil micro-organisms and soil is sparse on Rangitoto Island, it could be considered a worst-case situation. Nevertheless it is apparent that even in this environment measurable quantities of 1080 did not percolate through to the water table.
- Investment in advice for operational planning, audit and quality assurance of baits and poisons and monitoring of the environmental contamination have proven to be funds well spent. Quality Assurance analysis (QA) on this project paid for itself (since Animal Control Products were forced to refund $8000 for not meeting agreed bait specifications). Furthermore, QA data on bait size and the concentration of 1080 in the baits influenced the final decisions on sowing rates, which could have contributed to the success of the operation. Sowing rates were increased because of the larger than normal baits used (standard specifications suggest a 4-g bait) and the variability in the 1080 bait concentrations noted (C.T. Eason, D. Batcheler & G. Wright 1990, unpubl. FRI contract report).
- The analysis of water samples for residue not only ensured the integrity of the Rangitoto operation, but produced publicably defendable data for DOC.

7. RECOMMENDATIONS

- Public concern over the use of 1080 was highlighted by this operation. Analysis of baits from the control area is obviously essential to ensure the safety of the public. Analysis of biological samples or water will not be necessary for all future operations. However, they should be considered if there are unique environmental features or special concerns are raised by the public in an area designated for large-scale control.
- It is recommended that the care and attention to detail shown by DOC staff, which were the hallmark of both the Rangitoto and Waipoua (1990) operations, become standard for all large-scale possum control. Careful planning, quality assurance, and environmental impact assessment contributed to overall success, both in terms of % kill and the high standard of DOC's accountability to the public in this region.
- Bait-size distribution after sowing does not warrant routine assessment unless the integrity of the bait is suspect or new methods of aerially sowing bait are being used.
- Investment in QA, efficacy, and environmental analysis is strongly recommended. The 'dividends' in terms of safety, success, cost-effectiveness, and publicably dependable operations are substantial.
- We strongly recommend that due diligence is given to the task of eradication of possums and wallabies from Rangitoto Island to complete the job and to justify the expense and effort in planning, Q.A. (C.T. Eason, D. Batcheler & G. Wright 1990, unpubl. FRI contract report), monitoring animal numbers (C. Pekelharing 1991, unpubl. FRI contract report), monitoring the effects on non-target animals (C. Miller 1990, unpubl. FRI

contract report), and the recently completed environmental safety analysis described in this report.

8. ACKNOWLEDGEMENT

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9. REFERENCES

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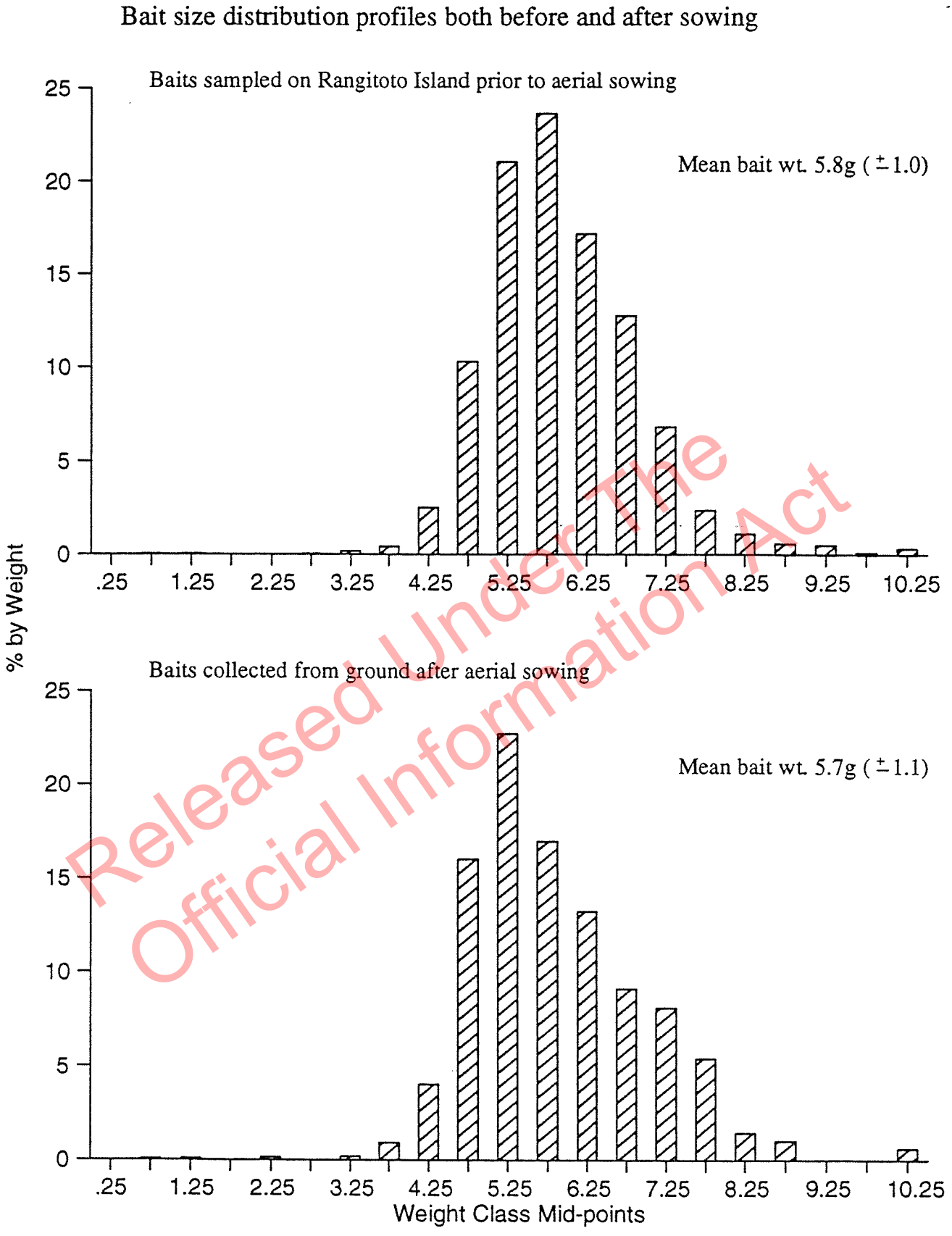

Fig. 1. Pre- and post-drop bait size distribution