Instructions for using poisoned hen eggs for control of stoats *(Mustela erminea)*

E B Spurr and S J Hough
Manaaki Whenua
Landcare Research
PO Box 69
Lincoln
New Zealand

Published by
Department of Conservation
Head Office, PO Box 10-420
Wellington, New Zealand

This report was commissioned by Science & Research Division

ISSN 1171-9834

Reference to material in this report should be cited thus:

Spurr, E.B. and Hough, S.J., 1997.
Instructions for using poisoned hen eggs for control of stoats *(Mustela erminea).* *Conservation Advisory Science Notes No. 156,* Department of Conservation, Wellington.

Keywords: Stoats, sodium monofluoroacetate, 1080, diphacinone, bait station, dye, pesticide, toxin.

Abstract

The use of poisoned hen eggs in bait stations is a new method for controlling stoats. Previously, the Department of Conservation has used Fenn traps in tunnels baited with hen eggs as its main method of stoat control. In summer and autumn 1994 and 1995, Landcare Research carried out successful field trials using hen eggs poisoned with sodium monofluoroacetate (1080) or diphacinone for control of stoats. Instructions are given on how to inject poison into eggs, the dosage of poison required, the deployment of poisoned eggs in bait stations, and monitoring the reduction in stoat numbers.

1. Introduction

Predation by stoats *(Mustela erminea)* is implicated as an important factor in the continued decline of several bird species, such as brown kiwi *(Apteryx australis)*, yellow-eyed penguin *(Megadyptes antipodes)*, black stilt *(Himantopus novaezelandiae)*, kaka *(Nestor meridionalis)*, yellow-crowned kakariki *(Cyanoramphus auriceps)*, and yellowhead *(Mohoua ochrocephala)*. The Department of Conservation (DoC) currently uses Fenn traps in tunnels baited with hen eggs as the main method of stoat control for protection of these species (O'Donnell et al. 1992). However, traps and tunnels are costly, bulky, and heavy to carry. Consequently, stoat control is labour-intensive and limited to small, localised, areas.

The feasibility of using hen eggs poisoned with either sodium monofluoroacetate (1080) or diphacinone for control of stoats was investigated by Manaaki Whenua - Landcare Research, Lincoln, for the Department of Conservation, Wellington. The instructions below were developed during field trials in 1994 and 1995. Results of the field trials will be reported separately.

2. Instructions

2.1 SAFETY ITEMS REQUIRED

Protective clothing (e.g., overalls, apron, and rubber gloves) is required when handling toxins, a face mask should be worn while mixing powder dyes, and a carpenter's bradawl or other sharp-pointed object (not a syringe needle) should be used for puncturing eggs.

2.2 HEN EGGS

Use Grade 5 (small) hen eggs for economy. If the Medical Officer of Health requires poisoned eggs to be dyed green, use brown eggs because they dye the correct shade of green better than white eggs, following the instructions given below. Eggs may be purchased in bulk from egg farms, but cardboard egg cartons are useful for carrying eggs in the field.

2.3 DYEING HEN EGGS

Check with the Medical Officer of Health about the necessity to dye poisoned eggs; some Officers require toxic eggs to be dyed green, others don't.

Use 'Dylon' brand 'Tartan Green' and 'Leaf Green' cold water clothing dyes (numbers A15 and A24), available from pharmacies. One packet of each is enough for about 150 eggs. Calculate how many eggs are required (allow for minor breakage) and hence how much dye solution to mix. Mix equal quantities of each colour into 0.5 litres of hot tap water for each packet of dye. It is not necessary to use salt or the fixer mentioned in the manufacturer's instructions. Add this concentrate to an additional 4 litres of hot tap water for each packet of dye. The temperature of the final solution should be about 40°C. Immerse eggs in the dye solution, and place the container in a chilly-bin or other insulated container to help maintain the temperature. Remove the eggs after 4 hours and allow them to air-dry. The egg colour must fall within the range of colours 221 to 267 as described in the New Zealand Standard Specifications 7702 declared under section 23 of the Standards Act (regulation 23(1) of the Pesticides (Vertebrate Pest Control) Regulations 1983). This is approximately the colour range of green vegetation. Place eggs not dark enough back in the dye solution for a further period of time. Reheating the dye solution to 40°C will speed up the dyeing process. It is unlikely that any eggs will be too heavily dyed, but if there are some then legally these should be discarded.

WARNING: ***Wear protective clothing and a face mask when handling powder dye. Avoid inhaling the powder.***

Even if the Medical Officer of Health does not require eggs to be dyed to a standard colour, you may wish to dye the eggs anyway, to indicate that they are toxic. Green food dye is suitable for this.

2.4 SYRINGE AND NEEDLE

To inject toxin into the eggs, preferably use an automatic vaccinator (e.g., Phillips model 74) with a flexible enema administration unit attached (e.g., Baxter Pharmaceal, capacity 1500 ml) (both available from veterinarians or from Chemstock Animal Health Ltd, Christchurch). The vaccinator can be pre-set to deliver the dose required and automatically re-loads. Otherwise, use a 1 ml hypodermic syringe; this will have to be re-loaded for every egg.

Use a 16-22 gauge needle with a minimum length of 35 mm (e.g.,Terumo 18G x 1.5 inch needle, available from veterinarians or Chemstock Animal Health Ltd, Christchurch).

2.5 AMOUNT OF TOXIN

2.5.1 1080

Use a solution of 0.1% 1080 (see Appendix 6.1).This can be obtained from Animal Control Products, Private Bag, Wanganui, or Landcare Research, PO. Box 69, Lincoln. Inject 1 ml of this solution (equivalent to 1 mg 1080) into each egg.

WARNING: ***1080 may be handled only by a licensed operator or under the supervision of a licensed operator. Use green-dyed but not cinnamon-lured 1080. If the 1080 comes from suppliers other than those listed above, check the concentration of the solution by having a laboratory test done.***

2.5.2 Diphacinone

Use a solution of 0.5% diphacinone (see Appendix 6.2).This can be obtained from Pest Management Services, PO. Box 121, Waikanae. Inject 1 ml of this solution (equivalent to 5 mg diphacinone) into each egg.

WARNING: ***Check that the diphacinone is completely dissolved. If not, shake the "solution" every time before filling the syringe or injecting the egg so that the diphacinone is evenly distributed. A dose of 1 ml is about the maximum that can be injected into an egg without toxic solution or albumen (egg white) exuding. If a weaker solution of diphacinone is used (e.g., 0.1%, also available from Pest Management Services), a larger volume (S ml) will have to be injected into the egg, and about 5 ml of albumen should be withdrawn first.***

2.6 INJECTING HEN EGGS

Inject eggs in the field to avoid transporting toxic eggs. Carefully make a small hole slightly larger than the diameter of a syringe needle in the blunt end of each egg using a sharp instrument such as a carpenter's bradawl. Don't use the syringe needle. Insert the syringe needle through the hole and carefully inject the syringe contents into the centre of the egg so that toxic solution does not exude from the hole. There is no need to seal the hole after injection, but sealing with nail varnish or candle wax may prolong the field-life of the egg. Sealing the hole may also prevent eggs from being eaten by mice *(Mus musculus)*.

WARNING: ***Wear protective clothing. Ensure that the needle is firmly attached to the syringe. If the needle becomes blocked, do not attempt***

to clear it by forcing the syringe plunger, because this could eject the needle and a spray of poison. Do not use the syringe needle to puncture the eggs because you may damage the needle and/or stab yourself.

2.7 BAIT STATIONS

Use bait stations to protect the eggs from non-target species such as kahu *(Circus approximans),* kea *(Nestor notabilis),* and weka *(Gallirallus australis).* Bait stations may be made by modifying the tunnels used for trapping stoats (Fig. 1).The floor of bait stations should be solid to prevent stoats, rats *(Rattus* spp.), mice, and brushtail possums *(Trichosurus vulpecula)* from burrowing underneath. The entrances should be large enough to allow stoats to enter but small enough to prevent them from removing the eggs (e.g., 40 mm diameter or square).

NOTE: *Check that the openings in the bait stations are smaller than the eggs being used.*

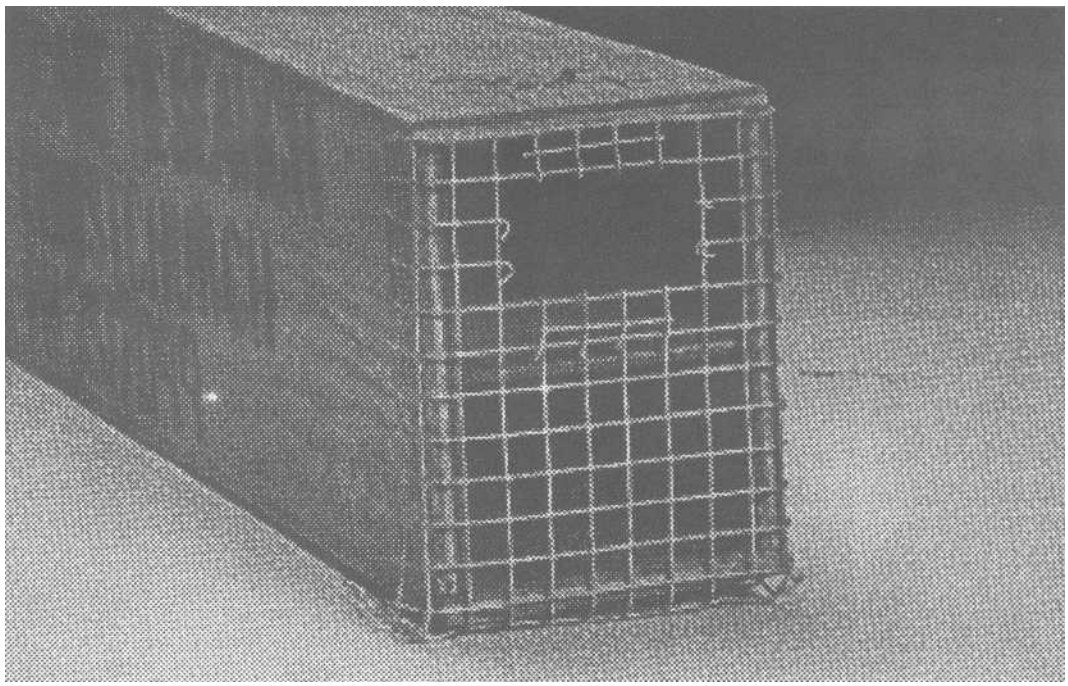

Fig. 1. Bait station with entrance restricted to allow entry by stoats but not by non-target species such as kahu, kea, or weka. The entrance is also small enough to prevent stoats removing eggs from the bait station.

Bait stations should be spaced about 100 m apart on lines (not necessarily straight) in a circuit or grid, or following a roadside, river bank, or ridge, similar to the layout used when trapping.

2.8 BAITING BAIT STATIONS

If time allows, non-toxic eggs should be placed in bait stations initially, to accustom stoats to feeding from the bait stations and to reduce the number of toxic eggs used.The average number of eggs per day eaten by stoats may also give an index of the stoat population (see below). Two non-toxic eggs (one punctured, one whole) should be placed in each bait station. Eggs should be checked every 2-3 days for 2-3 weeks, or until the number of non-toxic eggs eaten per day levels off. Eaten eggs should be replaced. At each check, record the bait station number, number of eggs eaten, whether completely or partly eaten, whether inside or outside the bait station, and an indication of the species responsible; e.g, stoat, rat, or mouse (Fig. 2). See Appendix 6.3 for an example of a data recording form.

Toxic eggs should be placed in bait stations when the number of non-toxic eggs eaten per day has levelled off. To minimise the amount of toxin used, toxic eggs may be placed only in bait stations from which non-toxic eggs have been eaten. The number of toxic eggs placed in each bait station will depend on the rate of consumption of eggs and the interval between checks. For example, if two non-toxic eggs were eaten in 2-3 days in the pre-poison period, then five or six toxic eggs should be placed in each bait station if the checking interval is increased to weekly. Toxic eggs should be checked at least once fortnightly, and eaten eggs replaced. Uneaten eggs should be re-placed after about 4-6 weeks. Data should be recorded as above.

NOTE: *Uneaten toxic eggs should be disposed of by breaking and burying to a depth of 60 cm, or by burning in an approved manner.*

If circumstances don't allow pre-feeding with non-toxic eggs, toxic eggs may be placed in bait stations from the start; i.e., pre-feeding with non-toxic eggs is not essential. However, care must be taken to ensure that stoats cannot remove toxic eggs from bait stations (and so endanger non-target species).

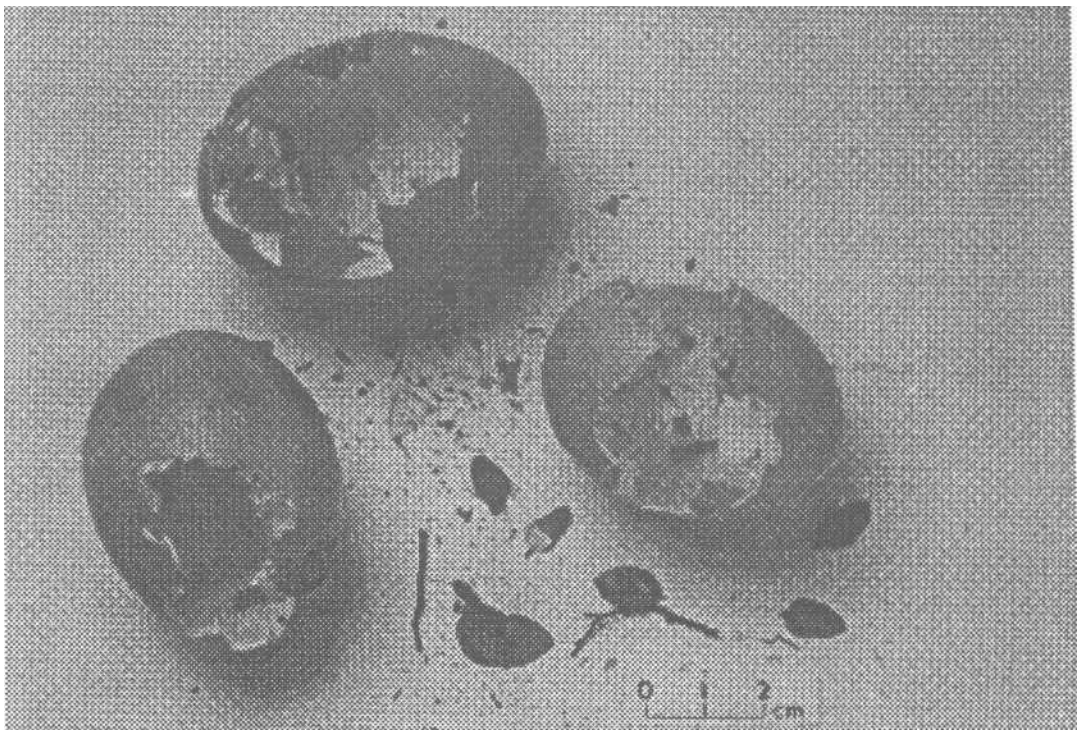

Fig. 2. Hen eggs eaten by stoats (Mustela ernzinea)

2.9 MONITORING EFFECTIVENESS OF POISONING

The effectiveness of poisoning should be assessed by comparing stoat populations in the poison area before and after poisoning with those in a comparable non-poison area monitored at the same time. Ideally, stoat numbers should be monitored independently of the poison-baiting programme; e.g., using traps or tracking tunnels. Traps cannot be used in the pre-poison period because they will reduce stoat numbers in both poison and non-poison areas. However, provided there is no bait shyness to toxic eggs, the average number of eggs per day eaten by stoats in poison and non-poison areas can be used as an index of stoat numbers. Non-toxic eggs should be placed in bait stations in the non-poison area, and checked and replaced as necessary, at the same time as eggs (initially non-toxic, then toxic ones) are placed in bait stations in the poison area. For statistical purposes, there should be a minimum of 30 bait stations in each area. If pre-feeding with non-toxic eggs is not possible, pre-poison stoat abundance will have to be estimated from the number of eggs eaten on the first night, before any stoats have been poisoned. Thus:

Percentage kill = (1-O/E) x 100 ..... (1)

where O = observed number of eggs eaten in the poison area post-poison
and E = expected number; i.e., (number of eggs eaten in the poison area pre-poison / number of eggs eaten in the non-poison area pre-poison) x number of eggs eaten in the non-poison area post-poison

One likely result is that the number of eggs per day eaten in the poison area will decline after poisoning (because stoats and/or rats and mice will have been poisoned) but the number in the non-poison area will be similar throughout, or may even increase as young animals enter the population.

Example 1: Percentage kill from pre- and post-poison egg take

Number of eggs per day eaten in poison area before poisoning	8.5
Number of eggs per day eaten in non-poison area before poisoning	7.5
Number of eggs per day eaten in poison area after poisoning	0.3
Number of eggs per day eaten in non-poison area after poisoning	8.0

Observed number of eggs per day eaten after poisoning = 0.3
Expected number = (8.5/7.5) x 8.0 = 9.1

Percentage kill = (1 - 0.3/9.1) x 100
=(1-0.03)x100
= 0.97 x 100
= 97

Fenn traps set in both non-poison and poison areas for 3-5 days after poisoning could provide a second estimate of the success of poisoning. A minimum of 30 traps should be used. Traps should be baited with meat rather than eggs. Provided there were similar numbers of stoats in the two areas before poisoning, more stoats should be caught in the non-poison area than in the poison area after poisoning. Pre-poison stoat numbers in the two areas can be compared from the number of eggs eaten in each area.

Example 2: Percentage kill from pre-poison egg take and post-poison trap catch

Number of eggs per day eaten in poison area before poisoning	8.5
Number of eggs per day eaten in non-poison area before poisoning	7.5
Number of stoats caught in poison area after poisoning	2
Number of stoats caught in non-poison area after poisoning	18

Observed number of stoats caught after poisoning = 2
Expected number = (8.5/7.5) x 18 = 20.4

Percentage kill = (1 - 2/20.4) x 100
=(1-0.1)x100
= 0.90 x 100
= 90

In these two examples, the percentage kill was calculated as 97% from the number of eggs eaten before and after poisoning, and 90% from the number of eggs eaten before poisoning and the trap catch after poisoning. Either value would confirm the success of the poisoning operation. Confidence limits around the percentage kill can be calculated if there is more than one line of bait stations or traps.

3. Discussion

The methods described in this report were used in three trials in 1994 and 1995. They should be followed by the Department of Conservation for field trials in 1995-96, to confirm and refine their effectiveness. Experience with different types of automatic vaccinators, dyes, and bait stations, for example, may lead to technical improvements. Experiments with coating eggs with a preservative (e.g., petroleum jelly) to prolong their field-life, provided it did not affect their palatability to stoats, may lead to greater cost-effectiveness.

Bait stations with restricted entrances exclude kahu, kea, weka, possums, and hedgehogs *(Erinaceus europaeus),* but not rats and mice. It is not possible to distinguish readily from the shell remnants whether eggs have been eaten by stoats, rats, or mice. Droppings (faeces) in bait stations may also be an unreliable indicator, because rats or mice may have visited the bait stations after stoats. For the same reason, track markings may be useful only if a single species has entered a bait station and eaten eggs. The most reliable method for determining which species is eating eggs is video recording.

The poisoning of rats and mice as well as stoats makes it difficult to monitor the effectiveness of control for individual species, but multi-species control may be advantageous to native birds. If only stoats were poisoned, rat and mouse numbers, and consequently their predation on birds, might increase so that the benefits of stoat control would be lost. Multi-species control ensures that one predator is not replaced by another.

Department of Conservation trials in 1995-96 should be carefully monitored to enable the instructions in this report to be revised in time for stoat control operations in 1996-97.

4. Acknowledgements

We thank the Department of Conservation for funding, G. Loh and S. Phillipson for assistance with field trials, G. Wright for constructing the 1080 label, J. Coleman and E. Murphy for comments on the draft manuscript, and T. Duval for editorial assistance.

5. References

O'Donnell, C.FJ; Dilks, PJ.; Elliott, G.P. 1992. Control of a stoat population irruption to enhance yellowhead breeding success. Science Research Series 124. Department of Conservation, Wellington. 16 p.

6. APPENDICES

6.1 Label for 0.1% 1080 solution

DEADLY POISON

Available to authorised persons only.
Keep out of reach of children.

0.1% 1080 SOLUTION

FOR EXPERIMENTAL USE ONLY - NOT FOR SALE

To be injected into hen eggs for stoat control

Active ingredient: contains 1.0g/1 sodium fluoroacetate in the form of a solution in high purity water. Bayer V200A dye added at 6.2 mg/l.

WARNING: Extremely dangerous if swallowed or absorbed through the skin.

PRECAUTIONS: Wear rubber gloves. Do not eat, drink or smoke when applying the solution. After use thoroughly scrub and wash gloves, implements and hands with soap and water. Avoid contamination of any water supply with the chemical or used container. Store in original container, tightly closed, under lock and key, away from foodstuffs. Dispose of container by burning and burying to a depth of 60 cm.

SYMPTOMS OF POISONING
EARLY SYMPTOMS: Nausea, vomiting, tingling and numbness in face and hands, stomach pains, apprehension and anxiety.
LATER SYMPTOMS: Muscular twitching, blurred vision, mental confusion.
SEVERE SYMPTOMS: Coma, convulsions.
FIRST AID: Act immediately if poisoning is suspected. Call a doctor as soon as possible. If swallowed, give a glass or two of water and cause vomiting by putting a finger down the throat. Repeat until vomit fluid is clear in appearance.

SPILLAGE
If accidental spillage takes place gather up spilt liquid with absorbent material and dispose of by burying 60 cm underground. Ensure that bottles are resealed. In the case of large spillages which may endanger humans report immediately to the Police and the nearest Medical Officer of Health. Take all practicable steps to prevent or abate any hazard that may or does arise from the spillage.

DIRECTIONS FOR USE: For use in the dosing of hen eggs. Application by injection into eggs at 1 ml per egg.
IMPORTANT: Only a licensed operator or a person under the supervision of a licensed operator can apply this product, the use of which is restricted by the Pesticides (Vertebrate Pest Control) Regulations 1983.
Net contents: 250 ml Certificate: P95/1, 25/10/95
Landcare Research New Zealand Limited, PO Box 69, Lincoln.

6.2 Label for 0.5% diphacinone solution

CAUTION

KEEP OUT OF REACH OF CHILDREN

DIPHACINONE LIQUID CONCENTRATE

For experimental use only - not for sale

To be injected into hen eggs for stoat control

Active ingredient: 5 g/litre diphacinone in the form of a ready to use liquid

WARNING:	May be harmful if swallowed, inhaled, or absorbed through the skin.
PRECAUTIONS	Avoid contact with skin. Wear overalls, face mask, and waterproof gloves when applying to bait. Do not eat or drink or smoke while using. Avoid contamination of any water supply with baits or empty containers. Wash splashes off skin immediately. Wash hands and exposed skin before meals and after work.

FIRST AID: If swallowed give a glass or two of water and cause vomiting by putting finger down throat. Repeat until vomit is clear in appearance. Call a doctor. If concentrate is splashed into eyes, flush with running water for 15 minutes, then get medical attention.

DIRECTIONS: Use 1 cc hypodermic syringe with needle length of at least 35 mm and a gauge of 16 to 22. Withdraw 0.75 ml of concentrate into syringe. *

Make a needle-sized hole in blunt end of green-dyed egg using a carpenter's bradawl or dividers (not syringe needle). Insert syringe needle through hole to centre of egg. Inject poison gently.

Place egg in bait station with maximum opening of 60 x 40 mm, so stoat can enter but not remove egg from bait station.

Experimental Use Permit (Not for Sale) No. 4797/1
Issued pursuant to the Pesticides Act 1979

Net contents: 250 ml

Manaaki Whenua - Landcare Research, P.O. Box 69, Lincoln. Telephone 03 325 6700.

* Note: New Directions: Withdraw 1 ml (not 0.75 ml) of concentrate.

6.3 Data recording form

Date Observer

Location Poison area / non-poison area (cross out one)

Record (1) the number of eggs eaten/not eaten, (2) extent to which eaten, (3) stoat?, rat?, etc.

Bait station	Bait station
1	31
2	32
3	33
4	34
5	35
6	36
7	37
8	38
9	39
10	40
11	41
12	42
13	43
14	44
15	45
16	46
17	47
18	48
19	49
20	50
21	51
22	52
23	53
24	54
25	55
26	56
27	57
28	58
29	59
30	60