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## CONSERVATION ADVISORY SCIENCE NOTES

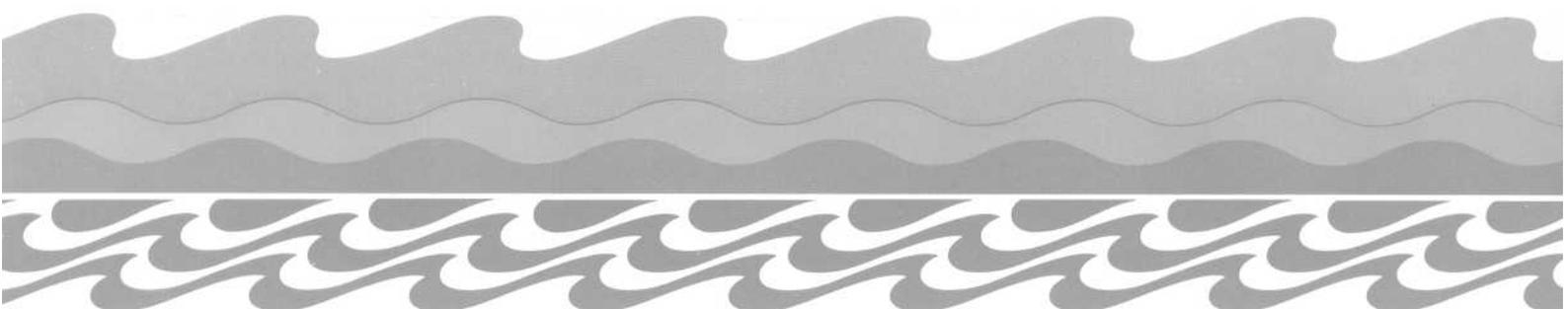
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### ASSESSING THE PALATABILITY OF THREATENED PLANT SPECIES TO POSSUMS

(Short Answers in Conservation Science)

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# ASSESSING THE PALATABILITY OF THREATENED PLANT SPECIES TO POSSUMS

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## 1. SUMMARY

### PROJECT & CLIENT

A method for assessing the palatability of selected threatened plant species to brushtail possums (*Trichosurus vulpecula*) is proposed, based on a brief review of relevant literature. This report was prepared as external unprogrammed science advice for Westland Conservancy, Department of Conservation.

### OBJECTIVES

- Develop a procedure for assessing the palatability of particular threatened plant species to possums.
- Discuss the extent to which such results might be extrapolated to field situations.
- Cite references relating to any similar work undertaken in the past.

### PROPOSED METHOD

Measuring diet preferences of free-ranging possums is fraught with problems. Consequently, we recommend that the palatability of threatened species be assessed through feeding trials with captive possums. These should be individually caged and allowed to adjust to captivity for 2-3 weeks. The threatened species should then be presented together with other common species of known palatability. Relative preference for these species should be scored based on the dry weight of plant material consumed.

Diet preference is not the only factor affecting food choice in the field. Consequently, the results of captive preference trials of this type should be interpreted with considerable caution.

### RECOMMENDATION

We recommend that a small trial be undertaken as a preliminary validation of the method. This should be done using several common plant species for which relative palatabilities are already known from field observations.

## **2. INTRODUCTION**

The introduction of brushtail possums (*Trichosurus vulpecula*) into a country previously without arboreal mammals has had a pervasive impact on New Zealand's indigenous ecosystems (Green 1984). Possums selectively browse palatable plant species, eliminating some while favouring those that are unpalatable. This results in a progressive change in the species composition of browsed vegetation associations.

Measuring diet preferences of free-ranging animals is fraught with problems (Norbury & Sanson 1992), especially when the species concerned are rare or threatened. However, it is particularly important to establish the palatability of such species to possums, as this will help direct their future conservation management.

In this report, we propose a method for assessing the palatability of selected threatened plant species using captive possums. The report was prepared as external unprogrammed science advice for the Westland Conservancy, Department of Conservation.

## **3. BACKGROUND**

### **3.1 Possum diet preferences**

Possums eat a wide variety of plant material including leaves, fruits, seeds and flowers (King 1990). Some fungi and animal material (mainly invertebrates) are also taken as protein. Studies conducted in the Orongorongo Valley (Mason 1958; Fitzgerald et al. 1973) suggest that possum diet changed in this area between 1946 and 1968. A number of the most highly favoured plant species in 1946 were no longer present in the valley forest during the early 1970s; browsing on these species had been sufficiently intense that they virtually disappeared from both the forest and the diet.

In these studies, Mason (1958) assessed plant material found in possum gut samples, claiming that the technique was reliable except for species with very thin leaves. Observations of possum browse based on damage to plants were used to support the gut analyses. Fitzgerald (1976) chose to assess diet by faecal analysis, which may be unreliable for some plant species because of variable persistence of cuticle in the faeces (Dunnet et al. 1973).

A number of other studies on possum diet conducted in the field have shown marked diet preferences, with these varying according to species availability in the areas studied (e.g., Fitzgerald & Wardle 1979; Coleman et al. 1985). These preferences were assessed using faecal or gut sample analyses.

### **3.2 Field methods for assessing possum diet**

Diet preferences can potentially be assessed by direct observation. However, possums are nocturnal so this requires the use of night-vision or video equipment. Such methods are expensive and exceedingly time-consuming, especially when seeking highly infrequent encounters of possums with rare plant species.

Meads (1976) developed a method of scoring levels of possum browse on northern rata (*Metrosideros robusta*), which was later used and refined by Payton (1988). Discrete bunches of leafy vegetation ("crowns") were used as units of measurement for both studies. One aspect of each tree studied was

photographed at the beginning of trials and used as a reference by observers. Meads used six observation sites, three on the ground and three 20 metres above ground on platforms in trees close to the study trees. Consequently, trees could be viewed from above and below. Meads initially developed a 5-point scale for scoring browse, later adopting a 7-point scale. Payton (1988) used six divisions, arguing that the use of further gradations resulted in too many inconsistencies.

Both authors found that other animals, particularly invertebrates, browsed on the plants so that methods for distinguishing possum browse from insect browse had to be developed. Meads (1976) estimated that one hour per tree was required to provide accurate observations. Observations could not be conducted in early morning or early afternoon because the sun produced too much glare.

Given that Meads and Payton both studied a single plant species, we consider such field methods are considered too problematic and time-consuming to be effective for assessing the palatability of numerous threatened plant species.

#### **4. OBJECTIVES**

Through a review of the literature currently available on possum feeding behaviour and dietary preferences, to:

- Develop a method for assessing the palatability of particular threatened plant species to possums.
- Discuss the extent to which such results might be extrapolated to field situations.
- Cite references relating to any similar work undertaken in the past.

#### **5. CAPTIVE METHODS FOR ASSESSING POSSUM DIET PREFERENCES**

Measuring diet preferences of free-ranging possums is problematic (see above). Captive feeding trials may offer a way to gain some information on the palatability of species that would be very difficult to study in the field. Such trials have been conducted by a number of researchers, with objectives varying from improving knowledge of the physical and nutritional requirements of possums in captivity (Fitzgerald et al. 1981) to selecting artificial diets which are both palatable to possums and produce good possum pelts for export (Dellow et al. 1985; Giles 1981). Edwards (1978) investigated the link between levels of salicin compounds in foliage of *Populus* by testing the palatability of clones differing in their salicin content.

##### **6.1 Proposed methodology**

We recommend that the palatability of threatened species be assessed through feeding trials with captive possums. Possums should be individually caged and allowed to adjust to captivity for 2-3 weeks. The threatened species should then be presented to the possums, together with other common species of known palatability. Relative preference for these species should be scored based on the dry weight of plant material consumed.

## **6.2 Maintenance in captivity**

Select possums for captive trials from the area where the plant species under threat are found, as there is considerable variation among possums from different populations. For example, Williams and Turnbull (1983) compared aspects of nutrition, thermoregulation and water balance for possums taken from two populations, one in the Wanganui area and the other in Westland. The Westland animals were consistently larger than the Wanganui animals, and physiological differences were noted between the two populations.

Possums are often kept in pens with two or more individuals (S. Jolly, pers. comm). One captive feeding study kept possums in groups of 6-8 rather than in separate cages and, apparently, experienced no difficulties with aggressive interactions (Edwards 1978). However, since aggression between individuals may interfere with feeding trials, we recommend housing possums in individual cages. Cages should be large enough for presentation stands (for holding branches of vegetation) and wooden nest boxes (for a daytime retreat). We consider most cage sizes used most previous studies to be too small, and recommend a cage size of about 3 m<sup>3</sup> for each possum.

Fitzgerald et al. (1981) allowed 2-3 weeks for wild possums to adjust to captivity. During this time the animals were fed leafy native vegetation supplemented with apples, carrots and bread. Alternatively, a commercial pelleted diet seems to be acceptable to captive possums (Giles 1981; Fitzgerald et al. 1981; Dellow et al. 1985; S. Jolly, pers. comm.).

Possums should be weighed frequently, daily if possible, to monitor their stress levels (body weight is likely to decrease after capture if the animals are stressed). Trials can begin after 2-3 weeks, provided body weight has returned to a level similar to that at time of capture. Weight monitoring should continue to ensure that the possums are not further stressed by the trials.

## **6.3 Presentation of plant material**

The trial vegetation should be presented in as natural a form as possible; for example, by presenting whole branches with leaves intact. Branches should be numbered to avoid errors in data recording. To prevent leaf desiccation, branches could be placed in bottles of water sunk into the ground (Edwards 1978). If the cages are outdoors, shade cloth should be erected over their tops and sides to reduce sunlight and airflow. Spraying the cage with water after each trial is laid down was recommended by Edwards (1978).

The normal ration of food provided during the adjustment period should be maintained during the trial, together with sufficient clean water.

## **6.4 Assessment of possum browse**

We recommend a minimum of three, and a maximum of five, plant species be trialled on a given night with each possum. At least two common species of known palatability should be present to "calibrate" each trial. Each night, the branches should be shifted to a new location in the cage to avoid position bias.

The initial wet-weight of each "experimental" branch (IWE) should be recorded and the leaves counted at the start of each presentation. Also record the initial wet-weight of a matched "control" branch

that is similar in leaf, fruit and flower distribution (this is used for a subsequent dry-weight calibration). To avoid bias, the experimental branch should be selected from each pair using a coin-toss.

On the morning after the trial, remove the experimental branch and record its remaining wet-weight (RWE) and the weight of the control branch (RWC). In addition, score the plant parts that have been removed by the possums (i.e, leaves, stems, fruits, flowers and seeds). We recommend the following scores:

1. No fruit (flowers) eaten
2. Less than 1/3 eaten
3. Between 1/3 and 2/3 eaten
4. 2/3 or more eaten but not all fruit (flowers) eaten
5. all fruit (flowers) eaten

## **6.6 Analysis**

### *6.6.1 Dry weight estimation*

After recording wet-weights, the leaves, stems, fruits and flowers of the controls should be removed from their branch to mimic the feeding that has occurred on the experimental branches. The wet weight of this sample (WS) should be recorded, then oven dry at 45-50C to constant weight (24-48 hours, depending on how much moisture is contained in the material). After drying, reweigh the material to obtain DS.

Calculate the dry weight of plant material eaten as follows:

$$\text{DRY WEIGHT EATEN} = (\text{IWE} - \text{RWE}) * (\text{IWC}/\text{RWC}) * (\text{DS}/\text{WS})$$

(Note that IWC/RWC corrects for desiccation, and DS/WS is a dry wt/wet wt conversion.)

The relative palatability of different species can then be determined by direct ranking of the dry weight of plant material consumed (Lechowicz 1982; Norbury & Sanson 1992).

## **6.6 Sample size**

A pilot study should be conducted to determine how much replication should be necessary. We recommend a minimum of 6 possums for this trial.

The occasional possum may need to be excluded from the trials if it is feeding abnormally: monitoring of body weight is probably the least subjective method of assessing how well adjusted individuals are. Where possible, include both sexes, and adults and immatures, in such trials.

## **7. EXTRAPOLATION TO THE FIELD**

Diet preference is not the only factor affecting food choice in the field (Norbury & Sanson 1992). Consequently, the results of captive preference trials of this type should be interpreted with considerable caution.

## 7.1 Regional Variation

When individuals are compared from different areas around the country, palatability trials may prove inconclusive due to regional variation (see King 1990: 81). The value of trialling animals with plant species that were not available in their normal habitat may be low.

## 7.2 Learned diet preferences

Possums may feed on some species based on behaviour learned as dependent juveniles. This could cause marked variation between individuals, especially young possums raised in captivity.

## 7.3 Effect of captivity on diet preferences

Edwards (1978) points out that dietary preferences of possums may be somewhat different in captivity to that in the wild. Given the artificial environment in which possums are placed for such trials, some changes in behaviour can be expected. Efforts made to present vegetation in a fairly natural manner may alleviate this problem, but trials are necessary to validate this assumption.

## 8. RECOMMENDATION

We recommend that a small trial be undertaken by DoC Westland, in collaboration with Lincoln University, to begin validating the method and determining the sampling effort required for such studies. This should be done using several common plant species for which relative palatabilities have already been established through field observations.

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