Comparison of baits and bait stations for the selective control of wild house mice on Thevenard Island, Western Australia

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Abstract Past studies to eradicate or control house mice (*Mus domesticus*) have rarely been designed to reduce the impact on non-target and native species of rodents. General poison-baiting on an island reserve off the Western Australian coast required management actions to control or eradicate house mice in the presence of a threatened native short-tailed mouse (*Leggadina lakedownensis*). Cafeteria-style trials were conducted to ascertain a preferred bait medium that could be used to deliver a poison for house mice. When presented with a choice, the results show that it was not possible to make the level of bait uptake differ between the two species of mouse by treating the parrot seed with agar or wax, with or without the addition of salt to the bait. Three bait stations were tested for their effectiveness at selectively capturing house mice, or for the selective delivery of bait, and two showed promising results. From a management perspective, the use of these bait stations to deliver a poison bait for the control of house mice offers the most practical strategy without undue impact on non-target, native mice.

Keywords Australia; bait; house mouse, *Mus domesticus*; island; short-tailed mouse, *Leggadina lakedownensis.*

INTRODUCTION

Rodenticides are still the mainstay for the control of house mice. In Australia, these include strychnine, sodium flouroacetate (compound 1080), warfarin, brodifacoum, and bromadiolone, and they can be administered as liquids, powders, fumigants, gels, or baits (Rowe and Chudley 1963; Caughley *et al.* 1996). Baits are usually presented as attractive and edible foods, and include commercial pellets, wax blocks, coated cereal, or water (Caughley *et al.* 1996). Past efforts to eradicate or control house mice have not focussed on their selective control because this was not of primary importance during, for example, crisis management periods such as mouse plagues (Caughley *et al.* 1994), or they have been designed to exclude larger and non-target species such as birds (Taylor and Thomas 1993). Selective control becomes a concern, however, when the non-target species is also a rodent.

Compound 1080 is often used to manage invasive alien species in Western Australia (Mead *et al.* 1985). Its potential for target specificity is enhanced by a natural tolerance by many native species to the natural occurrence of the chemical in plants of the genus *Gastrolobium*, with which they co-evolved (McIlroy 1982). Fauna which have evolved in areas where these plants are absent are much less tolerant to 1080.

In Western Australia, house mice were introduced to Thevenard Island in 1986. Periodic plagues caused problems with the electrical facilitites of an oil storage and processing plant located on the island, and with the hygiene of work personnel. There was also concern that house mice would outcompete a rare species of short-tailed mouse. The presence of this native rodent made it unwise to broadcast spread a poison to control house mice. A study to identify the bait uptake and susceptibility to 1080 poisoning by short-tailed mice found they had a high projected intake of, and low tolerance to, this compound (Calver *et al.* 1989). Therefore, broadscale and non-selective baiting with 1080 on Thevenard Island were not options for the control of house mice, and other strategies for selective control were sought.

In an effort to identify ecophysiological differences between house mice and short-tailed mice on Thevenard Island, Moro and Bradshaw (1999) found that house mice had a higher requirement for water and sodium than the native species of mouse for the maintenance of physiological homeostasis. Since free water was limited to dew, which formed occasionally on the island, the main source of water for mice was from the plant and invertebrate material they ate. High water consumption by house mice is associated with their physiological need to meet high minimum-water requirements and to compensate for high water losses from evaporation. High sodium influxes were also observed for wild house mice, and reflected a dietary source in the field that was rich in sodium, in addition to a salt appetite at and above 0.25 µg/*l* sodium concentrations (Moro and Bradshaw 1999). A requirement for high water influxes, and a taste for salt, may therefore offer a suitable means to control house mice selectively by exploiting their physiological needs for salt and water.

No published data are available that identify an effective bait medium or bait station to permit the control or eradication of the house mouse in the presence of a non-target rodent species. The delivery of poisons to rodents using palatable baits is a common strategy for population control (Sterner *et al.* 1996), and a study by Creekmore (1998) examined the effectiveness of administering biological markers to wild rodents using baits. It may be possible to exploit the house mouse's higher requirements for water and salt in the form of a palatable bait, and thereby formu-

Pages 213-218 In Veitch, C. R. and Clout, M. N. (eds.). *Turning the tide: the eradication of invasive species*. IUCN SSC Invasive Species Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK.

late a selective poison bait while simultaneously reducing non-target mortality. I therefore evaluated the palatability of three baits, and relative preference of three types of bait station to deliver these baits, for the selective and future control of wild house mice on Thevenard Island.

METHODS

Source of mice and laboratory maintenance

Six adult short-tailed mice (three male, three female) and 12 house mice of various ages (six male, six female) were collected in early summer (December 1997) from Thevenard Island (21°28' S, 115°00' E). The island is a nature reserve situated 20 km off the north-west coast of Australia (Fig. 1), and experiences hot and humid summers and mild winters. A detailed description of the climate, vegetation, and geography is presented elsewhere (WAPET 1987; Moro 1997). Mice were air-transported within three days of capture to a controlled temperature room (air temperature = 25 ± 1°C, relative humidity = 40 ± 5%, 12:12 hour photoperiod) at Agriculture Western Australia (Forrestfield, Western Australia). Short-tailed mice were kept individually in plastic mouse containers (40 x 25 x 10 cm high). House mice were kept individually in glass aquaria (25 x 45 x 25 cm high) as they were less likely to escape when replacing food. All enclosures were secured with wire lids and supplied with paper as bedding material. Both species were acclimated to these enclosures for three days prior to the preference trials. Before trials, mice were maintained on an *ad libitum* diet of mixed parrot seed, and had apple available as a water source. Six individuals (three male, three female) of each species were used in each trial. The day before the first trial, the quantity of food given to each mouse was halved to encourage hunger. The same individual was used for each bait consumption trial so that comparisons were valid between trials. Each trial lasted for three nights.

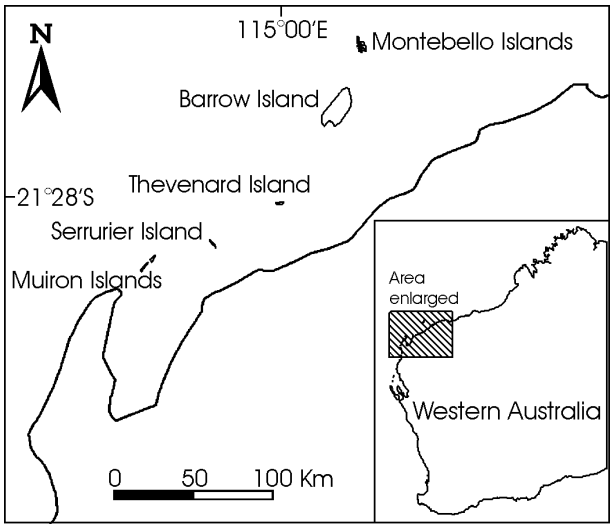

Fig. 1 Location of study site and surrounding islands.

Trial 1: Consumption of bait, no added salt

Three non-toxic media were chosen for the palatability trials: parrot seed, parrot seed coated with bees wax, and parrot seed coated with agar. These media were selected because they would be easy to procure for a broad-scale control operation, the coating would provide a suitable medium for a poison, and each bait could be produced in quantity. Baits of a known mass were presented separately and simultaneously in plastic trays (5 x 5 x 1.5 cm high) in a cafeteria format (Krebs 1989) to individual mice. Total mass of food supplied to each mouse during these trials exceeded their maximum intake of 2-3 g per day (Moro 1997), so bait was available at all times. The total mass of food consumed overnight was calculated (±0.1 g). An additional five of each bait type were placed in the room to measure evaporation overnight. Total mass of food consumed could therefore be corrected for any mass losses due to evaporation.

Trial 2: Consumption of bait, added salt

After three days, the experiment was repeated with the same cafeteria-style design, the same individuals, and the same bait and bait coatings (none, agar, wax), except each bait was mixed with salt. Aqueous solutions containing 0.25 µg/*l* sodium chloride were prepared in distilled water following laboratory trials that identified that house mice and short-tailed mice increased their water intake at this saline concentration (Moro and Bradshaw 2000). Equal volumes of saline were added to each bait coating, or to the seed (no coating).

Trial 3: Use of bait stations

The effectiveness of three bait stations was tested to evaluate their visitation by each species of mouse. Bait station one (BS-1) was constructed from a 20 *l* plastic bucket (Rheem, Australia; 40 cm high, 28 cm diameter; Fig. 2a).

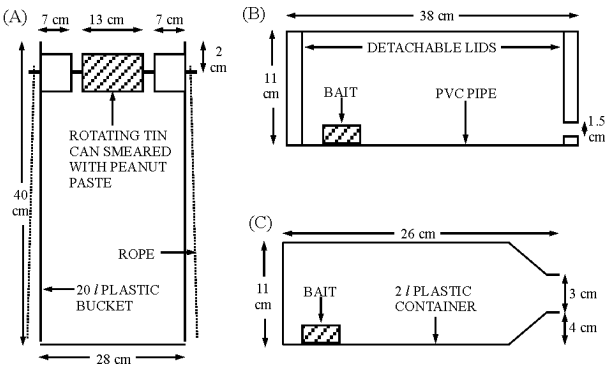

Fig. 2 Diagrams of the bait stations tested for the selective entry or capture of house mice: (A) BS-1, entry by ropes; (B) BS-2, entrance through minimum hole size; (C) BS-3, entrance raised and through a larger hole size.

It comprised a metal rod passed through three enclosed aluminium cans (7 cm high, 6.5 cm diameter), resting approximately 2 cm below the rim so that the cans lay neatly along the inside of the bucket. The cans on either side of the central can were secured to the bucket using an epoxy resin or silicon, while the central can (13 cm high, 6.5 cm diameter) was smeared with peanut paste and left to freely rotate. Rope (1.5 cm diameter) was hung on either side of the rod. This design is currently in restricted use on Thevenard Island. It works on the principle that a mouse will climb the rope, rest on the fixed can, and smell the peanut paste, whereupon it will move onto the central can which spins on the rod and causes the mouse to fall inside.

Bait station two (BS-2) was constructed from a PVC tube (38 cm long, 11 cm diameter) fitted with lids at each end, one of which was perforated with a hole that only permitted the entry of house mice (Fig. 2b). Bait was placed inside the tube at the opposite end to the point of entry. This design was dependent upon the use of a suitable hole diameter that excludes the entry of adult short-tailed mice. To identify a suitable hole size, adult mice of both species were individually placed inside a large aquarium (76 x 30 x 36 cm high) fitted with four perspex walls, and left overnight. Each wall was perforated with a hole of diameter 20 mm, 15 mm, 13 mm, or 10 mm. A small tray of food that was placed between partitions was disturbed if a mouse entered that partition. When the minimum hole diameter that would permit the passage of house mice but not short-tailed mice was found, it was drilled into one of the lids of the plastic tube and used in the trials. Each tube was positioned horizontally on the floor of the room with the hole close (0.5 cm) to the floor.

The third bait station (BS-3) was a 2 *l* plastic milk container (26 cm long, 11 cm diameter; Fig. 2c). The parrot-seed bait was placed inside the tube opposite the entrance, and the bait station was positioned horizontally on the floor. BS-3 differed from BS-2 because it was of simple design, and had a larger entrance diameter (3 cm) which rested higher (4 cm) off the floor.

All trials were performed in a controlled-temperature room, as described before, over a three-night period. Each bait station design was tested separately. Bait stations were positioned throughout the room, and mice were released and left overnight. The disturbance to the parrot-seed bait inside BS-2 and BS-3 was used to gauge mouse visitation. Mice captured within BS-1 could be counted before release. A total of 12 house mice were initially used during these trials. The experiment was then repeated using six short-tailed mice after all 12 house mice were removed.

Data Analysis

Manly's selection index, β (Manly 1995), was used to assess the difference in the amount of food eaten by each species when offered a choice. The β indices are estimates of the actual consumption as a proportion of the initial amount of food provided. The global 95% corrected *t* distribution confidence intervals (CI) follow equations in Manly (1995), and provide the limits to which the null hypothesis of no selection for a food type [where no selection(β) = 1/(number food types used)] can be compared. In all statistical analyses, a probability of $P \leq 0.05$ was considered significant. Total food consumption between trials was compared using a paired *t*-test after data were logarithmically transformed.

RESULTS

Trial 1: Bait consumption, no added salt

When presented with a choice of bait media, house mice selected parrot seed coated with agar 84% more often (global 95% CI 71-98%) than either parrot seed alone, or parrot seed coated with wax (Table 1, Fig. 3). This selection

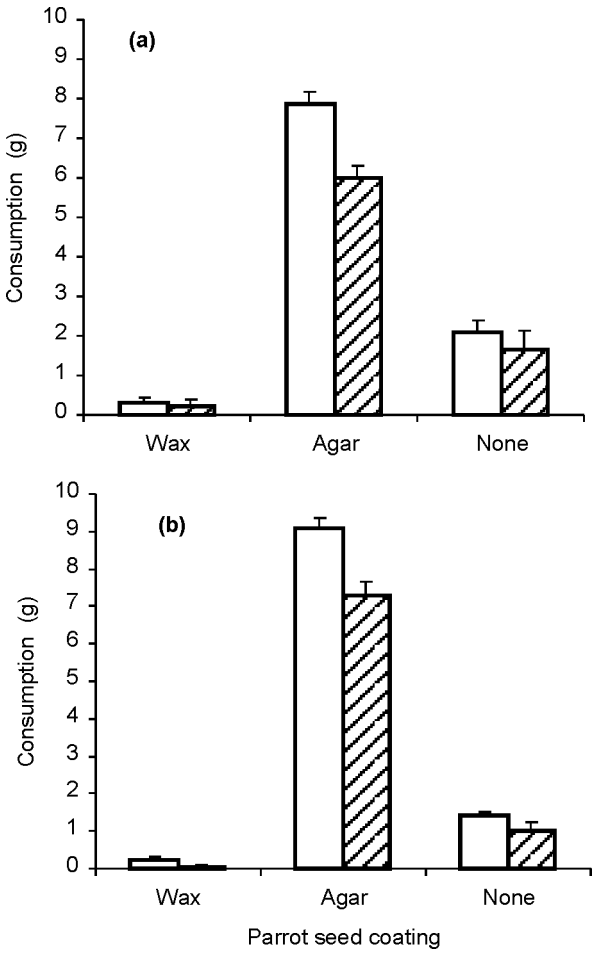

Fig. 3 Mean (±SE) daily consumption by short-tailed mice (open bars) and house mice (hatched bars) of bait (a) without added salt and (b) with 0.25 µg/*l* added salt. In each trial, consumption was calculated for six individuals of each species over a three day period, and only after each individual was acclimatised to their enclosure for three days. All three baits were presented simultaneously to each individual mouse.

Table 1 Results of cafeteria feeding trials for short-tailed mice and house mice offered parrot seed coated in wax (W), parrot seed coated in agar (A) and parrot seed alone (S). Statistics follow selectivity measures in Manly (1995), $n=6$ for each mouse species.

Trial		Short-tailed mice			House mice		
		W	A	S	W	A	S
No salt	β	0.02	0.85	0.13	0.02	0.84	0.15
	(±SE)[a]	(0.01)	(0.03)	(0.04)	(0.01)	(0.05)	(0.04)
	t(global)[b]	0-0.33	0.75-0.96	0.02-0.34	0-0.35	0.71-0.98	0.03-0.35
	Selection[c]	+/-	+	+/-	+/-	+	+/-
Salt	β	0.04	0.78	0.19	0.08	0.86	0.14
	(±SE)	(0.02)	(0.06)	(0.05)	(0.01)	(0.04)	(0.04)
	t(global)	0-0.11	0.54-0.92	0.08-0.31	0-0.03	0.71-0.96	0.04-0.27
	Selection	-	+	-	-	+	-

[a]Selection index (standard error)
[b]Global 95% corrected *t* distribution 95% confidence intervals
[c]Food selected for (+), avoided (-), or neither selected nor avoided (+/-)

is significantly different from the null hypothesis expectation of 33% if no food selection was detectable. Of the remaining foods, house mice selected parrot seed alone 15% (global 95% CI 3-35%) of the time, and parrot seed coated in wax only 2% (global 95% CI 0-35%) of the time.

The selection of bait type by short-tailed mice was similar to that of the house mice (Table 1, Fig. 3). Short-tailed mice selected parrot seed coated in agar 85% (global 95% CI 75-96%) more often than parrot seed coated in wax (2%, global 95% CI 0-33%), or parrot seed alone (13%, global 95% CI 2-34%). Clearly, parrot seed coated in agar was the preferred food type selected by house mice and short-tailed mice. However, parrot seed coated in wax, and parrot seed used alone, were neither avoided nor preferred by either species.

Trial 2: Bait consumption, added salt

When house mice and short-tailed mice were presented with a choice of foods after the addition of 0.25 µg/*l* salt to the foods, agar was still their preferred choice (Table 1), and consumption increased (Fig. 3). In contrast to Trial 1, both house mice and short-tailed mice showed an avoidance for parrot seed with or without a wax coating. However, when the type of bait is ignored, total consumption of food (mean ± standard error) increased after the addition of salt to the baits. The total food consumed by house mice was significantly higher (22.2±1.6 g/day, $t = 9.83$, df = 5, $P < 0.0001$) after salt was added to their foods than before added salt (7.9 ± 0.3 g/day). Similarly, short-tailed mice consumed significantly more food after the addition of salt (31.0±1.7 g/day) than before its addition (10.3 ± 0.5 g/day, $t = 12.1$, df = 5, $P < 0.0001$).

Trial 3: Efficiency of bait stations

The bucket design bait station (BS-1) captured five, seven, and 10 house mice in each of three consecutive nights, respectively. This design required that the captured mice had to be removed regularly.

The minimum hole diameter that all house mice were found to pass through was 15 mm (Table 2). Only one short-tailed mouse was found to pass through a hole of this dimension, although this individual was the smallest and lightest in body mass (19 g) of all short-tailed mice used in the trials. This hole dimension was subsequently drilled into the lid of BS-2 to identify entry by each species of mouse. Visitation to BS-2 and BS-3 was recorded for house mice.

In contrast, no short-tailed mice were captured using BS-1. One individual short-tailed mouse was found within BS-2 after it had enlarged the entrance hole by chewing. All BS-3 designs showed evidence that short-tailed mice had entered.

Table 2 Body mass of house mice and short-tailed mice collected from Thevenard Island, and frequency of mice that successfully passed through a hole of a specified diameter, as used during the bait station trials.

Species	*n*	Body mass (g) Mean (±SD)	Hole diameter (mm) 20	15	13	10
Short-tailed mouse	6	22.8(4.3)	6	1	1	0
House mouse	12	12.7(4.2)	12	12	5	0

DISCUSSION

The cafeteria trials showed that parrot seed mixed with an agar coating will increase bait consumption by both house mice and short-tailed mice. However, the level of bait uptake did not differ between species of mouse, indicating that, if used on its own, parrot seed mixed with an agar coating would not be a suitable medium to lace with a rodenticide for house mouse control without affecting the short-tailed mice.

The addition of salt to the agar increased the consumption of the bait by both rodent species. Adding salt to a bait could therefore offer one way to increase bait consumption by house mice. This increase could be an inherent need to consume moist foods (agar) to compensate for an increase of salt into their bodies. Alternatively, a more salty diet may have stimulated an increase in the consumption of agar because mice developed a salt appetite (Denton 1982), and is consistent with laboratory data demonstrating high saline intakes in both species (Moro and Bradshaw 2000). Native bush rats (*Rattus fuscipes*) have also been found to increase their water intake within six hours of increasing the sodium content of the water, indicative that a taste for salt developed in response to an increase in sodium concentration (Abraham *et al*. 1975).

The selection of food can depend upon how well it satisfies the nutritional requirements of a rodent (Murray and Dickman 1994, 1997), or upon its physical or chemical characteristics (Westoby 1977). Agar provides a moist medium relative to a wax medium or to parrot seed supplied without an additional coating, and may explain why it was selected for during these trials. When presented with a choice of seeds of variable water content, the sandy inland mouse (*Pseudomys hermannsburgensis*) and the kangaroo rat (*Dipodomys merriami*) selected those with a high moisture content (Frank 1988; Murray and Dickman 1997). Selection for moist foods is clearly an adaptive trait for a species inhabiting an environment where free water is scarce. The amount of water produced from metabolic processes can also be an important component of diet selection for mice (Olsen 1976; Post 1993). Alternatively, diet choice may be based upon caloric and nutritive factors as well. However, this is unlikely to have influenced the results of food selection by house mice or short-tailed mice in the present study, because each bait represented the same fundamental food type (parrot seed) presented with different coatings. Caloric (energy) content, therefore, would not have varied between bait media.

It must be recognised that the selection of a bait under laboratory conditions may differ to selection in the field, where the availability of alternative (and preferred) foods exists. For example, the effectiveness of strychnine in controlling house mice is well recognised (Caughley *et al.* 1996), but its effectiveness was found to be low when alternative foods were available in abundance (Brown *et al.* 1997). In the present study, parrot seed coated in wax was not a preferred bait by either species of mouse, perhaps because of an abundance of (preferred) seed coated with agar in the choice experiments. Elsewhere, wax has been used as an effective medium to deliver a poison. Rodenticide wax blocks (Talon™, ICI Australia) were effective for the control of house mice on Varanus Island, Western Australia (J. Angus, pers. comm.).

The results that investigate the suitability of a bait station for the control or capture of house mice selectively appear promising. Bait stations were successful at either capturing house mice (BS-1), or restricting the access of adult short-tailed mice to the baits (BS-2). Reasons why the short-tailed mice were not captured in BS-1 remain speculative, but may indicate a reluctance to climb. These designs exploit differences in the body sizes of each species (BS-2) and differences in their agility (BS-1), which may explain the reluctance of short-tailed mice to climb up the ropes and fall into the bait station. Buckets similar to BS-1 are currently in limited use around the dwellings on Thevenard Island, and to date have only captured house mice (West Australian Petroleum, unpub. data). The success of bait stations in restricting other species from accessing baits has been reported elsewhere. Bait stations made from plastic tubing have been used in New Zealand to poison rats whilst excluding birds (Taylor and Thomas 1993). The use of a bait box that partially encloses a rodenticide was found to be more effective for the control of house mice in a food store, compared to the use of the rodenticide alone (Rowe and Chudley 1963).

Management implications

Short-tailed mice face some risk of poisoning when poison is considered as a population management option to eradicate or control house mice, although the degree of exposure to toxic baits can be reduced. The use of an agar coating as a medium to deliver a poison for house mice seems a feasible option for use in the field. The addition of salt may increase the consumption of bait by a house mouse, and therefore increase the chance that an individual consuming a sublethal dose of poison will return to consume more. Agar coated baits are a feasible option for the delivery of rodenticides to wild house mice if non-target mice are absent. A preference of this bait and coating by short-tailed mice implies that these baits cannot be used for selective control if used on their own on Thevenard Island. However, exposure of a non-target mouse to a poison bait can be reduced if the bait is used in conjunction with a bait station such as BS-1 or BS-2. Plastic tubes that exclude short-tailed mice, such as BS-2, can provide a cost-effective method for broad-scale distribution to control house mice selectively. The use of tube stations on Thevenard Island will not restrict the entry of juvenile short-tailed mice. However, if their use is restricted to a time of year when juveniles are absent or low in density, they may reduce or eliminate non-target mortality and provide an effective control for house mice. Alternatively, a combination of the body size/agility selection process might make it possible to design a bait station that selected all house mice for all short-tailed mice. The combined use

of a bait and bait station may therefore be an efficacious means to control house mice in areas where they coexist with non-target species of mice that may have threatened or endangered status.

ACKNOWLEDGMENTS

This project was approved by the Department of Conservation and Land Management Animal Ethics Committee. Thanks are due to the staff at Agriculture Western Australia for providing laboratory space, particularly M. Massan for logistical support. This project received support from Environment Australia and West Australian Petroleum. I would like to thank N. Marlow and D. Algar (Department of Conservation and Land Management), and G. Mutze for comments on a draft of this manuscript, and S. J. Bennett for assistance with Arcview to prepare the location map. I also thank M. Williams for help and advice with the Manly statistical analyses.

REFERENCES

Abraham, S. F.; Blaine, E. H.; Denton D. A.; McKinley M. J.; Nelson J. F.; Shulkes A.; Weisinger R. S. and Whipp G. T. 1975. Phylogenetic emergence of salt taste and appetite. In Denton D. A. and Coghlan J. P. (eds.). Olfaction and Taste: Volume 5, pp. 253-280. London, Academic Press.

Brown, P. R.; Singleton G. R.; Kearns B. and Griffiths J. 1997. Evaluation and cost-effectiveness of Strychnine for control of populations of wild house mice (*Mus domesticus*) in Victoria. *Wildlife Research 24*: 159-172.

Calver, M. C.; King D. R.; Bradley J. S.; Gardner J. L. and Martin G. 1989. An assessment of the potential target specificity of 1080 predator baiting in WesternA u s tralia. *Australian Wildlife Research 16*: 625-638.

Caughley, J.; Bomford, M.; Parker, B.; Sinclair, R.; Griffiths J. and Kelly D. 1996. Managing Vertebrate Pests: Rodents. Bureau of Resource Science, Canberra, Australian Government Publication Services.

Caughley, J.; Monamy V. and Heiden K. 1994. Impact of the 1993 mouse plague. *GRDC Occasional Paper Series 7*.

Creekmore, T. E. 1998. Evaluation of two oral baiting systems for wild rodents. *Journal of Wildlife Diseases 34*: 369-372.

Denton, D. 1982. *The Hunger for Salt: an Anthropological, Physiological and Medical Analysis*. Berlin, Springer-Verlag.

Frank, C. L. 1988. The influence of moisture content on seed selection by kangaroo rats. *Journal of Mammalogy 69*: 353-357.

Krebs, C. J. 1989. *Ecological Methodology*. New York, Harper and Row.

Manly, B. F. J. 1995. Measuring selectivity from multiple choice feeding preference experiments. *Biometrics 51*: 709-715.

McIlroy, J. C. 1982. The sensitivity of Australian animals to 1080 poison. IV. Native and introduced rodents. *Australian Wildlife Research 9*: 505-517.

Mead, R. J.; Oliver, A. J.; King, D. R. and Hubach, P. H. 1985. The co-evolutionary role of fluoroacetate in plant-animal interactions in Australia. *Oikos 44*: 55-60.

Moro, D. 1997. Interactions between native and introduced rodents in an insular environment: strategies for the conservation of the Thevenard Island short-tailed mouse. Unpublished PhD Thesis, University of Western Australia, Australia.

Moro, D. and Bradshaw, S. D. 1999. Water and sodium requirements of field populations of house mice (*Mus domesticus*) and short-tailed mice (*Leggadina lakedownensis*) on Thevenard Island, in the arid Pilbara region of Western Australia. *Journal of Comparative Physiology 169*: 419-428.

Moro, D. and Bradshaw, S. D. 2000. Water and sodium balances and metabolic physiology of house mice (*Mus domesticus*) and short-tailed mice (*Leggadina lakedownensis*) under laboratory conditions. *Journal of Comparative Physiology 169*: 538-548.

Murray, B. R. and Dickman, C. R. 1994. Food preferences and seed selection in two species of Australian desert rodents. *Wildlife Research 21*: 647-655.

Murray, B. R. and Dickman, C. R. 1997. Factors affecting selection of native seeds in two species of Australian desert rodents. *Journal of Arid Environments 35*: 517-525.

Olsen, R. W. 1976. Water: a limiting factor for a population of wood rats. *Southwestern Naturalist 21:* 391-398.

Post, D. M. 1993. Detection of differences in nutrient concentrations by eastern woodrats (*Neotoma floridana*). *Journal of Mammmalogy 74*: 493-497.

Rowe, F. P. and Chudley, A. H. J. 1963. Combined use of rodenticidal dust and poison solution against housemice (*Mus musculus* L.) infesting a food store. *Journal of Hygiene (Cambridge) 61*: 169-174.

Sterner, R. T.; Ramey, C. A.; Edge W. D.; Manning T.; Wolff J. O. and Fagerstone, K. A. 1996. Efficacy of zinc phosphide baits to control voles in alfalfa - an enclosure study. *Crop Protection 15*: 727-734.

Taylor, R. H. and Thomas B. W. 1993. Rats eradicated from rugged Breaksea Island (170 ha), Fiordland, New Zealand. *Biological Conservation 65*: 191-198.

WAPET. 1987. Saladin Oil-field Development - An Environmental Review and Management Programme. Volume 1. West Australian Petroleum, Perth, Australia.

Westoby, M. 1977. What are the biological bases of varied diets? *The American Naturalist 112*: 627-631.