

Husbandry Guidelines

Plains Rat *(Pseudomys australis)*



Alice Springs Desert Park 2006

Compiled by Peter Nunn



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1. Taxonomy

1.1 Common Name: Plains Rat

Other Names: Plains Mouse, Eastern Mouse, Eastern Rat

1.2 Classification:

Class: Mammalia

Order: Rodentia

Family: Muridae

Subfamily: Hydromyinae

Genus Species: *Pseudomys australis* (Gray, 1832)

sude'-oh-mis ost-rah'-lis:

“southern false-mouse”

Subspecies: none

Recent Synonyms: *Mus lineolatus* (Gould, 1845)

Hapalotis murinus (Gould, 1845)

Pseudomys auritus (Thomas, 1910)

Pseudomys rawlinnae (Troughton, 1932)

Pseudomys minnie (Troughton, 1932)

Pseudomys minnie flavescens (Troughton, 1936)

1.3 A.S.M.P. Category: 3, 1b.

Endangered – Parks and Wildlife Commission of the Northern Territory (PWCNT)

Vulnerable – Department of Environment and Heritage South Australia (DEHSA)

1.4 I.U.C.N. Category: Vulnerable

1.5 O.H.&S. Category: Non-hazardous

1.6 Studbook Keeper: Wesley Caton

2. Natural History

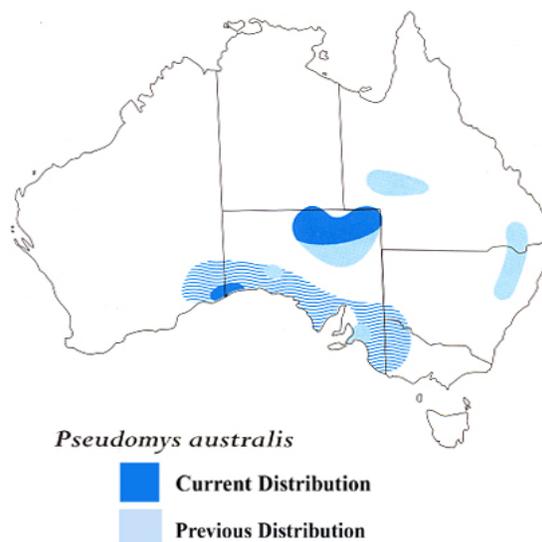
2.1 Habitat and Distribution

A study of the distribution and habitat requirements of the Plains rat carried out by Brandle *et al* (1999) found the species to occupy a band of habitat west of Lake Eyre that stretches over 600km in a north-south orientation. Plains rats were found in gibber or floodplain with chenopod shrubland or lignum claypan, preferring minor cracking clay drainage depressions over major drainage channels or floodouts. It is theorised that the surface cracks trap windblown material such as seeds, enabling plains rats to survive long periods of unfavourable environmental conditions. Displaying boom-and-bust population cycles, ideal environmental conditions can result in population explosions which in turn attract large numbers of predators such as letter-winged kites.

Watts and Aslin (1981) described the species as inhabiting shallow burrow systems which are dug directly into the hard substrate or, where possible, in the soil mounds that form at the base of stunted bushes. These burrows may be only a few centimeters below the surface in hard gibber substrates. A Plains rat burrow complex generally contains a few side passages and a single nest chamber. Typically occurring at around 10m intervals, neighbouring burrows are interconnected by a network of surface runways. Such colonies may stretch continuously for several kilometres where habitat is suitable.

2.2 Map

Figure 2.2.1 Current and Former Distribution of *Pseudomys australis* (Watts, 1998).



2.3 Description

The Plains rat is an attractive rodent with a bulky build, short slender tail, and soft fur which often has a beautiful sheen (Watts and Aslin, 1981). The adult body colour is grey or grey-brown above and white or cream below. Juveniles are uniformly grey dorsally. The tail is equal to or shorter than the head-body length, and is bi-coloured dark above (becoming lighter towards the tip) and pale below. The ears are relatively large and round (Strahan, 1998).

2.4 Morphometrics

Table 2.4.1 Measurements (average in brackets).

Head and body length (mm)	*100 – 140 (135)
Tail length (mm)	*80 – 120 (110)
Weight (g)	*50 - 80 (65)
Weight (g) – ASDP captive stock (2001- 2006)	Males 38 - 70 (52.0) Females 32 - 49 (40.3)

* Watts (1995)

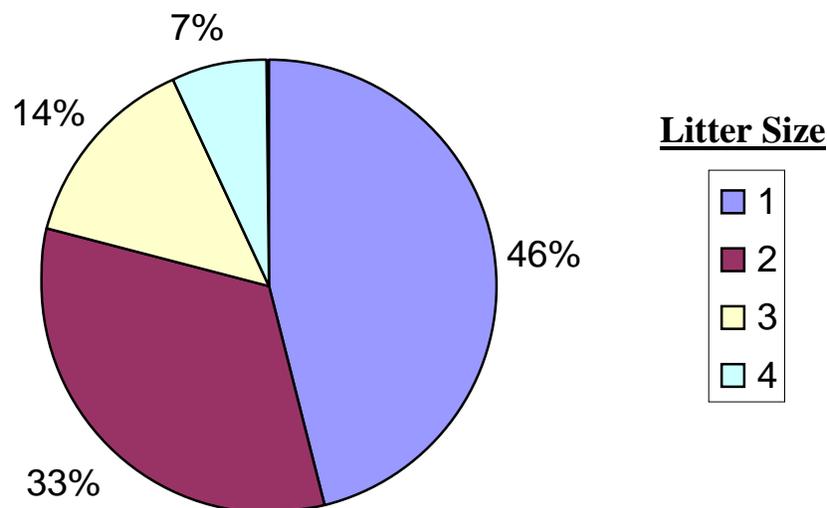
2.5 Sexual Dimorphism:

None, although males tend to be larger than females.

2.6 Social Structure and Reproductive Strategies:

The Plains rat is a social species, occurring in often large colonies on the barren, open plains it calls home. Thought to breed opportunistically after heavy rains, observations of excavated burrows suggest the basic breeding unit is one male to 2 - 3 females. The oestrus period is 7 - 8 days, gestation is 30 - 31 days, litter size ranges from 1 - 4 pups (average = 2, Fig. 2.6.1), and the females experience post-partum oestrus. Young are weaned at 28 - 33 days and sexual maturity is reached at around 180 days (Watts and Aslin, 1981). During periods of poor environmental conditions, breeding ceases and 20 or more individuals of both sexes have been found to share a single burrow system (Watts and Aslin, 1981).

Figure 2.6.1 Litter Size (number of pups born per litter) for Plains Rats at ASDP (2001 – 2006).



3. Captive Reproductive Breeding Strategy

Plains rats are established as pairs at ASDP for captive breeding. Individuals are introduced by first dusting with Pyrethrum powder to mask any scents the animals may be carrying or those of other individuals they may have been previously housed with. The animals are then introduced to a neutral enclosure and their behaviour monitored periodically to ensure compatibility.

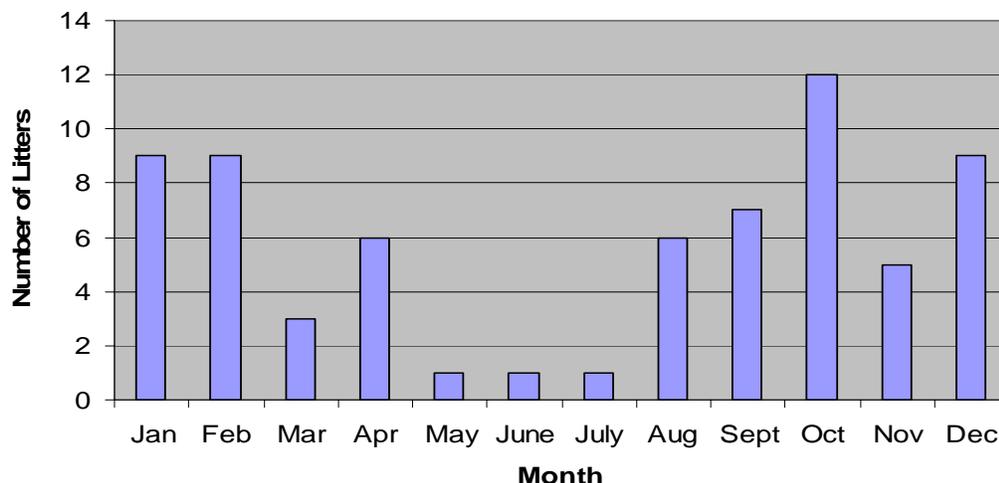
When a single animal is required to be introduced to an established group, the group is systematically broken down and introduced to that animal one individual at a time until the group is re-established. Subordinate individuals in the group should be selected for introduction first, with the final introductions being the dominant animals from the original group. This may take several days to establish.

When housed indoors in a climate-controlled environment plains rats may breed year-round. Animals which are subject to normal environmental cues breed through the warmer months of the year. At ASDP mating is first observed in August in response to the increase in temperature and breeding typically ceases around March/April at the onset of winter (Fig. 3.1). All disturbance should be minimized during the breeding season. Disturbance can be a critical factor with pups less than one week of age, so to avoid mortalities checking of females with young should be carried out every 2 – 3 days only.

Offspring of both sexes can remain within the group once sexually mature since strict social hierarchies generally ensure group cohesion. Dominance hierarchies are established and maintained for both sexes, with breeding suppressed in subordinate individuals. Subordinate females may give birth but survivorship of pups is typically low in an established group.

All enclosures have a carrying capacity, which is the maximum number of individuals that can be held long-term in a stable social situation. Carrying capacity is primarily determined by enclosure size, but will be influenced by other factors such as season, diet, group composition and age structure. Once the carrying capacity of the enclosure is reached a high rate of infant mortality may be observed, and if further breeding is required it may be necessary to remove subordinate individuals to reduce the group number.

Figure 3.1 Seasonal Variation in Plains Rat Births at ASDP for the period 2001 to 2006.
(showing litters, not individuals born)



4. Captive Husbandry

4.1 Housing Requirements

Plains rats are housed indoors in commercially manufactured, smooth-sided plastic tubs (600mm x 400mm x 400mm) with secure clip-on lids. A large hole is cut into the lid and fitted with wire mesh for ventilation. Tubs of this size may keep individuals, pairs or breeding groups that may reach a carrying capacity of up to nine individuals. The tubs are lightweight, easy to clean, and are relatively quick and inexpensive to purchase and set up. As with any plastic enclosure however, there is always the possibility of animals chewing through the sides and escaping.

Outdoor enclosures require 12mm galvanized wire mesh with a solid base of concrete, sloped for drainage. A 400 - 500mm high tin skirt should encircle the inside of the enclosure to prevent animals from climbing the wire mesh walls and reduce aggression between enclosures. The enclosure should be covered by a partial corrugated iron roof to counter extremes in weather whilst providing both sunny and shaded sites.

Supplementary heating is not required in enclosures housing social groups of Plains rats, regardless of whether they are housed indoors or outdoors. Animals which are housed individually however may require additional heating through the cooler months. This is provided by housing individuals indoors where supplementary heating can be provided to the entire room.

4.2 Substrate and Furniture

A coarse-grained river sand is the preferred substrate for outdoor Plains rats enclosures as it provides the animals with opportunities to carry out natural behaviours such as digging and burrowing. For indoor housing in plastic tubs fine-grained sand is used as it is better able to absorb water. Plains rats regularly spill their water bowl or fill it with sand (to increase the moisture content of the substrate). The depth of substrate should be 80 - 100mm for large enclosures and 40 - 50mm for plastic tubs.

Being a terrestrial species whose natural habitat is typically quite barren with sparse vegetation, captive Plains rats require little in the way of cage furniture. The provision of a few freshly-cut branches or grass tussocks will stimulate natural foraging behaviour as well as providing material for nesting. Hollow logs and other pieces of wood may be added to the enclosure, particularly where animals are housed in groups, as these provide refuge for subordinate individuals to avoid or escape pursuers. All furniture should be placed toward the centre of the enclosure to limit climbing opportunities. For the same reason, in plastic tubs furniture such as browse should not exceed 150mm in height.

4.3 Nest Box Design

For small indoor enclosures the most effective nest box is a commercially produced plastic "lunchbox". Cheap and readily available, lunchboxes have removable lids which allow for easy monitoring of the animals nesting inside, and are simple to clean. All they require is a 45 - 50mm access hole to be drilled in one side. Plains rats will often chew additional holes in these nest boxes, seemingly being more comfortable when they have multiple points of entry and exit.

Plastic nest boxes should be installed directly on the floor of the enclosure and the substrate distributed around them. Plains rats will burrow under nest boxes that are placed on top of the substrate, and while these small plastic boxes alone are unlikely to crush or trap animals in the event of a tunnel-collapse, crushing may inadvertently occur in the process of the keeper replacing the nest box lid after carrying out a routine check.

Outdoor enclosures require a sturdy, weather-resistant nest box that provides insulation from the highly variable external temperatures. A 400mm x 250mm x 250mm box constructed from marine ply will house a small group of plains rats comfortably. Again a 45 - 50mm access hole must be drilled low-down on one of the sides of the box.

Outdoor nest boxes should be raised off the concrete enclosure floor to provide further insulation, particularly from extreme cold. A useful technique is to place two bricks on the floor of the enclosure, onto which the nest box is mounted. Substrate can then be distributed around the nest box to the required level to allow the animals to access the entry hole. Nest boxes and other heavy furniture items (eg. Rocks and logs) should never be placed directly on top of the substrate as Plains rats will readily tunnel under such objects, risking burrow-collapse and the crushing of animals. Environmental conditions (eg. Exposure to sun and rain) must be considered when selecting the location of nest boxes in outdoor enclosures. Multiple nest boxes should be provided when housing a breeding group of Plains rats as females have been observed to utilize separate nesting locations with offspring.

Shredded paper is an ideal nesting material for nest boxes in indoor enclosures. When exposed to the weather however paper performs poorly, quickly becoming waterlogged and thus providing little comfort and insulation. Outdoor nest boxes are more suited to a bedding layer of loose, dry grass. Nesting material deteriorates in quality quite quickly, so should be replaced regularly. The exact interval between replacement depends on a number of factors such as environmental conditions, the number of animals using the nest box and the breeding status of the group.

4.4 Diet and Food Presentation

Limited studies suggest the diet of wild Plains rats consists predominantly of seeds, supplemented with vegetable matter and invertebrates. Captive animals at the Alice Springs Desert Park are fed a diet of seed (finch or small parrot mix) and mixed vegetables. Comprised of carrot, sweet potato, broccoli, cauliflower, apple, and spinach or endive leaf in roughly equal proportions, this vegetable mix is dusted with calcium and vitamin E powder to prevent deficiencies from occurring in captive animals.

A.S.D.P. Plains Rat Diet:

Note: all quantities are per individual and vary depending on housing and group composition.

Monday	Veg mix	12g
Tuesday	Seed	12g
	Rat & mouse cube	2 cubes
Wednesday	Veg mix	12g
Thursday	Veg mix	12g
Friday	Seed	12g
Saturday	Veg mix	12g
Sunday	Seed	12g

Food should always be presented in a single bowl regardless of the number of animals housed in the enclosure. This is due to the social organisation that is established within a group of Plains rats, where one food source will be adopted as the primary source. Multiple feed stations instigate competition amongst the dominant individuals. This leads to aggression and stress, resulting in injuries and possible death.

4.5 Special Dietary Requirements

None.

4.6 Water

Drinking water should be presented in a single shallow bowl. In small enclosures Plains rats may also use this water to moisten the substrate and raise the relative humidity level, particularly in indoor situations where the use of climate control systems results in very dry conditions. Hanging water bottles are avoided as they provide an opportunity for climbing.

4.7 Identification Method

All captive animals should have a unique identifier of some description. For Plains rats the most effective identification technique is a Trovan™ microchip implanted interscapularly (between the shoulder blades). Immediately after inserting the microchip, Vetbond™ (a tissue adhesive) is applied to secure and bind the opening. Microchipping is carried out once the animals exceed 20 grams in weight (5 - 6 weeks of age). Other means of identification include metal eartags, tattooing, and a coded system of holes punched through the ears.

All records and correspondence thereafter should refer to this unique identifier.

4.8 Daily Husbandry

- Removal of all uneaten food.
- Water bowl cleaned and water replenished.
- Cleaning – sweeping up faecal material with a brush and dustpan as it accumulates.
- Animals sighted to ensure they are in good health (Reduce to 2 - 3 times weekly in breeding groups to minimise disturbance).
- Enclosure security checked visually, looking particularly for signs of animals attempting to chew their way out (especially relevant when housing plains rats in plastic tubs).
- Food provided in a clean dish as late in the day as possible (Animals housed indoors may be fed earlier).

4.9 Monthly Husbandry

- Weigh all animals and carry out physical health checks.
- Small indoor enclosures to be emptied, cleaned and fresh substrate added. For large outdoor enclosures, simply remove the surface layer of sand and faeces with a broom, brush and dustpan (An annual substrate exchange is generally sufficient for large outdoor enclosures).
- Substrate in large outdoor enclosures to be raked level after cleaning to fill in all burrows and cover over all runways.
- Nest boxes to be cleaned and fresh nesting material added in accordance with the animals' requirements (Less often during breeding season to reduce disturbance and maintain familiarity).
- All equipment should be washed with detergent and water, rinsed, and then sprayed with a 1:100 dilution of Avisafe® (halogenated tertiary amines).
- Any browse present should be changed as needed.

4.10 Capture and Restraint

In large outdoor enclosures, individuals will commonly run along the wall or side of the enclosure when pursued. The technique used to capture such animals is to place the hand net flat on the ground against the side of the enclosure and flush the animal in the direction of the net. As the speeding animal passes over the net the trailing edge is raised so that the animal runs directly into the net.

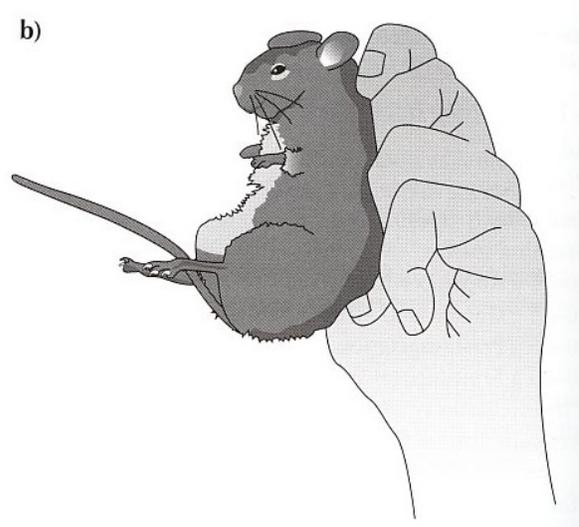
The animal can then be transferred to a small cloth bag (secured with a tie at the top) for weighing or transportation.

For Plains rats sheltering in nest boxes, an effective technique is to place a cloth bag over the outside of the nest box access hole, partially remove the lid of the box, and use one hand to flush the animal out through the access hole and into the bag. The keeper's spare hand should be used to hold the bag in place over the entry hole, and then to seal off the bag as soon as the animal runs into it. Another technique requires the sealing off of the nest box entry hole with the animal contained inside, using a sliding door panel or a rolled-up cloth bag. The lid of the nest box is first partially removed for access. A hand is placed into a cloth bag which has been turned inside-out (seams on the inside) and inserted into the nest box to grasp the animal gently but securely around the base of the head. While restrained in this manner, the bag is reversed over the animal and then securely tied. The latter technique is most effective on quiet animals.

Once the animal is contained within a bag, further restraint may be required for routine or veterinary examinations. The technique for securing Plains rats is as mentioned previously, where a flat or cupped hand is placed on the bag to limit movement while the other hand grasps the animal behind the head. The bag may then be peeled back over the animal to reveal the head or body for further examination. Alternately, while the cupped hand restrains the individual through the bag the other hand is inserted into the bag to grasp the animal behind the head. This technique allows the animal to be completely removed from the bag for inspection.

The preferred hold for Plains rats involves the head being secured behind the mandible on both sides. This can be executed with the thumb and middle finger, placing the index finger at the rear of the skull (Fig. 3.11.1a). Plains rats may also be restrained by the scruff of the neck using the thumb and index finger (Fig. 3.11.1b). This hold is best used when the animal is to be partially kept within the cloth bag, particularly with the eyes covered, as is the case when inserting an interscapular microchip. Animals held in the open in such a manner will generally fight vigorously to break free so care should be taken to minimize the length of time and necessity of this type of restraint.

Figure 3.11.1 Techniques for Holding Rodents showing (a) mandible restraint (ASDP), and (b) animal restrained by the scruff of the neck (Jackson, 2003).



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Plains rats should never be picked up by the tail as the tail sheath is easily stripped (Watts and Aslin, 1981). Once properly restrained however (in the hand or a cloth bag) the tail can be manipulated by using a light hold to the tail base using thumb and forefinger for purposes such as checking the sex of an individual.

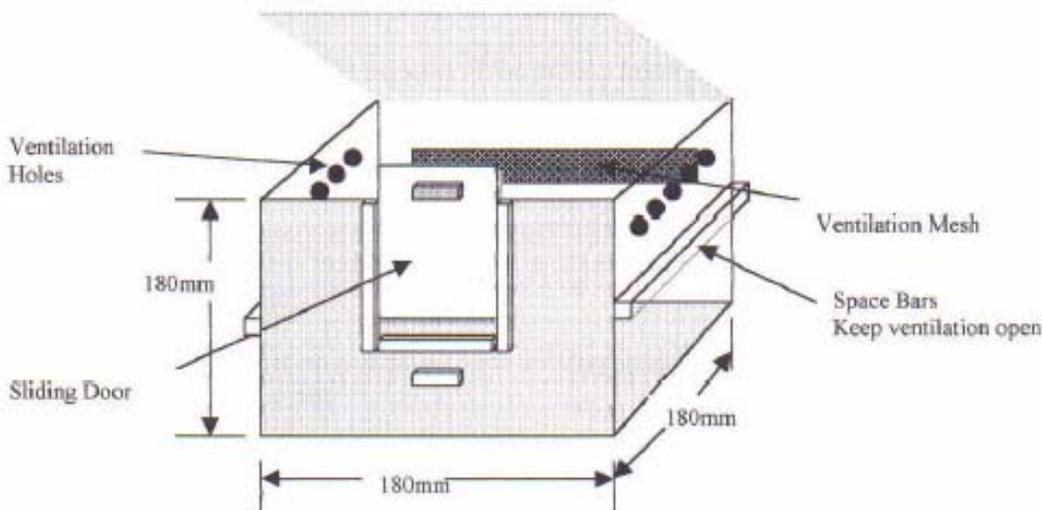
Upon completion of examination, the animal should be released onto the ground within the enclosure (rather than directly into the nest box) to allow the movement and behaviour of the individual to be observed by the keeper.

Capture and restraint should be carried out in the coolest part of the day as stressed animals are less able to thermoregulate effectively and fatalities could occur.

4.11 Transportation

Transportation can be a stressful experience for animals, so care must be taken to ensure a minimum of disturbance to the individual/s. External stimuli should be minimised from the moment the animal is placed within the transportation box. Avoid banging, jerking and tipping the box, and limit the animal's ability to see out through ventilation holes. Prior to shipment the box should be kept in a quiet and cool location. Extremes in temperature should be avoided during the transportation process, with an ideal temperature for travelling being 18 - 25°C. Air travel or air-conditioned motor vehicle are therefore the preferred options.

Figure 3.12 1 Transportation Box.



A plywood or craftwood box with a sliding door provides an ideal transportation box for plains rats (Figure 3.12.1). Internally the box should be smooth; free of splinters, nail points and wire ends. The box should be well ventilated, with either mesh panels or holes drilled in the timber to allow a sufficient exchange of air. These can be covered with a breathable material such as hessian to reduce light and noise. The sliding door should fit neatly and be firmly secured to prevent accidental opening during transit. A good technique is to secure the door with screws, as this also minimises the risk of the box being opened by curious 3rd parties during the transportation process.

The box should be $\frac{1}{2}$ to $\frac{3}{4}$ filled with loose bedding such as grass or shredded paper. Plains rats should generally be housed individually for transportation in segregated compartments. Females or family groups may be transported in a single compartment if previously housed together.

It is not necessary to provide food and water when transporting Plains rats over short distances. For longer trips a piece of vegetable such as carrot or apple may be provided for the animal to obtain moisture from during transit. Temperature dependent, subcutaneous fluids may be required, even when transporting animals short distances.

4.12 Health Problems

The Plains rat is a robust species in captivity, suffering few health problems. Listed below are several health issues, specifically relating to the species, which may be encountered.

Ectoparasites:

Both wild-caught and long-term captive Plains rats at ASDP have been found to carry mites of the genus *Orthonis*. Mites can be detected using skin scrapings and microscopic examination, or by visual detection either on the animal or in the nest box. When treating parasites it is important that contact with wild rodents is minimized or eliminated to ensure long-term success. Ectoparasites such as mites can be eliminated by the direct treatment of plains rats in conjunction with the treatment of the enclosure and the changing of nesting material and washing of nest boxes. Consideration must be made however with regards to the breeding status of the animals as this level of disturbance is undesirable during the breeding season.

External parasites may be treated with a single dose of Cydectin[®] (monidectin, 5g/L) applied topically to the animal at a dose rate of 0.2mg/kg, or Ivomec[®] Injectable (ivermectin, 10g/L) through subcutaneous injection at a dose rate of 200µg/kg. Care must be taken to ensure accurate dosage when injecting Ivomec[®] however as it is possible to overdose the animal. Alternately a 3-day in-water treatment of Ivomec[®] Liquid for Sheep (ivermectin, 0.8g/L) may be carried out at a dose rate of 40mg/kg. The latter may be used where disturbance is undesirable (eg. During breeding season). In addition, enclosures and furniture can be sprayed with Cislin[®] (deltamethrin, 10g/L – dilution 150mL in 5L water). The treatment of an enclosure with Cislin[®] should remain effective in controlling pests for up to 6 months depending on exposure to weather.

Endoparasites:

Nematodes such as *Aspicularis* sp. (Family Oxyuridae) have been found in captive Plains rats. Internal parasites are detected through faecal floatation, which should be carried out every 4 - 6 months for all captive animals/groups. A 3-day treatment of Panacur[®] 25 (fenbendazole, 25g/L) applied to the animal's food is generally sufficient to eliminate nematodes and several other types of endoparasites. Good hygiene such as the regular removal of faeces will help to reduce the prevalence of internal parasites (Jackson, 2003).

Capture Stress:

Capture and restraint is a stressful procedure for most animals. Plains rats are susceptible to overheating when stressed as their ability to thermoregulate is compromised. In extreme cases this may result in the death of the individual. Several steps can be taken to minimize stress during capture and restraint:

- Always plan to catch animals in the coolest part of the day.
- Carry out capture in a fast and efficient manner, avoiding chasing animals around the enclosure for extended periods of time. If an individual proves difficult to capture it is better to abandon the effort than to continue and risk overstressing the animal.
- Animals in bags awaiting processing should never be clumped together or piled on top of each other as this will trap heat in and increase the likelihood of overheating.
- Carry out handling and restraint in an efficient manner. Restraint is a particularly stressful period for Plains rats so handling time should be as short as possible.

- Monitor individuals during capture and restraint, as well as after release, for signs of stress such as irregular breathing and lethargic movement.

Physical Injuries:

Fighting can occur between plains rats due to the complex social structure within the species, particularly when incompatible individuals are housed together. This may result in physical injuries to one or more individuals in a group. Bites to the back, rump or tail are telltale signs of conspecific aggression, and may lead to abscesses, septicaemia or partial tail loss (Jackson, 2003). If left unchecked aggression can also lead to the death of a subordinate animal, with the stress associated with the situation being a major factor.

Plains rat groups should be carefully monitored for signs of aggression, particularly when changes occur to social structure or physical environment. Introductions are one such period where monitoring is essential as incompatibility may lead to injuries or even death. As juveniles in a group reach sexual maturity an increase in aggressive interactions may be observed as dominance hierarchies are established. Groups moved to new enclosures may also experience a period of negative interactions, particularly if the group size exceeds the carrying capacity of the new enclosure.

Eye Problems:

Corneal and conjuncti ulcers have been observed in captive plains rats. These usually occur as a result of ongoing irritation to the eye by a foreign body such as a grain of sand. Symptoms include inflammation, fluid discharge, and the abnormal placement of the outer eyelids. All eye problems should be monitored closely and veterinary advice sought.

Excessive Grooming:

When housed in pairs or groups captive plains rats may exhibit excessive grooming, resulting in large patches of bare skin to the muzzle, back or flanks. This occurs in situations where there is a lack of environmental stimulus, and can be rectified through enrichment techniques such as the addition of fresh browse or grasses to the enclosure. This should not however be confused with fur loss through rubbing on enclosure furniture, particularly in situations where animals are trying to squeeze through openings that are too small (eg. Nest box entrance holes or piping).

5. References

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