DIBBLER
Parantechinus apicalis

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1. TAXONOMY

COMMON NAME: Dibbler
SCIENTIFIC NAME: *Parantechinus apicalis*

ORDER: Dasyuromorphia
FAMILY: Dasyuridae
OTHER COMMON NAMES: Freckled Antechinus, Speckled Marsupial Mouse. Southern Dibbler
RECENT SYNONYMS: *Antechinus apicalis*

The Dibbler was removed from the genus *Antechinus* by Tate (1947), who placed it in the specifically created genus *Parantechinus*, based on differences in dentition. There is now some discussion as to whether this is the Dibbler's correct position, or whether it should be returned to *Antechinus* (Kitchener et al 1988, Archer 1982) where it was once placed, along with the Pseudantechinuses and Kaluta. The position of *Parantechinus bilarni* (Strahan 1995) is also under some discussion, with many people considering it to actually be a *Pseudantechinus*.

1.1 DESCRIPTION

The Dibbler is brownish-grey, freckled with white on its back, and greyish-white tinged with yellow on its underside. It is distinguishable from similar small mammals by its tapering hairy tail, and striking white rings around each eye.

1.2 AFFINITIES WITH OTHER GROUPS

The Dibbler is one of 2 species currently in the genus *Parantechinus*, the other being the Northern Dibbler (*Parantechinus bilarni*). The name Northern Dibbler is considered erroneous by some, as 'Dibbler' is one of the names local Aborigines attributed to *P. apicalis*, and therefore should not be applied to a different species. I will therefore refer to *P. apicalis* as Dibbler throughout this manual.

The genus *Parantechinus* is one of 13 in the family Dasyuridae. At present, the Dibblers belong in the Sub-family Dasyurinae, along with the Mulgara, Kowari, Tasmanian Devil, the Quolls, Pseudantechinuses and the Kaluta. Previously, Dibblers were regarded as belonging to the genus *Antechinus*, along with the Pseudantechinuses and the Kaluta.

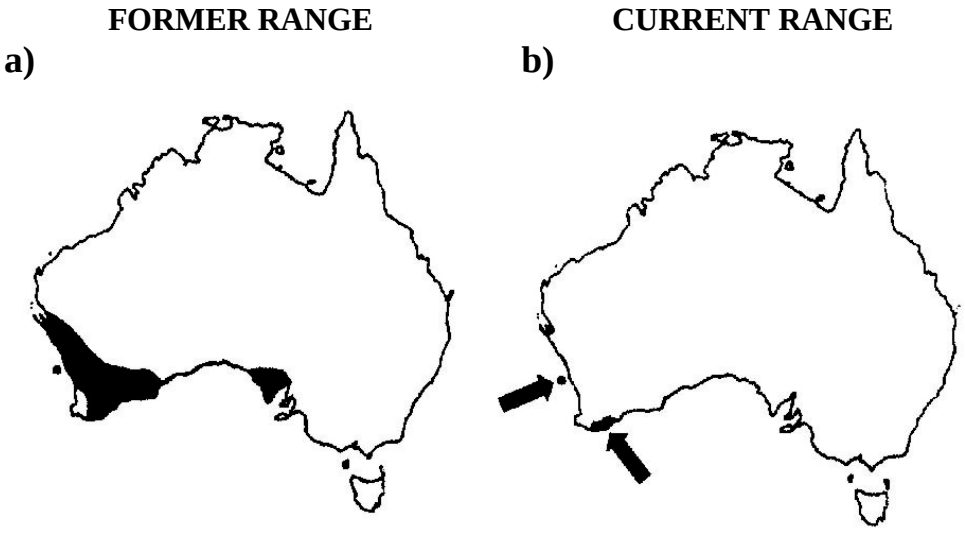
2. WILD POPULATION DATA

2.1 DISTRIBUTION

In a review of sub-fossil records, Start (1998) reports a past distribution of the Dibbler as extending from the coastal regions of Shark Bay on WA's west coast, to the Eyre Peninsula in South Australia (see Figure1a). There is however, a noticeable absence of evidence in sub-fossil remains in the wetter and largely forested areas between Perth and Albany. Peak Charles (about 150km north of Esperance), is the furthest site inland that a sub-fossil record

has been found. Historical records from early European settlement indicate Dibblers were found from the Moore River region to King George Sound (Strahan 1995).

Figure 1. Past and Present Dibbler Distribution (Adapted from Strahan 1995, Baczocha & Start 1996, and Baynes, A. as reported in Baczocha & Start 1996).



No Dibblers were recorded between 1904 and 1966, and hence were considered "presumed extinct". However, in 1967, they were "rediscovered" near Cheyne Beach, east of Albany, on WA's south coast (Morcombe 1967). Since this discovery, Dibblers have been found only sporadically in this general area, with most locations being within the Fitzgerald River National Park. A further discovery occurred in 1985, when WA's Department of Conservation and Land Management (CALM) officers found Dibbler populations on 2 small islands – Boullanger (approx. 26ha) and Whitlock (approx. 8ha) - situated off Jurien Bay, approximately 200km north of Perth (Fuller and Burbidge 1987). The Dibbler's range contraction is such that they can now only be reliably caught on the Jurien Islands, and in the Fitzgerald River National Park (see Figure 1b).

2.2 HABITAT

Mainland Dibblers appear to occupy areas of sandy soil, with thick heath and deep layers of leaf litter (Start 1998). It has also been suggested that Dibblers require long unburnt vegetation (Morcombe 1967, Chapman and Newby 1995), however Start (1998) suggests that further research is required, as some populations have been found in areas only 10 years post fire. Morcombe (1967) reported mainland Dibblers to be semi-arboreal, natural climbers, that probably use banksia flowers as a food source for nectar and insects.

In floristic composition, the island habitat of the Dibbler is very different to the mainland (Start 1998), however the habitats do have a similar structure, with the islands being mostly low closed heath over sandy soils (Fuller and Burbidge 1987).

2.3 WILD POPULATION

It is likely that the Boullanger and Whitlock Island populations hold no more than a few hundred animals. The difficulty of locating and reliably catching mainland animals makes mainland population estimates unclear. If they exist outside of the Fitzgerald River National Park, then they are probably highly restricted to areas of suitable habitat in the southwest.

In 1998, as part of the Interim Recovery Plan for the Dibbler, CALM began the process of trying to establish animals on Escape Island in Jurien Bay, a site without a resident Dibbler colony. Between October 1998 and January 2000, 86 Dibblers from the Perth Zoo colony were released. There are positive signs that the population is doing well, with CALM monitoring indicating that Dibblers have bred and successfully raised young. A monitoring trip in October 2000, yielded 72 individuals, with most of that number being born on the island. It is still too early to be sure that the population has established itself, but results to date are very promising.

2.4 STATUS

ASMP: Category 1 (under review)
IUCN: Endangered
ANZEC (NPWS): Endangered

2.5 WILD POPULATION MANAGEMENT

Please refer to CALM's Interim Recovery Plan for the Dibbler (Start 1998).

3. NATURAL HISTORY

3.1 REPRODUCTION AND DEVELOPMENT

Dibblers are seasonally monoestrus. Mating occurs from mid-March through to mid-April. In captive animals, males usually begin to produce sperm in mid-February (sometimes as early as January), and females begin to cycle (cellular signs of pro-oestrus) by the beginning of March. Dibblers show strong sexual dimorphism as adults, with captive males showing a faster rate of growth than females. This can be observed from animals as young as 72 days (Mills et al. 2000).

Pouch Development. Dibblers do not have a true pouch. In the non-breeding season, there are no folds of skin covering the mammary area, and the tiny teats are exposed. Towards birth however, there is a gradual increase in swelling of the lateral skin folds and the area surrounding the teats, until the pouch eventually becomes almost fully enclosed. Just prior to birth, the skin surrounding the teats develops a very granular appearance, which is accompanied by a clear secretion. By the time of birth, the coat hairs anterior to the female's pouch have usually grown longer, somewhat covering the pouch area. As the 'young' grow, they become less protected by pouch skin, and can clearly be seen clinging to the teats beneath the mother.

A second year female may have some red staining in the pouch, indicating lactation from a previous season.

The pouch goes through the same developmental changes, whether conception has taken place or not.

Breeding Strategy: Wild data are inconclusive, but it is probable that Dibblers are solitary animals, with overlapping ranges during the breeding season. In captivity, Dibblers are paired at the onset of the breeding season, but it is also possible to group them with 1 male to 2 females.

Breeding Season:

Mating period: Mid-March to mid-April

Birth period: Late April to late May

Length of Oestrus: Cornified epithelial cells appear in the urine of the females for an average of 15 (+/-5; n=13) days (H. Mills, pers. comm.). However, females are usually receptive to males over a period of only 1-3 days, when cell numbers are at a peak.

Duration of sperm in urine: Males generally begin to shed sperm in their urine from February to March, and continue through to the end of May (average 82 days +/- 5; n=15 with a range of 56-118 days). (H. Mills, pers. comm.)

Reproductive Behaviours: Breeding animals respond to each other in a variety of ways when first paired. Confident animals usually exit their own nest-boxes immediately and sniff around and explore. Upon encountering the other Dibbler there is sometimes a loud altercation with squawking vocalisations by both animals, often leading to them gripping each other belly to belly and tumbling around together. They may then sniff each other all over, often concentrating around the head area, with the male showing particular interest in the female's cloacal region. Some pairs are more immediately compatible, and by-pass the loud squawking and tumbling behaviour. Some following and chasing may then occur.

If the male is doing the chasing then this is a good sign, however if the female is the instigator, then it is likely that she is rejecting the male, and the pair may not be compatible. In these instances, the male may incur some wounds (particularly on the tail), and may even be chased towards the point of exhaustion. From the results of 2 breeding seasons, it appears that size may be an important factor in the acceptance of a male by a female - with compatible pairs, the male is usually larger than the female. Female Kowaris (*Dasyuroides byrnei*), which show similar dimorphic weight ratios to their males as Dibblers do, have also been observed to show a preference for larger males (T.P. Fletcher, pers. comm.).

If the female is not yet in full oestrus, then these initial pairing behaviours may settle down for a while, and build back up again towards the time she is ready to mate. On the odd occasion, a pair may show little interest in each other at all, sharing their space quite compatibly but ignoring each other. In these instances, mating may be unlikely, and a new pairing should be made. A compatible pair may eat from the same feed-bowl, and share the same nest-box.
A male will generally attempt to mount the female many days before she is in full oestrus. He attempts to grip with his jaws on the back of her neck and use his front feet to hold under her belly. If she is not receptive, she will vocalise loudly and turn and try to bite at him to get

him off, often very vigorously. Even with matings that have successfully produced young, the female will sometimes still carry on with these loud vocalisations, although often not as continuously nor as strenuously.

Matings seem to occur mostly out of the nest-boxes in full view. It is generally a rather noisy event, and quite readily detectable if regular observations are made. Over 2 breeding seasons at the Perth Zoo, matings were observed for 13 of the 14 litters born. These matings were all observed during the day, although no night observations were made. Some animals have been observed to mate over a 3-day period, and often a number of times throughout the day. Copulation times ranged from a few minutes, to 2 hours, and even up to 6 or 7 hours. In some cases, slow thrusting has been observed. Post-mating, females may have wet and ruffled fur on the back of their necks, and also around the base of the tail. Males may also groom around their genital area.

Both males and females build up to a peak weight just prior to mating, and then show a small weight drop. Females will then generally experience another peak weight, drop again after birth, and then gradually build up as the pouch-young grow. Females will generally not eat on the night they give birth (See Appendices 1 & 2 for typical weight changes throughout the breeding season).

A Dibbler that is being chased and harassed, will often have the guard hairs missing from the fur around the rump and the base of the tail. This area becomes very soft and downy looking. Bite wounds may also be visible on the tail. On a male, these signs may indicate non-compatibility of a pairing. On a female, the loss of guard hairs is common following chasing by the male prior to mating.

Following mating, both animals should be thoroughly checked for wounds. Common areas on a female are on the tail and rump area, as well as the back of the neck where the male grips her with his jaws. Females should also be checked on the belly, for claw wounds from the male's front feet, as he hangs on to her in the mating position. Males may receive bite wounds on their shoulders, incurred by the female as she turns and tries to fight the male off while they are in the mating position.

Females will often pack their nest-boxes very tightly with nest material in preparation for birth.

Breeding Sites: There is little information available about breeding sites, and even regular nest sites of Dibblers in the wild. The best details still come from local Aborigines' descriptions to the naturalist Gilbert, in the 1800's, as recorded in Morcombe (1967). Mainland Dibblers were described as nesting beneath the overhanging grass skirts of the Xanthorrhoea, sometimes constructing their nest in a slight hollow in the ground. They may also nest in the upper grasses of the Xanthorrhoea, or in their dead stumps. Nests have been described as heaps of short pieces of sticks and grasses on the ground.

It is likely that Dibblers on Boullanger and Whitlock Islands may use the abundant sea-bird burrows as refuge or nest-sites. Fuller & Burbidge (1987) noted that upon release, most Dibblers ran quickly into one of these burrows.

Other Breeding Features: Many small Dasyurids, particularly the Antechinuses, show a die-off of all males following the breeding season in their first year. This breeding strategy has been demonstrated with Dibblers, but certainly does not occur in every year. Dickman and Braithwaite (1992) recorded a male die-off in the island populations over 3 consecutive years, but observations in other years have shown that this does not occur (Woolley 1991, Baczocha and Start 1997, McCulloch 1998). It certainly does not occur in the Perth Zoo's captive population. A complete male die-off was recorded on Boullanger Island in 1999, but only a partial one in 3 other years, leading to the proposal that a new category of life-history strategy exists for the Dibbler – that of a facultative male die-off rather than an obligate one (Mills & Bencini 2000).

Antechinus stuartii females can store sperm for up to 14 days before development of young begins (Shimmin et al 1997). It is possible that Dibblers may also exhibit this feature, as the length of time between mating and birth varies from between 41 and 48 days. Sperm has also been observed in the urine of females for up to 6 days post-mating.

Gestation Period: From the length of pseudopregnancy, Woolley (1971) estimated gestation to be from 44 to 53 days. Similarly, results from Mills (pers. comm.), taken from 14 litters born at Perth Zoo, indicate gestation to average 44 days (range 41-48), taken from the date of the last mating, until birth.

Number of Young Born: In most Dasyurids, the number of embryos developing exceeds the number of teats available (Tyndale-Biscoe & Renfree 1987). There is some evidence that Dibblers are also supernumerary breeders. Dibblers usually have 8 nipples, however one animal at the Perth Zoo in 1998 successfully raised and weaned 9 young. This Dibbler had an extra nipple.

Number of Young Surviving: Only individuals reaching a nipple will survive - this will therefore usually be a maximum of 8.

Birth Weight: Weights at birth are not known, however their crown-rump length is 3-4mm.

Growth Curves: See Appendix 3 for comprehensive Dibbler growth curves.

Age at Weaning: Captive young begin eating solid foods at 13-14 weeks of age.

Age at Independence/dispersal: Captive young are first deposited in the nest at 8-9 weeks of age, and are seen exploring out of the nest-box at 11-12 weeks.

Captive Dibblers are weaned away from their mothers at 16-17 weeks of age, or approximately 2 weeks after first seen eating solid food. At this stage, females generally weigh 25-30g, and males 30-35g.

Age at Sexual Maturity: Both male and female Dibblers are ready to breed in their first year. This may be as early as 9.5 months.

Adult Weight: (from Strahan 1995)

Males:	60-100g
Females:	40-75g

Island Dibblers are noticeably smaller than those on the mainland (Woolley 1991). Data from Harriet Mills (pers. comm.) also shows that Whitlock Island animals are smaller than Boullanger Island animals.

	Boullanger	**Whitlock**
Males	49.9g (n=7)	44.4g (n=42)
Females	42.8g (n=41)	40.0g (n=39)

NB This data was collected from 1997-99 in April/May of each year, when all animals were adult size.

Adult Measurements:

Head and Body Length (Strahan 1995)

Males:	145mm
Females:	140mm

Tail Length (Strahan 1995)

Males:	105-115mm
Females:	95mm

Pes Length - Island Dibblers (H. Mills, pers. comm.)

Males:	14.7-17.5mm
Females:	13.4-16.5mm

Head Length - Island Dibblers (H. Mills pers. comm.)

Males:	35.3-38.4mm
Females:	34.0-38.5mm

3.2 LONGEVITY

Wild (H. Mills, pers. comm):

Males: Maximum at least 3.5 years
Females: Maximum at least 3.5 years
(the majority don't normally live past 2 years)

Captive:

Males: Maximum at least 4.5 years
Females: Maximum at least 3.5 years

3.3 WILD DIET: Dibblers are predominantly insectivores, but have also been known to consume small lizards, rodents, small birds (chicks), and small native marsupials such as dunnarts. Scat analyses have also shown that they consume small quantities of plant material (Fuller and Burbidge 1987). It is also likely that Dibblers lick nectar from Banksia flowers in the wild (Morcombe 1967), and they have been observed to do so in captivity at the Perth Zoo from both Proteaceae and Myrtaceae species.

3.4 HABITS: Dibblers are extremely agile, and tend to move in short sporadic bursts. They climb particularly well, and can leap distances of about 30cm straight up. They burrow vigorously beneath layers of leaf litter and dig in sand looking for food. Data from the wild is limited at present, but in captivity, Dibblers appear to be mainly crepuscular (Morcombe 1967). This is supported by observations at the Perth Zoo, along with common sightings of captive Dibblers basking in the sun during the day.

3.5 BEHAVIOUR: It is probable that the Dibbler is a solitary animal, although observations in the wild are yet to confirm this. In captivity, pairs of similarly aged adult females may nest together compatibly, however in some instances, aggression may develop. Similarly, between February and May, compatible breeding pairs will often share the same nest.

Home ranges of wild Dibblers have not been determined as yet, however, trapping data have indicated that they can travel long distances in a short time. One mainland Dibbler was shown to move 600m within half an hour (Baczocha & Start 1996). More recent radio-tracking work on the mainland Dibblers however, has shown that Dibblers do not appear to move very far (T. Friend pers. comm.), and similarly, the island animals are showing very high site fidelity (H. Mills pers. comm.).

Dibblers are very inquisitive animals and keenly explore changes to their enclosures almost immediately they are made. They are, however, quite flighty, and will dart quickly away from view with any unexpected movements or sounds.

Aggression: Dibblers generally retreat into their nest-boxes or beneath the leaf litter when work needs to be done in their enclosures. However, if threatened in their nest-boxes or while restrained in a bag, they will bite in defence. Dibblers are extremely active prior to their invertebrate feed, and some will attempt to bite if the food isn't put in quickly enough. This may be more an impatience behaviour rather than aggression.

Bathing: There is no evidence to suggest that Dibblers bathe, although they have been seen at their water bowls grooming their faces with wet paws, and also licking their paws before scratching their fur.

Drinking: There is no evidence to suggest that Dibblers drink in the wild, although they certainly do in captivity. No permanent water exists on the islands, although it is possible that they may take moisture from dew or puddles etc left after rain.

Common Captive Problems: Dibblers require constant stimulation by the provision of fresh leafy branches to climb and explore in. Without occupation, some develop stereotypic behaviours such as pacing, and repetitious jumping from their nest-boxes, up to the lid of their enclosures and back again.

In the first year Dibblers were held at Perth Zoo (1997), all 19 young born to wild-caught animals were successfully raised to weaning. In 1998 however, slightly less than 50% of young survived, with 3 out of 7 females cannibalising their entire litters. These mothers were all captive-born animals. Aslin (1982) reports similar problems with other captive-bred Dasyurid females not being able to maintain correct maternal behaviour and recognition of their young. It is important therefore, that captive-raised Dibblers should be exposed to fewer stresses while raising a litter, than their wild-born counterparts can possibly tolerate. Removal of stresses in the 1999 breeding season produced better results, with only 1 litter being lost to cannibalism. Measures initiated included an increase in the number of invertebrates in the diet, a completely hands-off approach, the installation of visual barriers between animals, provision of their favourite meat ('pinkie' rats) *ad lib.*, and the provision of extra enclosure space by joining more tanks together.

4. CAPTIVE MANAGEMENT

4.1 DIET

Current Diet: Dibblers are offered a variety of meats (cooked chicken, roo, baby 'pinkie' rats), fruit (dried fig, sultanas), boiled egg, small carnivore mix, cat biscuits and as wide a variety of invertebrates as possible. 4g invertebrates is the standard amount given to all Dibblers in the non-breeding season, and this is made up with meat to the total food required. When available they are also given nectar treats of blossoms from Proteaceae and Myrtaceae species, particularly the grevilleas and bottlebrushes. They are also given fruits from plants of the genus *Rhagodia*, which grow on the Dibblers' wild island habitat and probably make up part of their natural diet (see Appendix 4 for an example of a non-breeding season diet).

Breeding Season Diets: Mid-February, the proportion of invertebrates in the diet of both males and females is increased to approximately 50%, to more closely resemble what the animals would be receiving in the wild (see Appendix 5 for an example of a breeding season diet). Following mating, the males are returned to the non-breeding season diet, and the females remain on the 50% invertebrate diet until the birth of their young. Females are then given 10g of live-food per day plus meat *ad lib.* until the young begin eating solid food. Once the young are eating, the mothers are reduced to 4g invertebrates, each young Dibbler is given 2g, and the whole group is given meat *ad lib.* (See Appendix 6 for an example of a female's diet with independent young). Once the young are weaned, they can be placed on one of the non-breeding season diets.

Dietary Supplements: SF40 (vitamin supplement) is applied at the rate of one quarter of a teaspoon per 100g of meat.

Preparation and Presentation of Food: Water is provided in a small bowl. When mothers have young, a very shallow bowl is used with only a small amount of water, so any young which may be on and off the nipple, cannot fall in and drown.

All food is chopped into small pieces. This is particularly important with the "pinkie" rats, so they bear as little resemblance to Dibbler young as possible. Food must be properly thawed before feeding in. Most live-food is scatter fed, except for things such as mealworms and termites, which are given in a bowl so the Dibblers can find them.

Weighing of Food: Dibblers in captivity have a tendency to over-eat, so food quantities must be weighed out carefully before feeding in. Weighing the food remainder the following day is not necessary, but is helpful in recognising early signs of illness, particularly if the animals are in an enclosure where they are not easily observed on a daily basis.

Dietary Changes: The usual live-food component of the diet can occasionally be substituted with other types of invertebrate for variety. Major changes however, should be discussed with the Veterinary Department.

Due to problems sourcing suitable quantities of "pinkie" rats and mice (meat consumption increases significantly after females give birth, continuing to increase until young are fully weaned and release into the wild), other food types and feeding regimes for non-breeding animals were investigated. The use of weaner rats and mice was rejected due to dibblers being largely insectivorous, and possessing digestive tracts unused to processing large quantities of hair. Utilizing skinned and minced adult rats was also rejected due to the possibility of their bones splintering during mincing and causing internal tears in the digestive tract. Ultimately a minced meat preparation was decided upon.

Three feeding regimes were developed. One regime for when "pinkie" rats and mice were abundant, one regime for when "pinkie" rat supplies were running low and "pinkie" mice supplies were abundant, and one regime for when both "pinkie" rats and mice supplies were low (See Appendix 8). It is important to note that all of these changes are only made to the diets of non-breeding individuals. Breeding animals, in particular females with young, need to be kept on the breeding diet at all times.

Three minced meat preparations were examined for use when "pinkie" rat and mouse supplies were low. Two different Kowari diets and a previously used Dibbler diet were examined for their suitability. A modified version of on of the Kowari diets was deemed the most appropriate (See Appendix 9).

After successfully trialing the minced meat preparation the Dibbler feeding regime was altered to reduce the amount of chicken utilized. Dibblers were being fed chicken twice per week, but it was evident that most of the breeding colony was not eating on those days. The new regime involved feeding in more of the minced meat preparation instead of chicken (See Appendix 7). Chicken was left in the diet at least one day per week to ensure that the Dibblers were experiencing some form of bird meat.

Live Food: Mealworms and crickets make up the bulk of the daily live-food component. Moths, termites, silkworms, slaters (wood-lice), native woodroaches and fruit-fly pupae are used as occasional substitutes, particularly in the lead up to animals being released to the wild.

Feeding Regime: The live-food component of the diet is fed early in the morning when animals are active. The meat portion is fed late in the afternoon, when Dibblers are becoming active again.

4.2 ENCLOSURES: Dibblers at the Perth Zoo are maintained in 2 types of enclosures:-

1. Display Enclosure (Nocturnal House)

Dimensions are 2.3m long x 0.82m wide x 1.4m high. The walls are painted black, and the public viewing side is 100% glass. Deep layers of leaf litter cover white sand, and banksia branches are used as furnishings - the effect is to simulate the long unburnt banksia heath that some mainland Dibblers are found.

2. Breeding Enclosures

Design: Dibblers are housed singly in glass aquariums (1200mm long x 350mm wide x 450mm high). Tank lids are wooden framed and covered with metal mesh (between 2 and 6mm grid). Each lid has a hinged wooden feeding hatch (220mm x 250mm) towards one end, so feed-bowls can be accessed without removing the whole lid. At feed times in particular Dibblers are very excitable and may jump out if the lid is removed. Metal brackets are used to hold food and water dishes. These are attached to the glass with silicon, thus preventing dishes from being tipped over.

Figure 2. Dibbler Breeding Enclosure

95mm diameter holes have been cut in the ends and sides of some tanks to allow interaction

between individuals during the breeding season. These holes are covered when not required by a removable metal slide.

Position: The aquariums are kept indoors, so position is not an issue, other than to say that Dibblers enjoy basking in the sun, so positioning of tanks by windows that permit direct sunlight is of value.

Substrate: 60-80mm of white sand covered by about 100mm of leaf litter is used as a substrate. The leaf-litter (which is collected from the bush), is thought to be the source of a past mite infestation in the colony, so is now routinely frozen for 4 days prior to use to eliminate that possibility.

Water: Fresh drinking water is supplied daily.

Heating: The Dibblers are held in air-conditioned buildings. Temperatures are adjusted through the year to try and keep them linked as closely as possible to the outside temperatures of Perth, as the climate is very similar to where the colony's "founder" animals came from. There is one exception to this regime - temperatures are not permitted to exceed 28-30 degrees at any time of the year, as the animals cannot seek out cooler places, as they may be able to in the wild.

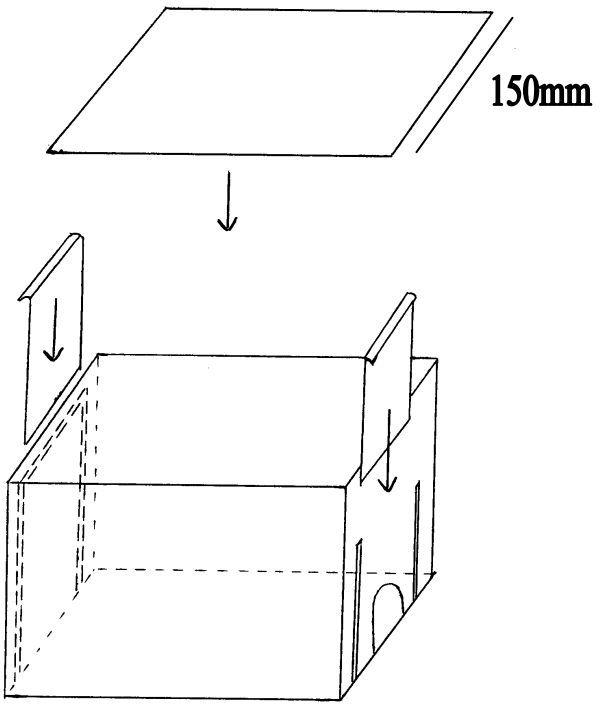
Shelters:

Types:

Nest-box 1:

Made from 10mm plywood, it has a removable lid, and sliding doors both ends - one for animal access, the other for tipping the animal into a bag. The lid should be covered by a waterproof layer such as melamine, as most animals defecate and urinate on it.

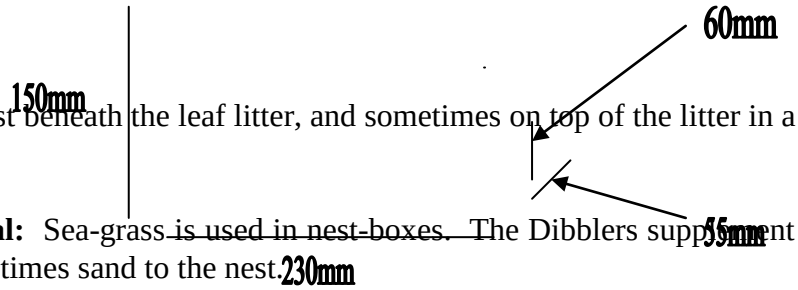
Figure 3. Dibbler Nest-box



Nest-box 2:

PVC nest-boxes are also used - they have benefits in that they are easier to keep clean, and do not offer good refuge to external parasites such as mites. They are made of 150mm diameter PVC pipe with end caps jammed on each end. They have a sliding door on one end for removing animals, and a small door that swivels around a bolt, to cover the animal access hole on the other end. There is however, no removable lid on top for ease of animal checking.

During the mating period, and while females have young, the plywood nest-box is preferred, so animals can be checked easily by lifting the removable lid. The PVC boxes are more suitable for maintaining single animals.



Sites:

Dibblers may nest beneath the leaf litter, and sometimes on top of the litter in a corner of their enclosure.

Nesting Material: Sea-grass is used in nest-boxes. The Dibblers supplement this by adding leaves, and sometimes sand to the nest.

Furniture: Predominantly *Acacia sp.* branches are used, and are crammed into the tanks quite densely, to try and simulate the thick heaths where most Dibblers are found. Some *Acacia sp.* lose their rigidity quite quickly when cut, so more woody plants such as tea tree can be used in conjunction to keep a good structure to the arrangement. Branches should be changed at least fortnightly to maintain good structure for climbing, and also for enrichment - Dibblers become obviously stimulated when given new furniture.

Interspecific Compatibility: It is not appropriate to house this species with any other.

Things to Avoid: Overfeeding. Some Dibblers will eat to obesity if not kept in check. A condition index for Dibblers is currently being investigated, but in the mean time, weights are adjusted on their appearance alone.

Spatial Requirements:

See EAPA (Exhibited Animals Protection Act, NSW) guidelines.

Occupational Health and Safety Issues: A bite from a Dibbler will not be particularly damaging, however they can break the skin and draw blood (infection risk), so apply correct handling techniques (see Handling and Restraint).

4.3 CAPTURE FROM WILD

Preferred Time of Capture: Early morning, following traps being open all night.

Capture Equipment and Techniques: Medium sized Elliott traps (325mm long) are placed

under cover of a bush, and baited with a stiff mixture of rolled oats and peanut paste.

Triage and Baseline Data: Information gathered from wild animals includes weight, breeding condition of females (pouch development), and a variety of measurements including:

- short pes
- head length
- scrotal length and width

Depending on the location and CALM requirements, animals to be released again may be either ear-notched for identification, or inserted with a Trovan passive transponder.

Release: Animals caught in the wild and not required for captive stock, should be released immediately at their exact point of capture. Those captive animals being released into the wild as part of a breeding/release programme should be released at dusk.

4.4 SEXING TECHNIQUES: The male's scrotum and the female's pouch are very obvious, even while young are still permanently attached to the mother's nipple.

4.5 IDENTIFICATION

Transponder Implants: Trovan passive transponders are the preferred method. They are generally implanted following weaning, when the young are 25g +. The preferred position is in the rump or flank. Insertion over the shoulder blades can cause complications for the females during the breeding season, as this is where males grip with their jaws while mating.

Eartags: N/A - ears are too small and delicate.

Tattoos: N/A – ears are too small and delicate.

Ear-notches: Have been used in the past to identify as a particular stud-book number, but are used now only to identify male from female - males have a notch taken from their right ear, and females from their left.

Bands: N/A

4.6 GENERAL HUSBANDRY

Cleaning Routine:

Daily
Water bowl cleaned

Fortnightly
Animals are routinely weighed fortnightly. At this time, the outsides of nest-boxes are cleaned, and the insides cleaned and nest-material replaced if necessary. Branches in tanks are replaced fortnightly. At this time, the tank should be spot-cleaned of faeces and any damp areas of sand removed and replaced. Dibblers usually defecate and urinate in the same place, and this is most often in their feeding area. Faeces is removed by sieving the sand through a small hand-held sieve.

Changing of Substrate/Furniture: The whole tank will need to be cleaned out at the discretion of the keeper. Some animals will always defecate and urinate in an isolated area, making it easy to keep clean. Others will soil over the whole aquarium and so will need to be totally cleaned more often than those that restrict their wastes to one area. Do not let a strong ammonia smell build up.

Branches need to be replaced fortnightly, as they tend to flatten down, therefore becoming less useful for climbing and hiding amongst.

Enclosure Maintenance: A grease barrier is used around the base of the tanks for ant control, and must be checked regularly for breaches. The slide system used for allowing access between tanks during the breeding system must be checked daily, to make sure the silicon bonding it to the glass is still holding.

Routine Animal Checks: A good visual check can be done daily when the animals come out for their invertebrate feed in the morning.

All animals are weighed fortnightly. At this time a physical check can be made of their condition.

Moulting: Dibblers can moult in captivity at any time of the year, but most often towards the end of the breeding season and immediately after. It is most obviously seen on the head, and may appear as a straight line across the nose, which then progressively moves higher up the head.

Animal Introduction:

1. Single Dibblers can be introduced to a new enclosure at any time of the day. It is best not to clean their nest-box out at this time, so the animal will still have some familiar smells.
2. Breeding pairs, or pairs of females should be introduced to a new enclosure in the morning so they can be monitored throughout the day for compatibility (see Section 4.10 for methods of pairing breeding animals).
3. Males should never be introduced to each other.

Behavioural Enrichment: Fresh branches for climbing and hiding amongst should be provided at least fortnightly. If time and resources allow, more often is better. Adding extra leaf litter is always appreciated, as is the addition of nectar-filled blossoms of banksia, bottlebrush, grevillea etc. Scatter-feeding of the live-food component of their diet is extremely important to not only provide enrichment, but also to maintain the hunting skills of those due to be released to the wild.

4.7 HANDLING

Handling Bags: Small calico bags with some kind of a tie are used.

Nets: N/A

When to Handle: Dibblers are very active early in the morning and again in the late afternoon. In between these times they will usually be in their nest-boxes, and therefore easier to catch.

Capture Techniques: The best method is to capture Dibblers at a time when they are already in their nest-boxes. If you can't encourage them into their boxes, then they may be caught by hand, but this is not the preferred method as they may become stressed, and you may get bitten. Once in the nest-box, the small slide is inserted to cover the entrance hole. A capture bag is then placed over the other end of the box, the large slide is removed, and the Dibbler (usually all the nest material as well), is shaken into the bag.

Weighing: The animals can be weighed once caught in calico bags. Digital scales are the preferred type.

Restraint: The usual method is to reach one hand into the bag and grasp the dibbler with your whole hand using your thumb and fore-finger to hold the head (thumb slightly under one side of lower jaw), and with its back lying in the palm of your hand. This method allows the underside of the body, legs and head to be examined. If it is not required to have the animal's head exposed, then it is preferable to leave the animal in the bag with its head covered, and only expose the parts required. With this method, the animal should be less stressed and less likely to struggle.

Young: Pouches are checked for young every 2nd day from 42 days post-mating. The Dibbler should be restrained in a bag, and only the lower part of her body exposed. It is easier to get a second person to check in the pouch, and you may need to blow gently to part the fur to get a good look. Once pouch-young are found, the female is not handled again until the young are observed exploring their enclosure independently. At this stage, the young may also be weighed and sexed, handling them in the same manner as an adult. Growth information on pouch-young has already been collected (see Appendix 3). Also see Appendix 10 for photos of pouch-young.

Release: Dibblers can be released into their enclosure at any time of the day, however if introducing animals to each other, it should be done early in the day so a fair assessment can be made of their compatibility.

4.8 TRANSPORT

IATA Requirements: See Appendix 11.

Box Design: For external transfers, construct boxes according to IATA guidelines - however the internal size should not be less than 180mm long x 100mm wide x 100mm high. For transport of large numbers of animals for wild releases, medium Elliott traps (325mm long) are appropriate. The doors at either end are taped shut so they cannot be pulled open by the animal from the inside. Internal transport within the Zoo is in a calico bag, which is placed in a cardboard box.

Nest Materials: Sea-grass or leaf-litter

Animals per Box: 1

Identification: The Perth Zoo uses Trovan passive transponders, ARKs numbers and studbook numbers for identification. Boxes must be labelled as per IATA guidelines.

When to Transport: Mornings and late afternoons are best, to avoid heat stress during the day.

Maximum Transportation Period: Animals should not be in transit for longer than 24 hours.

Water and Food: It is not necessary to supply water and food, as transit should not exceed 24 hours. It is suggested however, that sultanas or dried fig can be placed in with each animal.

Release from Box: Animals being transferred to other institutions can be released immediately upon arrival. Those going to the wild should preferably be released at dusk when they are generally the most active so they can find food, a good nest-site, and be more able to avoid predators.

4.9 POPULATION MANAGEMENT

Compatibility with own Species: It is presumed that Dibblers are solitary animals, only coming together once a year to breed. However 2 adult females may be housed together permanently for display purposes. Similarly aged and sized animals should be used, and a close watch maintained on them initially to ensure compatibility.

Compatibility with other Species: None that is known

Group Structure: If 1 male is required to sire 2 litters, then it is possible to group Dibblers 1 male: 2 females during the breeding season.

4.10 CAPTIVE BREEDING

Enclosure Size: The minimum sized enclosure for a breeding pair, is a 1200mm glass aquarium as described in Section 4.2, although it is preferable to join 2 of these tanks together. For a group of 1 male and 2 females, 3 tanks need to be joined together.

Nesting Requirements: There are no special breeding season requirements, other than to say that both animals in a pair require their own individual nest-boxes.

Cover: It is important that a breeding pair have plenty of fresh branches in their tanks. This may distract a potentially aggressive partner, and give the other one more places to hide. If possible, do not house female Dibblers with pouch young directly next to other Dibblers. If not possible, then erect a visual barrier between them.

Breeding Group Size: 1.1 or 1.2

Introduction: Animals should be introduced to each other in the morning, so an assessment

can be made of their compatibility.

To introduce a breeding pair, or 2 females (for Display purposes) to a single enclosure, make sure the new enclosure is clean (and therefore neutral), and introduce both animals along with their own nest-boxes (not freshly cleaned).

To introduce a breeding pair, or a breeding male to 2 breeding females via the interconnecting aquarium system, simply lift the slides that connect them, and they will enter another's territory in their own time.

Pairing Duration: Breeding pairs can be put together as early as mid-February, however this means that there is no control over individual body weights, and a more dominant animal may become obese. For this reason, the preferred method is to take cloacal swabs from the females, and pair them only when their cells are showing full cornification. See McCracken (1990), for methods of oestrus detection via cloacal swabs. Matings may occur on a single day only, or a number of times over several days.

- Some pairs may mate and then settle quickly to a compatible sharing of their enclosure. In this case, there is no rush to separate them. A week after mating is probably long enough to be sure that there will be no more mating activity.
- In other cases, after a period of mating, the female may become quite aggressive towards the male, making it obvious that she will allow no further mating activity. The male may incur some injuries if left with her, and so should be removed.
- Another scenario is that the male will continue to mate with the female over a number of days, leading the female to become somewhat distressed. If she continues to resist strongly and is overpowered, she may incur some injuries. As a general rule, if this kind of mating persists into a third day, then the male should be removed.

Aggression: Aggression has been observed within some breeding pairs, and more often than not, the female has been the aggressor. In these cases, the males are generally smaller than the females, and aggression is indicated immediately upon pairing. Pairing arrangements should therefore be made with males being larger than females, otherwise incompatibility is likely to be the result.

Removal of Parents: Males are removed from a pairing following mating. When young are weaned, they are removed from the mother's territory to simulate dispersal.

Animal Checks: When paired, animals are checked regularly throughout the day (5-6 times). Single animals are sighted daily, but mothers with young are not disturbed at all.

Pouch-checking: Pouch-checking for prospective mothers begins at 42 days after the first mating. This is then done every second day until either young are found, or the pouch begins to regress in it's development.

Age Estimation: See Appendix 3 for growth curves.

Weaning Weight and Age: Young start eating solid foods at 13-14 weeks of age, and are weaned away from their mothers at 16-17 weeks of age when females will generally weigh 25-30g, and males 30-35g.

Juvenile Diets: The same as for adults. Dried fig is often the first thing that the young will eat, followed closely by live-food, and then meat.

Timeline (conception to independence): Juveniles are totally independent by 16-17 weeks.

4.11 RECORD KEEPING

Identification: Studbook number, ARKS number and Trovan microchip number.

Daily Record Keeping: Daily reports are written and submitted to the Records Officer for up-dating of ARKs records.

ARKS reports: Accessible on computer anytime. Records officer supplies ARKS numbers as required.
SPARKS reports: Managed by the Species Co-ordinator, Cathy Lambert, at Perth Zoo.

Record Updating Frequency: Daily

Studbook: National

4.12 HEALTH AND VETERINARY CARE

Quarantine: A minimum thirty day quarantine period applies to all Dibblers coming into Perth Zoo. This period may be extended if any conditions are found which warrant treatment or further testing. During the quarantine period, the following procedures will be carried out:

Faecal sample examination: A total of three faecal samples, collected at weekly intervals, will be examined from each individual (or cohabiting groups of individuals). The samples will be examined for the presence of internal parasites (protozoal organisms, worm eggs or larvae). To be released from quarantine, each of the three faecal samples must be negative for organisms requiring treatment. If a Dibbler is found to be infected with a parasite warranting treatment, it shall be treated with the appropriate antiparasitic drug, and a follow up faecal will be obtained 7-10 days after treatment. The animal will not be released to the section until this follow-up is obtained and cleared.

Parasites are only found rarely in Dibbler faeces. Cestode and strongyle eggs have been detected in the past, but only in low numbers which usually do not warrant treatment.

Import physical examination: Each Dibbler will be examined by a veterinarian to check its general health status. The following parameters will be examined: eyes, ears, teeth, integument and fur, abdomen, chest, nares, limbs. Physical examination of females will also include a pouch examination.

The animal will be weighed at least twice during the quarantine period: once at the start of quarantine (usually at the time of physical examination), again at the time of transfer to the section, and possibly once in between.

Identification microchips are implanted at the time of physical exam. These are placed

subcutaneously, in the skin fold cranial to the left thigh. The hole created in the skin is either glued or sutured closed. In the past, microchips were placed in the dorsal midscapular region. However, this led to incidences of chip loss, since this area is commonly traumatised during mating and intraspecific fighting. In addition, microchips placed in the midscapular position seemed to create a focus of irritation and inflammation when radio collars were fitted. None of these problems has been seen since changing to the cranial thigh skin fold site.

Temperature control: Dibblers do not have any unusual requirements with regard to ambient temperature. They do not require an external heating source; the temperature of their exhibit should be the same as the outdoor environment, both during the day and at night time. They may need cooling devices in summer, when the ambient temperature should not be allowed to exceed 30 degrees Celsius.

Major diseases: Disease problems with Dibblers are infrequent. The most commonly observed disease conditions are listed below:

Unidentified mite infestation: At one time there was an epidemic of crusty wounds on the head, shoulders and dorsal necks of many of the Dibblers. Mites were recovered from the leaf litter, but could only be identified definitively to the suborder level of *Mesostigmata* (which includes *Ornithonyssus* and *Dermanyssus*). All cases responded to a single topical application of "Frontline" (2.5g/L fipronil), coupled with disinfection of nesting boxes using a permethrin based residual insect spray (eg. "Execute").
While mites were never definitively found to have been causing the lesions seen, this problem led to a change in the design of the nesting boxes (using PVC instead of wood), and the treatment of leaf litter (frozen for 4 days prior to use in nest boxes). The problem has not recurred since these changes were made.

Demodecosis: There have been three cases of local infection with an unidentified species of Demodex mite. In all cases, there was only a single lesion. Lesions had a smooth, non-ulcerated, nodular appearance and emerged on the eyelid or snout. Lesions were not itchy or painful. When aspirated, these lesions expelled an inspissated white substance, which was found to consist almost entirely of demodex mite adults, larvae and eggs: a so-called "demodectoma". Lesions responded rapidly to curettage followed by topical application of 0.1% ivermectin directly onto the lesion. This treatment was carried out weekly until negative skin scrapes of the lesion were achieved (usually after 3-4 treatments).

Respiratory distress: A few of the older Dibblers have presented with loud, "clicking" respiratory noises. Affected animals do not appear dyspneic. Histological examination of the turbinates and sinuses of an affected individual which died of unrelated causes failed to reveal any turbinate or sinus pathology. No radiographic changes have been detected from chest Xrays.

The cause of this respiratory problem remains unknown, but it has only been seen in old animals. In many cases, affected individuals respond well to a course of broad spectrum parenteral antibiotics (eg clavulox injection IM once daily for 5 days). Nebulisation with saline and antihistamines (eg Niramine) also seems to be helpful. Affected individuals tend to have relapses.

Trauma: Trauma is not uncommon in Dibblers, particularly in the breeding season, when males can inflict injury when they bite the dorsal neck region of females during the mating process. Wounds generally respond well to minimal symptomatic treatment.

Examination and health problems: See above for details of physical examination and discussion of common health problems.

Due to their small size, collecting blood samples from Dibblers can be an unrewarding process. At Perth Zoo, the most successful sites have been the femoral vein and the brachycephalic vein. Blood is collected under general anaesthesia.

Routine treatments: Dibblers are not routinely treated for any disease condition. They do not routinely receive worming treatment, or treatment for external parasites, unless a clinical condition exists (see Major Diseases section above).

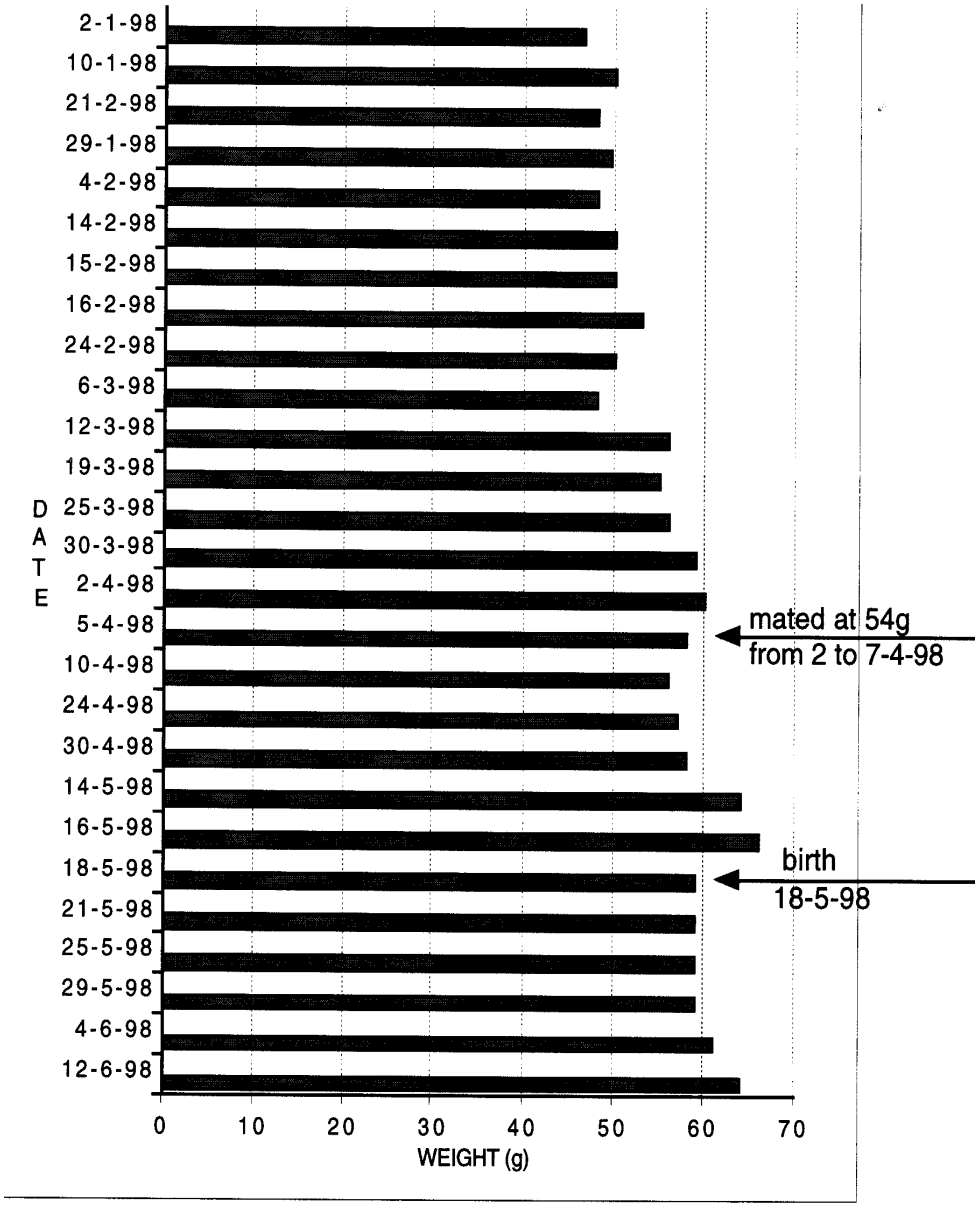
Hand rearing: There have been no instances of hand rearing of Dibblers at Perth Zoo. However, it is presumed that the guidelines for other dasyurid marsupials would also apply for this species. Milk replacement formulas which might be tried include Di-Vetelact, Wombaroo bilby formula, and Biolac. These could be fed via syringe, or via a bowl if the animal was big enough to lap.

Rehabilitation: Because of their small size and elusive nature, rehabilitation opportunities with this species are rare. Symptomatic rehabilitation treatment consists of:

- Immediate provision of a warm (30-32 degrees celsius), secure environment, as well as food and fluids
- Fluid therapy with subcutaneous warmed fluids (Hartmans or 2.5% glucose) if there is evidence of dehydration, or if the animal refuses to eat
- Treatment of obvious injuries; this may have to be delayed if the animal is debilitated
- Antibiotic therapy by intramuscular injection, if indicated.
- Further diagnostic work under anaesthetic may be indicated once the animal has stabilised.

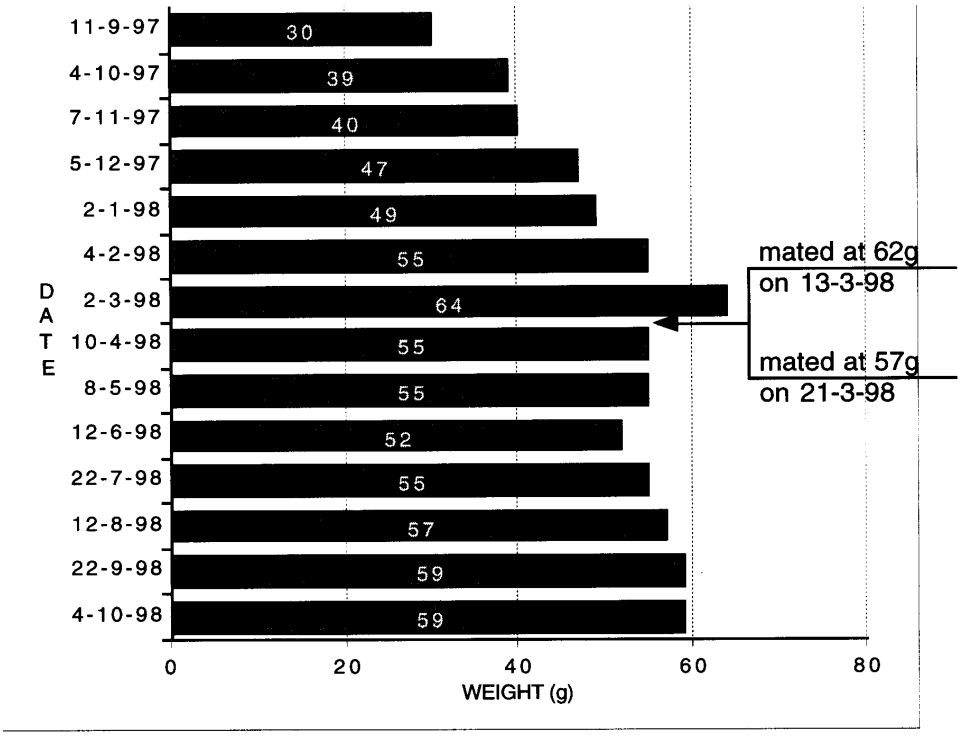
5. APPENDICES

Appendix 1: Breeding Season Weights of Female 9 (D.O.B. – May 1997)



Successfully raised 7 young

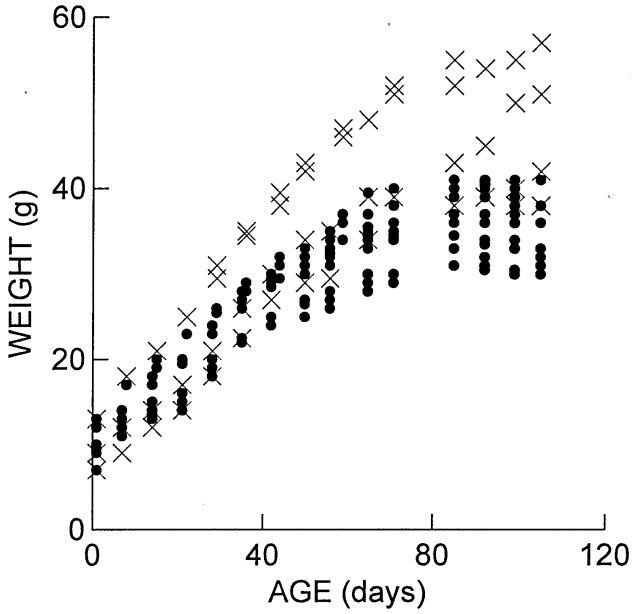
Appendix 2: 1998 Weights for Male Dibbler 15 (D.O.B. – May 1997)



Successfully sired 2 litters

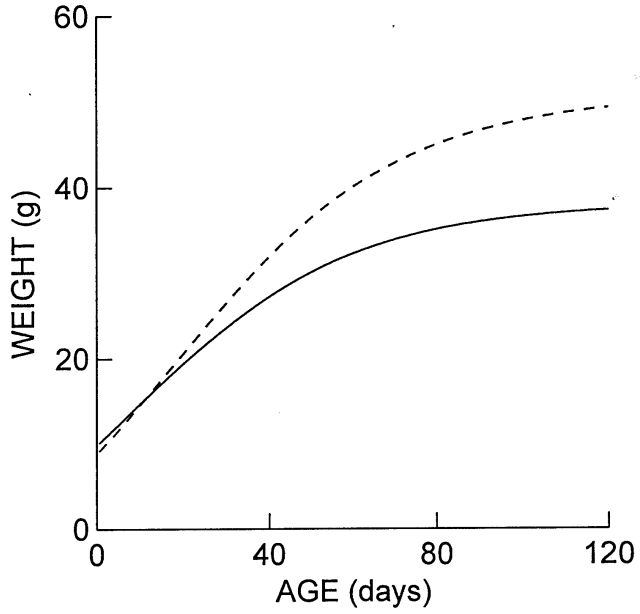
Appendix 3: Growth Curves of Dibbler Young

Figure 4. Dibbler Growth Curve – Weight v Age (a). (Mills et al, 2000)



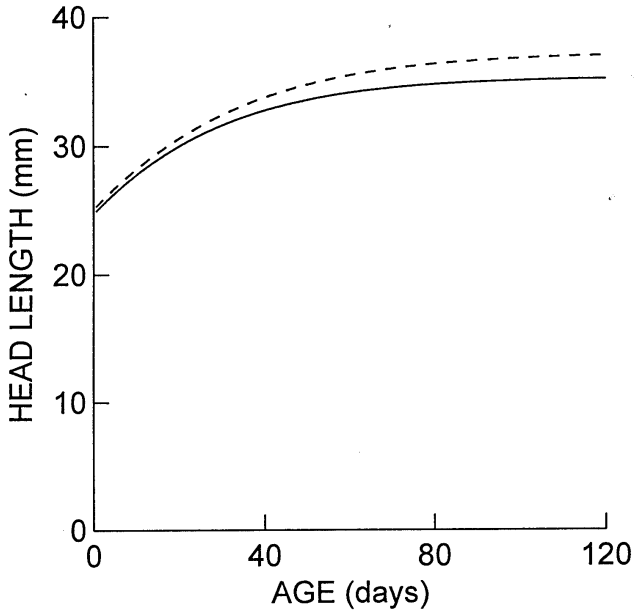
Note: 0 days = age at detachment from teat (approx. 72 days)

Figure 5. Dibbler Growth Curve – Weight v Age (b). (Mills et al, 2000)



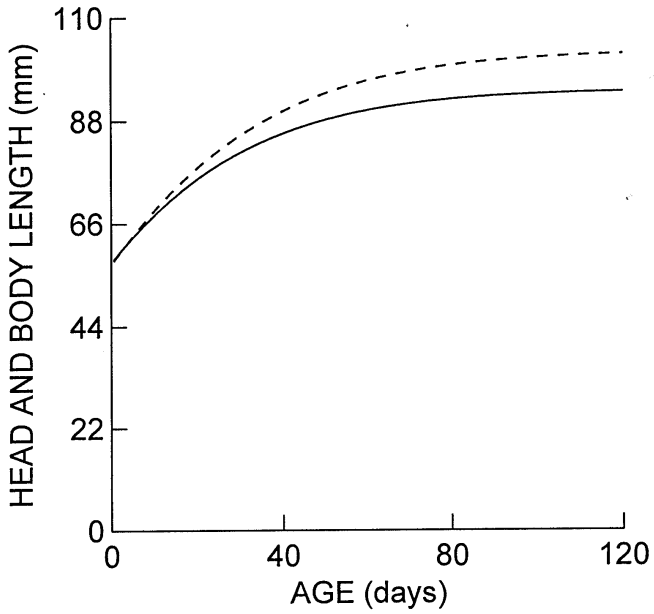
Note: 0 days = age at detachment from teat (approx. 72 days)

Figure 6. Dibbler Growth Curve – Head Length v Age. (Mills et al, 2000)



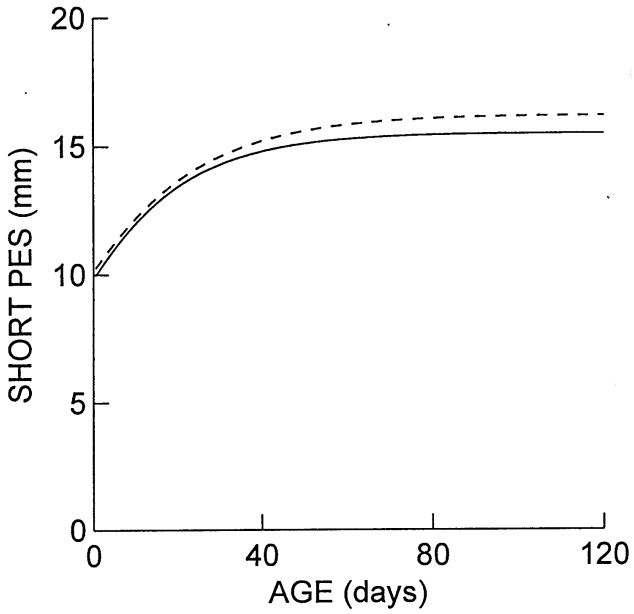
Note: 0 days = age at detachment from teat (approx. 72 days)

Figure 7. Dibbler Growth Curve – Head/body Length v Age. (Mills et al 2000)



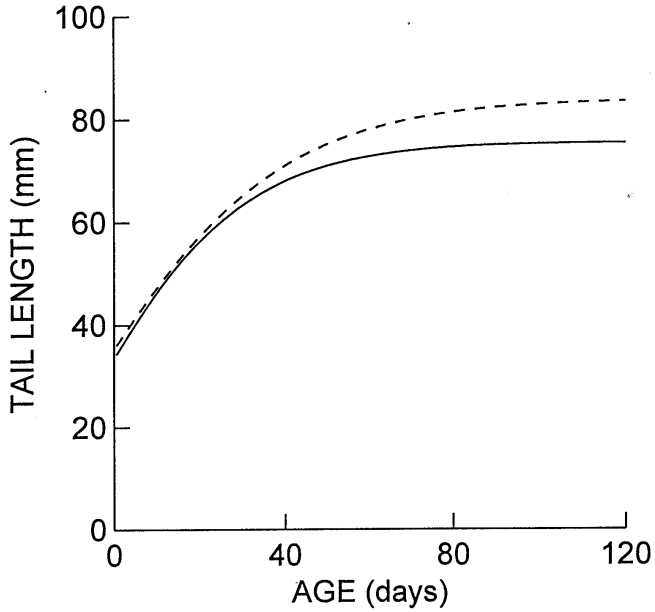
Note: 0 days = age at detachment from teat (approx. 72 days)

Figure 8. Dibbler Growth Curve – Pes v Age. (Mills et al 2000)



Note: 0 days = age at detachment from teat (approx. 72 days)

Figure 9. Dibbler Growth Curve – Tail Length v Age. (Mills et al 2000)



Note: 0 days = age at detachment from teat (approx. 72 days)

Appendix 4: Non-breeding Season Diet

MONDAY

a.m. 4g mealworms (in bowl)

p.m. 4g pinkies + 4g roo + SF40
3 cat food pellets + 1 sultana
(in mealworm bowl)

TUESDAY

a.m. 4g crickets (scattered)

p.m. 6g pinkies mixed with
2g prepared small carnivore mix

WEDNESDAY

a.m. 4g crickets (scattered)

p.m. 4g pinkies + 4g roo + SF40

THURSDAY

a.m. 4g mealworms (in bowl)

p.m. 4g pinkies + 4g chicken + SF40
2g chopped boiled egg

FRIDAY

a.m. 4g crickets (scattered)

p.m. 6g pinkies mixed with
2g prepared small carnivore mix

SATURDAY

a.m. 4g mealworms (in bowl)

p.m. 4g pinkies + 4g roo + SF40
1 small piece of fruit (fig is best liked) +
3 cat food pellets (in mealworm bowl)

SUNDAY

a.m. 4g crickets (scattered)

p.m. 4g pinkies + 4g chicken + SF40

Appendix 5: Breeding Season Diet

MONDAY

a.m. 6g mealworms (in bowl)

p.m. 3g pinkies + 3g roo + SF40
3 cat food pellets + 1 sultana
(in mealworm bowl)

TUESDAY

a.m. 6g crickets (scattered)

p.m. 4g pinkies mixed with
2g prepared small carnivore mix

WEDNESDAY

a.m. 6g crickets (scattered)

p.m. 3g pinkies + 3g roo + SF40

THURSDAY

a.m. 6g mealworms (in bowl)

p.m. 3g pinkies + 3g chicken + SF40
2g chopped boiled egg

FRIDAY

a.m. 6g crickets (scattered)

p.m. 4g pinkies mixed with
2g prepared small carnivore mix

SATURDAY

a.m. 6g mealworms (in bowl)

p.m. 3g pinkies + 3g roo + SF40
1 small piece of fruit (fig is liked best) +
3 cat food pellets (in mealworm bowl)

SUNDAY

a.m. 6g crickets (scattered)

p.m. 3g pinkies + 3g chicken + SF40

Appendix 6: Dibbler Mothers' Diet with 5 Independent Young

(Invertebrate portion based on 4g for mother and 2g for each young)

MONDAY

a.m. 14g mealworms (in bowl)

p.m. 15g pinkies + 15g roo + SF40
10 cat food pellets + 5 sultanas
(in mealworm bowl)

TUESDAY

a.m. 14g crickets (scattered)

p.m. 20g pinkies mixed with
10g prepared small carnivore mix

WEDNESDAY

a.m. 14g crickets (scattered)

p.m. 15g pinkies + 15g roo + SF40

THURSDAY

a.m. 14g mealworms (in bowl)

p.m. 15g pinkies + 15g chicken + SF40
6g chopped boiled egg

FRIDAY

a.m. 14g crickets (scattered)

p.m. 20g pinkies mixed with
10g prepared small carnivore mix

SATURDAY

a.m. 14g mealworms (in bowl)

p.m. 15g pinkies + 15g roo + SF40
5 small piece of fruit (fig is liked best) +
10 cat food pellets (in mealworm bowl)

SUNDAY

a.m. 14g crickets (scattered)

p.m. 15g pinkies + 15g chicken + SF40

Appendix 7: Non-breeding Season Diet Utilizing Less Chicken

MONDAY

a.m. 4g - alternate between mealworms and crickets

p.m. 5g pinkie rats + 5g roo
3 cat food pellets + 1 sultana
(in mealworm bowl)

TUESDAY

a.m. 4g - alternate between mealworms and crickets

p.m. 7g pinkie rats mixed with
3g prepared small carnivore mix

WEDNESDAY

a.m. 4g - alternate between mealworms (in bowl) and crickets

p.m. 10g minced meat mix

THURSDAY

a.m. 4g - alternate between mealworms (in bowl) and crickets

p.m. 5g pinkie rats + 5g chicken
2g chopped boiled egg

FRIDAY

a.m. 4g - alternate between mealworms (in bowl) and crickets

p.m. 7g pinkie rats mixed with
3g prepared small carnivore mix

SATURDAY

a.m. 4g - alternate between mealworms (in bowl) and crickets

p.m. 5g pinkie rats + 5g roo
3 cat food pellets + small piece of fig (in mealworm bowl)

SUNDAY

a.m. 4g - alternate between mealworms (in bowl) and crickets

p.m. 5g roo + 5g minced meat mix

Appendix 8: Alternative Feeding Regimes for Non-breeding Dibblers

Normal maintenance diet
3 days a week – "pinkie" rats and kangaroo
2 days a week – "pinkie" rats and small carnivore mix
2 days a week – "pinkie" rats and chicken

When short on "pinkie" rats, but with some "pinkie" mice available (non-breeding animals only)

3 days a week – "pinkie" rats and kangaroo
2 days a week – "pinkie" mice and small carnivore mix
2 days a week – kangaroo and chicken

When short on "pinkie" rats and "pinkie" mice (non-breeding animals only)

3 days a week – minced meat preparation
2 days a week – small carnivore mix (plus "pinkie" rats/mice if available)
2 days a week – "pinkie" mice and kangaroo

Appendix 9: Alternative Foods for Non-breeding Dibblers

Minced meat preparations examined:

Perth Zoo Kowari diet
15-20 cans Heinz beef dinner baby food
1 dozen boiled eggs
Heinz baby cereal – enough to form stiff consistency

Adelaide Zoo Kowari diet
1 egg
1 tspn. small carnivore mix
15g cat chow
40g mince
1 drop Pentavite
1 spatula Vitamin E powder
Pinch Ca powder
(makes approx. 110g)

La Trobe University dibbler diet
450g beef heart
115g beef liver
200g dry pet food
25g Calcium Carbonate
1 egg

Final minced meat preparation utilized:
1 egg (50g)
1tspn (3g) Wombaroo small carnivore mix
15g Hills adult cat kibble (ground)
40g minced beef
Add a generous ¼ tspn of SF40/Ca mix per 100g of meat mix before feeding in.

To make up a larger amount use the following proportions. Minced meat preparation should be frozen in small portions once it has been completed.
1.25kg eggs
1kg low fat minced beef
375g Hills adult cat kibble (ground)
75g Wombaroo small carnivore mix

Appendix 10: Photos of Pouch Young

Figure 10. Dibbler young at approximately 4 weeks old

Figure 11. Dibbler young at approximately 6 weeks old

Appendix 11: IATA Transport Requirements

IATA Live Animals Regulations

CONTAINER REQUIREMENT 81

☐ **The illustrations shown in this Container Requirement are examples only. Containers that conform to the principle of written guidelines for the species but look slightly different will still meet the IATA standards.**

Applicable to:

Dunnart	Mouse
Gerbil	Rat (wild)
Hutia (small)	Rat opossum
Jerboa	Rockrat
Kangaroo rat (tree climbing)	Rodent (small), n.o.s.
Marsupial mouse	Shrew
Mole	Stick nest rat
Mole rat	Tree shrew
	Vole

See Exception USG-06 in Chapter 2 except for rats and mice. Also refer to the other USG Exceptions.

1. CONTAINER CONSTRUCTION

(see Exception QF-01 in Chapter 3)

Materials

Lined wood, fibreglass, fibreboard, rigid plastic wire mesh, metal foil.

Principles of Design

The following principles of design must be met in addition to the General Container Requirements outlined at the beginning of this chapter.

Dimension

The animal(s) must be able to move around freely and have adequate air space over their highest body part. Refer to the Density Guidelines in this Container Requirement.

Construction

Containers may be made of fibreboard material with a laminated interface of PVC. In such cases the PVC must not be less than 0.150 mm thick. The ventilation gauze/fine wire mesh must be welded to the inner PVC liner. All joints must be made with strong, non-toxic water-resistant glue.

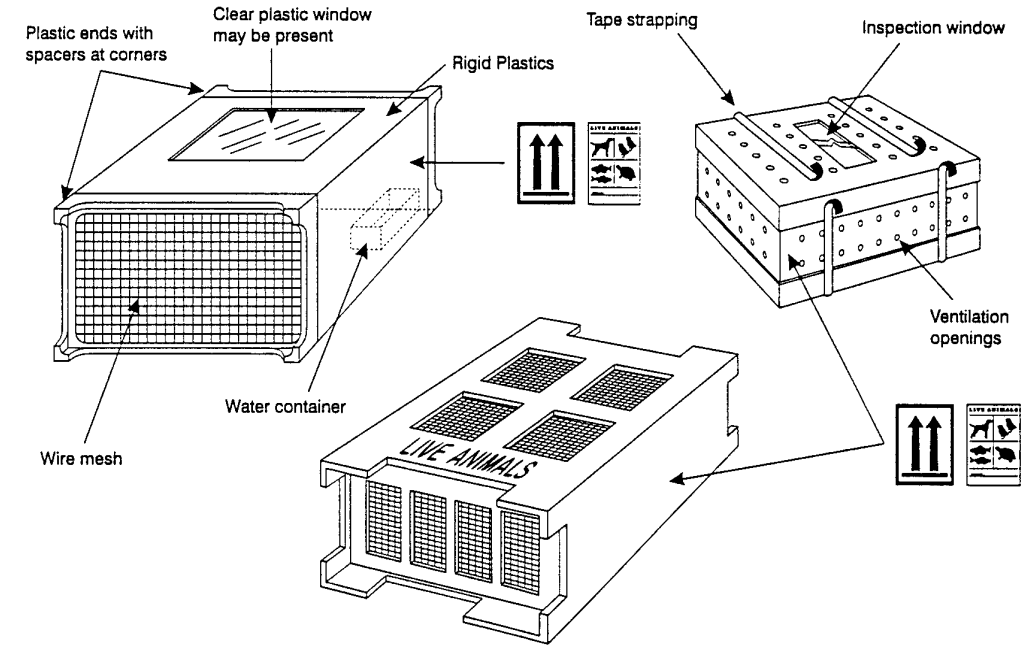
Containers made without a wire mesh liner must have wire screening on all ventilation openings. The mesh must be small enough to ensure that the snout or feet of the animals cannot protrude to the outside.

The interior of the container must be smooth and without any sharp edges.

Floor

The floor must be solid, leak-proof and covered with a layer of absorbent non-consumable bedding material.

EXAMPLE:



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CONTAINER REQUIREMENT 81 *(cont'd)*

Lid

The lid of the box can vary with the design but if it is not lined with wire mesh it must be made of plastic material or have a plastic PVC liner. The lid must fit the box closely and be secured in place.

The lid of the box must include a central aperture with a flap that allows the contents to be inspected. This inspection window must be present on all types of boxes.

Ventilation

Meshed holes must be present on all four sides and the lid of the box or the ends and top must have large meshed areas to ensure good ventilation.

Specific Pathogen Free (SPF) boxes have special gauze air filters fixed in the ventilation apertures, SPF boxes must never be opened at any time during transport without permission.

Spacer Bars

Spacers must be an integral part of the design of the box and be present at both ends at the corners.

Water Containers

A water container must be provided that is compatible with the number of animals in the container. It must be fixed within the container and in the case of laboratory animals it must be filled at the time of shipment.

2. PREPARATIONS BEFORE DISPATCH

(see Chapter 5)

Corn/wheat saturated with water, i.e. soaked for 24 hours minimum, is a suitable form of food and moisture for inclusion in containers.

△ ***Note:*** *Rodents, n.o.s. and small fur bearing animals must be given an ample supply of shredded paper or wood wool. A method for supplying warmth and the use of insulated outer container is indicated for naked mole rats.*

The following Table must be consulted for quantity of shipment:

DENSITY GUIDELINES

Species	Weight of Animal (grams)	Maximum Number per Compartment in Container *	Space per Animal		Height of Box	
			cm^2	in^2	cm	in
Rat **	59 or less	25	50	8	15	6
	60–65	24	55	9	15	6
	66– 70	23	60	9	15	6
	71– 80	22	65	10	15	6
	81– 90	21	70	11	15	6
	91–100	20	75	12	15	6
	101–110	19	80	12	15	6
	111–120	18	85	13	15	6
	121–130	17	90	14	15	6
	131–140	16	95	15	15	6
	141–150	15	100	16	15	6
	151–160	14	110	17	15	6
	161–170	13	115	18	15	6
	171–180	12	125	20	15	6
	181–200	11	135	21	15	6
	201–220	10	145	22	15	6
	221–270	9	165	26	15	6
	271–320	8	190	29	15	6
	321–370	7	220	34	15	6
	371–420	6	250	39	15	6
Mouse **	15 or less	30	18	3	10	4
	16–18	27	22	3	10	4
	19–21	24	26	4	10	4
	22–24	21	30	5	10	4
	25–27	18	35	5	10	4
	28–30	15	40	6	10	4
	31 or more	12	45	7	10	4

* If the ambient ground temperature at ground level exceeds 24°C (75°F), reduce maximum number per compartment in the container by 10%.

** When in filter containers reduce density by 15%.

CONTAINER REQUIREMENT 81 *(cont'd)*

3. FEEDING AND WATERING GUIDE
(for emergency use only)

Animals do not normally require additional feeding or watering during 24 hours following the time of dispatch.

If feeding is required due to an unforeseen delay, fruit or grain must be provided although some are omnivorous and may eat meat. Care must be taken not to overfeed.

Shrew must be shipped with a supply of food in the container to prevent fighting.

Note: *Laboratory and SPF animal containers must not be opened, therefore, these animals must be fed under scientifically controlled conditions.*

4. GENERAL CARE AND LOADING
(see Chapters 5 and 10)

Animals known to be for laboratory use must be separated completely from other animals to reduce any risk of cross-infection or contamination, e.g. specific pathogen free (SPF) consignments.

SECTION 9 — LABELLING

Question:

How to label a live animal container correctly?

Answer:

B

To prevent mishandling, **ALL** live animal containers must have:

1. The "This Way Up" labels on all four sides of the container whenever possible.
2. At least one "Live Animal" label or tag affixed to the container. Dog and Cat containers can be suitably imprint the label.
3. The "Live Animal" label or tag filled in with the information about the species contained.
4. In the case of Specific Pathogen Free (SPF) laboratory animals, the "Live Animal" label replaced by a "Lab Animal" label suitably marked with the name of the species.
5. All labels with dimensions of 10 x 15 cm (4 x 6 in).
6. Any damaged labels replaced.
7. The labels on small containers must not occlude the ventilation openings.
8. Labels may be punched through to the ventilation holes to allow the passage of air.

Question:

What are the marking requirements for an animal container?

Answer:

The container must have the following markings:

1. The full name, address and telephone number of a 24-hour contact for a person responsible for the shipment.
2. The scientific and common name of the animal(s) within the container, as shown on the shippers certificate.
3. The number of animals within the container.
4. If it contains animals that can give poisonous bites or stings the container must be marked "POISONOUS".
5. Containers holding animals that bite must be marked "THIS ANIMAL BITES".
6. The shipper's instructions for feed and watering.
7. The details of any medication administered prior to shipment should be recorded with the name of the drug, da and route of administration.

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