

Husbandry Manual
for
Southern Corroboree Frog

Pseudophryne corroboree

(Amphibia: Myobatrachidae)



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Southern Corroboree Frog

Pseudophryne corroboree

is classed as

Harmless

However, there is a slight toxicity to their skin pertaining to Indole Alkaloids. The pseudophrynamines represent a major class of alkaloids, unique to the genus *Pseudophryne* of the family Myobatrachidae.

(Heatwole 1993)

The wearing of gloves while handling this species is essential.

Please read quarantine procedures for this species, Section 8.5.

See section 8.4 for Known Health Problems

1 Introduction

The Southern Corroboree Frog (*Moore 1953*) is distinctive and easily recognized due to the striking colour pattern on its upper surface consisting of bright yellow longitudinal stripes alternating with black stripes (*Cogger 1992*). The Southern Corroboree Frogs colouring is probably a form of defence mechanism as these colours are widely associated in nature as danger. (*Schmida 1995*) Its undersurface is also marked with black, yellow and white blotches. A large femoral gland is present on each hind limb and the inner metatarsal tubercle is low and round. Adults reach a length of between 25-30 mm.

The Southern Corroboree Frog is found in sub-alpine areas within the Kosciusko National Park at high altitudes ranging from 1300 to 1760 meters above sea level. Thus the temperature levels within the container vary depending on the season between, 2-18°C through out the year.

In captivity the Southern Corroboree Frog lives on a diet of mostly pinhead crickets, although other small invertebrates may be offered. However in the wild their diet consists of mostly ants, it is thought that because of this, there is a high concentration of alkaloids in the skin of Southern Corroboree Frogs (*Daly 1990*), creating toxicity on it's skin, similar to the New World Poison Dart Frog's (genus *Dendrobatidae*) of South America

The Southern Corroboree Frog has been in captivity at the Amphibian Research Center (ARC) in Melbourne since 1996. The ARC is so far is having great success at raising spawn to tadpoles, and tadpoles to frogs. It is with the intention to successfully breed and raise The Southern Corroboree Frogs to be released into the wild, to aid in increasing the wild population and their recovery in the wild. The Southern Corroboree Frog is now considered to be Critically Endangered using the criteria applied by the IUCN and is officially listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act* (EPBC Act) 1999 and the NSW Government *Threatened Species Conservation Act* (TSC Act) 1995.

2 Taxonomy

Southern Corroboree Frog (*Moore 1953*)

2.1 Nomenclature

Class	Amphibia
Order	Anura
Family	Myobatrachidae
Genus	<i>Pseudophryne</i>
Species	<i>corroboree</i>

2.2 Subspecies

There are no subspecies of the Southern Corroboree Frog.

Until 1985 it was thought there was only one species of Corroboree Frog. Wells and Wellington (1985) put forward their argument that there was in fact two species of Corroboree Frog and named the second *Pseudophryne pengilleyi* Northern Corroboree Frog after Dr R Pengilley, who in the 60's undertook a great deal of research on the species. Through geographic analysis of morphology and vocalisation of Southern Corroboree Frog, in 1996 Osborne recommended that *Pseudophryne pengilleyi* be recognized as a separate species. This recommendation has been accepted by other authorities and is now recognized as a species in its own right on the Threatened Species Conservation Act.

2.3 Recent Synonyms

Family	Leptodactylidae
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At one time all Ground Frogs found in Australia, India and South America all came under the family of Leptodactylidae; the Australian ground frogs were however given a new family, Myobatrachidae.

2.4 Other Common Names

There are no other common names for the Southern Corroboree Frog.

3 Natural History

3.1 *Morphometrics*

The Southern Corroboree Frog has a very striking dorsal colour pattern that consists of bright yellow longitudinal stripes that alternate with black stripes (Cogger 1992). The under body surface is marked with black, yellow and white blotches. A large flat femoral gland is present on each hind limb; the inner metatarsal tubercle is low and round.



Adult Southern Corroboree Frog

Photo ©M. McFadden. Used with permission.

3.1.1 *Mass And Basic Body Measurements*

In total length the Southern Corroboree frog reaches between 25-30mm. On arrival at Taronga, the Corroboree Frogs weights varied depending on their ages. The 3year olds weighed between 0.9 and 1.0 grams, the 5year olds weighed between 2.1and 2.2gms. The eggs of the Southern Corroboree Frog are amongst the largest in the genus. (Tyler 1989) Measuring approximately 3-4mm in diameter, each egg is individually surrounded by tough transparent capsule that once hydrated swells up to 8mm in diameter. Hatching tadpoles measure approximately 15mm snout to tail and are relatively advanced. Emerging at Gosner (1960) stage 27 where the first signs of hind limbs showing as a bump near the base of the tail.

3.1.2 *Sexual Dimorphism*

The female Southern Corroboree Fogs are slightly larger than the males. However, this method of sexing can not be accurately used; in captivity it has been noted that males gain a little more weight than in the wild. Differences between the male and female Southern Corroboree Frogs are that the males have a mating call to let the females know he is there and another to also let other males know that this is his love nest.

3.1.3 Distinguishing Features

There are two species of Corroboree Frog, the Southern and the Northern. *Pseudophryne pengilleyi*. Due to their striking colours, no other species of frogs is likely to be mistaken for these species. During tadpole stage the two species are extremely difficult to tell apart however it has been noted that the Northern Corroboree Frog has a greater number of blotches on its tail fin. The mouth parts of the tadpoles are identical. The frog's differences include considerable genetic divergence (Roberts and Mason 1989; Osborne and Norman 1991), colour pattern, morphology (Pengilley 1966; Osborne 1996) and skin biochemistry (Daly et al 1990). However as adults the two species of Corroboree Frog differ slightly by their colour. The Southern Corroboree Frog has very bright and clean yellow stripes where as the Northern Corroboree Frog is a muddy green yellow.

3.2 Distribution and Habitat

The Southern Corroboree Frog is a native Australian Alpine species, and is found only in the Kosciuszko National Park. It has a limited range occurring from Smiggins holes in the south, northwards to the Maragle Range, about 5kms west of Cabramurra, a habitat length of range being approximately 50kms. The widest part being near Mount Jagungal is 24kms wide and a total habitat area of about 400km². This area is a sub-alpine and a mountainous habitat, between 1300 and 1760m above sea level, this area receives snowfalls during the winter. This area managed by DEC under the provisions set out in the Kosciuszko National Park Plan of Management.

There are two types of habitat that the Southern Corroboree Frog lives in. The first is for the breeding season and is based on sphagnum bogs and wet tussocks. With small pools or seepages within the bogs occurring on granite and volcanic substrates with the vegetation varying on the altitude, from bog and wet heath to wet sod tussock grasses. The adult Southern Corroboree Frogs inhabits this area for a short period of time only, leaving the eggs to hatch into tadpoles and juveniles. The adults and sub-adults can then spread out over 300m into the surrounding area, which becomes the non-breeding winter habitat of sub-alpine forest, woodlands or heath. (Hunter, Osbourne, Pietsch and Saxon 2005)

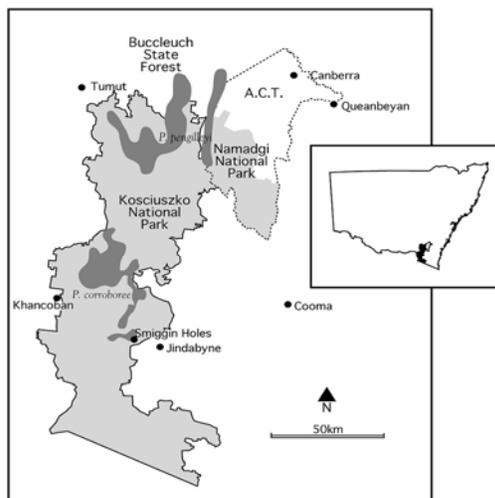


Fig 3.2 ©David Hunter. Used with permission

Fig 3.5 Shows distribution of *Pseudophryne corroboree* and *Pseudophryne pengilleyi* in relation to existing nature conservation reserves. Darker stippling indicates the range of each species.

3.3 Conservation Status

The Southern Corroboree Frog is now considered to be Critically Endangered using the criteria applied by the IUCN and has been officially listed as Endangered under both the Commonwealth *Environment Protection and Biodiversity Conservation Act (EPBC Act) 1999* and the NSW Government *Threatened Species Conservation Act (TSC Act) 1995*. There is a great deal of research currently being done regarding the Southern Corroboree Frog. Gerry Marantelli from Amphibian Research Centre has had limited success in 2006 in breeding corroboree frogs.

3.4 Diet in the Wild

In the wild the Southern Corroboree Frog predominately eats ants but may also include other small invertebrates in its diet. However, during the winter months the Southern Corroboree Frogs does not eat. This is due not only to food sources being reduced, but also due to the Frogs body temperatures dropping so low that they are unable to eat and digest. Moving from nesting sites into the non-breeding winter habitat of sub-alpine forest, woodlands and heath where they burrow into the earth and go into a cooled down state of brumation.

3.5 Longevity

3.5.1 In the Wild

The oldest know Southern Corroboree Frog in the wild is a male aged approximately nine years old. (Pers. Comms. McFadden, M. Taronga Zoo)

3.5.2 In Captivity

The Amphibian Research Centre has had Southern Corroboree Frogs since 1996. It is yet to be determined if any of the original frogs are still within their collection. However, they do have a large number of 5 and 6 year old frogs.

3.5.3 Techniques Used to Determine Age in Adults

All collections of Southern Corroboree Frogs from the wild have included adults and eggs. The best way for us to know the ages of the frogs have been to record all hatching/morphosing dates. This is also to aid in correct releases back into the wild. The only other technique that has been used to determine the age in adults has been through skeletochronology.

4 Housing Requirements

4.1 Exhibit/Enclosure Design

An exhibit for The Southern Corroboree Frog that is proving successful at Taronga Zoo is an old shipping container that has been made into a huge refrigerator on the inside and connected to Reverse Osmosis water tank on the outside. (See *Manual for Captive Husbandry Facility procedures*, McFadden, 2007 Unpublished). This exhibit was designed to house the Southern Corroboree Frogs not only as adults but as eggs and tadpoles also. It was designed to emulate the Corroboree Frogs natural environment, temperatures and the best way for us to keep them in a high quarantine facility. On the public access side, a wooden ramp was built leading up to two double glazed windows that were installed as viewing/display areas. The smaller of the two windows includes a built in display tank for adult frogs. This tank has a slightly slanted ground area that stops approximately 3cm from the front of the glass, which then drops off into a burrowing area for the frogs of about 10cm deep. The ground covering and burrowing areas are covered in Alpine Sphagnum mosses and ferns, ideal for resting and burrowing. The second display window gives an overview of the whole container, including the Tadpole tanks. There are four tanks in the container three of which are housing eggs and tadpoles from three different sites from within Kosciusko National Park.

4.2 Holding Area Design

The holding area for The Southern Corroboree Frog is also situated in the container. Running along the back wall, are a bank of four shelves. Each shelf has a lip of about 5cm high, UVB lights and water sprayers attached, small pet packs holding Southern Corroboree Frogs will sit on these shelves as holding areas until the frogs are sexually mature and can begin spawning or until they are at the correct release age.

4.3 Spatial Requirements

The EAPA standards for exhibiting terrestrial frogs are as follows -

For two (2) adult specimens (L= length of largest specimen)

Length = 20L

Width = 20L

Height = 10L

And for each additional specimen add 20% minimum area. (*Draft Standards for Exhibiting Amphibians in NSW 2002*).

4.4 Position of Enclosures

The Southern Corroboree Frog exhibit faces South West; this allows the container to have sun on it through out the day, avoiding any direct sunlight that may heat up the exhibit.

4.5 Weather Protection

As the container is an old shipping container it was already waterproof. It has been painted in colours that won't absorb too much heat and change the interior temperatures. Due to the refrigeration of the container outside weather won't have an effect on the inside enclosure.



Front outside view of Container.
Photo © Natacha Richards.

4.6 Temperature Requirements

The Southern Corroboree Frog comes from the Snowy Mountains of NSW where the temperatures can drop to minuses. The Southern Corroboree Frog's body temperature can not drop below 0°C as they would probably die. However because the Southern Corroboree Frog is fossorial the temperatures may tend to be a little warmer in the ground than the atmospheric air temperature. As they burrow down their body temperature would always be at least 1-3°C.

Controlling the temperatures within the container is imperative for the successful breeding of the Southern Corroboree Frog. In the container we are imitating seasonal temperatures, thus for each change of season, the temperatures will vary accordingly-

Container Air Temperature Control

- Winter (June to August), the container will be maintained between 2°C and 5°C.
- Spring (September to November) the temperature will be set at 14°C.
- Summer (December to February) the temperature will be set at 18°C
- Autumn (March to May) temperature will be set at 14°C.

(McFadden & Harlow 2006 Unpublished)

4.7 Substrate

In the holding pet packs and the adult Corroboree Frog exhibit there is Sphagnum moss, Snowy Mountain Silt, other Alpine mosses and ferns that are native to Kosciusko National Park. Wet tussock grasses are also used. In the tadpole tanks Snowy Mountain silt has been used to create a healthy environment for the tadpoles.

4.8 Nestboxes and/or Bedding Material

As The Southern Corroboree Frogs burrow into the substrate, and use the sphagnum bogs to lay its eggs on, there is no need to give additional nest boxes or bedding materials.

4.9 Enclosure Furnishings

The exhibit enclosures are furnished with Alpine ferns and mosses. We also place in there some pieces of fallen bark to create a natural environment for the frogs to move around and under.



Alpine Ferns and Mosses.
Photo © Natacha Richards

5 General Husbandry

5.1 *Hygiene and Cleaning*

There are four 250 L glass tadpole aquariums in the container, each with a substrate of silt collected from Alpine sphagnum bogs and a bank of four display rows for the metamorphosing and adult frogs.

Frogs have sprayers that are connected to the Reverse Osmosis Tank water, and sit just above the pet packs whereby filtered water is sprayed on to them, to break down and wash away faecal matter, effectively cleaning the pet packs.

Tadpoles the 10% water change daily ensures that the water remains clean.

An Automated sprayer system connected to a reverse osmosis water reservoir is programmed to deliver a 10% water change each day. Gloves must be worn inside the container and are required to be changed between working with each unit, **AND** any equipment within the container. (McFadden & Harlow 2005 unpublished)

5.2 *Record Keeping*

When the Southern Corroboree Frogs and eggs arrived at Taronga Zoo, the records with them had information such as the adult frog's ages and collection site details for all eggs and adults. Due to the numbers of eggs we received we have collection site species cards rather than individual cards for Southern Corroboree Frog. Information such as dates of acquisition, by what means (i.e.; from another institution), Records are also kept in a Daily Diary, maintained within the container on;

- When and how much the Tadpoles are fed
- When and how much the frogs are fed
- Behavioural observations of Tadpoles and frogs
- Birth details, breeding details
- Weight and length details,
- Fecal samples and vet checks
- Deaths and PM results

However as Taronga Zoo is a member of ARAZPA we abide by the guidelines and in keeping with this conform to ARKS.

5.3 Methods of Identification

At this time we have 5 adult Southern Corroboree Frogs, so it is quite easy to tell them apart by their dorsal markings and size. However for those who are not familiar with the different markings we have digital photographs of each frog. Once the numbers of Southern Corroboree Frog start to increase, it will become necessary to take pictures of the ventral surface. These patterns tend to vary a lot more than dorsal patterns. It will be also very important to ensure that every pet pack of metamorphosed frog is clearly labeled and a high level of quarantine is adhered to by not mixing up frogs of different regions and ages.



Dorsal and Ventral photo's for ID of Frogs
Photo's © Michael McFadden. Used with permission

5.4 Routine Data Collection

Routine data collection for the frogs and tadpoles will include quarterly fecals, weights and lengths where possible.

6 Feeding Requirements

6.1 Captive Diet

Frogs

- Winter; frogs will not be fed, due to the low ambient temperature in which they are maintained
- Spring; frogs will be fed weekly.
- Summer; frogs will be fed twice per week.
- Autumn; frogs will be fed weekly.

Frog Diet; Hatchling to week-old crickets, approximately 20-30 crickets per adult frog and 20 crickets per metamorphose per week. Note that the crickets remain alive, and will live happily in the sphagnum moss until consumed by the frogs. The size of crickets used will depend on the size of the frogs:

- Metamorphose; Day old crickets
- 6 month old; 2-3 day old crickets
- Adult frogs; 6-7 day old crickets

Tadpole Diet

Tadpoles will be fed throughout all seasons until metamorphosis. Endive or lettuce should be offered every two to three days. Endive or lettuce can be kept in the freezer and be used as needed. Tadpoles will also be offered a range of good quality vegetable-based fish flakes with a high algal content. e.g. Sera brand. (McFadden and Harlow unpublished 2006)

Purchased through Pisces Enterprises Live Food Supplies pin head crickets cost \$2.95 per 100 crickets. So if one frog is eating

$$\begin{aligned} & 30 \text{ crickets per week} \\ & \times 52 \text{ weeks} \\ & = 1560 \text{ total number of crickets needed} \\ & \div 100 \text{ crickets per container} \\ & = 15.6 \text{ containers of crickets} \\ & \times \$ 2.95 \text{ per container of cricket} \\ & = \$46.02 \text{ total cost per year.} \end{aligned}$$

6.2 Supplements

The pinhead crickets are dusted with Rep-Cal Calcium supplement and Herptivite multivitamin on alternate feeds.

6.3 Presentation of Food

Once a week crickets will be dropped in with frogs for frogs to eat as they please. The crickets will be alive and will happily remain so while living in amongst the sphagnum mosses until eaten. This is behavioural enrichment for the frogs as they end up having to find the crickets.

7 Handling and Transport

7.1 Timing of Capture and Handling

The Southern Corroboree Frogs came from ARC, so were already in small pet packs in the ARC hold area, making it easier to capture. Minimum handling of Corroboree Frogs is in place at all times so as to eliminate any stress. The frogs went straight from the pet packs into take away containers and then into a six-pack can polystyrene esky that is chilled.

7.2 Catching Bags

Catching bags are not applicable, however damp latex gloves must be worn at all times when handling Southern Corroboree Frog.

7.3 Capture and Restraint Techniques

Wearing damp latex gloves, frogs can be restrained by holding around lower body and keeping the legs back. Hold very gently as due to the size of this frog it may be difficult to get a proper hold.

7.4 Weighing and Examination

Placing the Southern Corroboree frog into the plastic takeaway container, then place the container on to scales, minus the weight of the container from the total number will give you the weight of the frog. While frog is in the plastic container, you maybe able to do a visual examination to check body condition, eyes and vent. A visual examination includes looking for any type of discharge, redness or loss of body weight. Are there any skeletal bones excessively protruding, is the skin and eyes clean, clear and healthy?

7.5 Release

By placing the takeaway container inside the enclosure and then lifting off the lid, lets the frog jump out when it is ready with no extra handling involved.

7.6 Transport Requirements

IATA standards for transporting terrestrial frogs are that the frogs must be packed singularly in rigid containers containing very moist substrate. The size of the container must enable the animal to have contact with its whole ventral surface to the floor of the container. Frogs and toads smaller than 15 cm (6in) require a maximum of 5cm (2in) of height clearance. All amphibians require moist substrate to maintain species-specific humidity during the whole time of transport. Due to their sensitive skins no burlap (hessian) or other abrasive materials are allowed.

The Draft Standards for Exhibiting Amphibians in NSW (2002) also state that care must be taken to avoid exposure of amphibians to extreme temperatures, Transport containers must not be placed in direct sunlight, water or draught and that amphibians must have direct access to water prior to and during transport to prevent dehydration. It also notes that during cold weather amphibians may become dormant for prolonged periods and therefore should not be presumed dead.

If the frogs are going by air you will need to ensure the airline can take them. They will need to travel as carry on luggage and CANNOT go through the X-ray machine.

Due to new air travel restrictions it is no longer possible to use air travel for means of transporting Southern Corroboree Frogs. The collection of year old frogs and eggs in April 2007 had to be done by car. Please see 7.6 Transport Requirements and 7.6.1 Box design for the best containers for transporting Southern Corroboree Frogs and the eggs.

7.6.1 Box Design

Using a clear plastic takeaway container with a secure lid, there needs to be plenty of air holes on the top and a few along the sides. When putting in the holes make sure to push the holes from the inside out or else make sure there is no sharp edges sticking out that may injure the frogs. You will then need to place the take away containers holding the frogs into a polystyrene esky that will keep them insulated against heat.



Take away containers used for Transporting Frogs.
Photo © Michael McFadden. Used with permission.

7.6.2 Furnishings

The only furnishings needed for the frogs and eggs are a thick layer of moist sphagnum moss.

7.6.3 Water and Food

No food needs to be provided for the Southern Corroboree Frogs at this time. The moisture in the sphagnum moss will provide the frogs with any necessary water requirements.

7.6.4 Animals per Box

Only two frogs should be placed in one takeaway container at any time and two takeaway containers six-pack polystyrene esky. A clutch of eggs can be transported together.

7.6.5 Timing of Transportation

The Southern Corroboree Frog is best being transported during the cooler months. Summer is way too hot for them and could possibly kill them. Keeping the esky container as cool as possible is best.

7.6.6 Release from Box

By placing the takeaway container inside the enclosure and then lifting off the lid, lets the frog jump out when it is ready with no extra handling involved.

8 Health Requirements

8.1 Daily Health Checks

These are made by the keepers each morning.

Each of the Tadpole tanks are checked for tadpole movement, changes in body condition or tadpoles movements. Water quality should be checked and tested.

The adult Southern Corroboree Frogs are cited three times per week. A visual examination of body condition, weight loss or gain, visible lesions or cysts is performed at each citing. This includes ensuring the gait of Southern Corroboree Frog not only in sitting position, but also when moving, is natural and looking at the general appearance of the Southern Corroboree Frog for any eye, nasal, vent discharges, fecal consistency, that its eyes are open and clear and that it is feeding well.

8.2 Detailed Physical Examination

8.2.1 Chemical Restraint

When administering chemical restraint, the stomach of the Southern Corroboree Frog should be empty. With a body weight of under 20grams many small Anurans maybe safely anesthetized with only a brief fast of about four hours or less with minimal risk of emesis. Length of fasting recommended is dependent on patient's condition (Wright and Whitaker 2001)

There are a number of ways to anesthetize Southern Corroboree Frog, from topical anesthetics such as *Tricane Methanesulfonate* or *Benzocaine* which will take the frogs to a surgical plane. For recovery to this method rinsing the Southern Corroboree Frog with clean water will wash away the solution from its skin.

Generally Inhalant anesthetics are not suitable for frog species however *Methoxyflurane* has worked as an inhalant aesthetic for laboratory frogs by placing them in an anesthetic chamber other anesthetics include *Ketamine Hydrochloride*, *Ethanol*, and other *Barbiturates*.

CHEMICAL RESTRAINT SHOULD BE DONE BY QUALIFIED PERSONS ONLY

8.2.2 Physical Examination

As Southern Corroboree Frog is quite small the use of magnification maybe required for an in-depth evaluation.

Because of its size it can be difficult to take blood samples from Southern Corroboree Frog however most Anurans release a significant stream of urine when first restrained; this is a good sample and should be caught in a sterile cup for analysis.

Examining Southern Corroboree Frog should be done with a hands-off observation first, to observe behaviour and overall body condition. Posture should be appropriate for the species. Anurans typically rest with their heads up and legs held flexed beside their body. (Wright and Whitaker 2001) SCF should be well fleshed, showing little of the underlying skeleton.

Wearing damp powder free latex gloves gently hold the Southern Corroboree Frog's hind limbs with an index finger and thumb and the upper body across the palm to do a visual examination. Using a pen light to look into the frogs eyes will provide illumination and magnification allowing inspection of the cornea, iris and retina. By carefully opening the mouth of the Southern Corroboree Frog, use an oral speculum, allowing a visual of the tongue, glottis, lingual plexus and mucous membranes for any abnormalities. (Wright and Whitaker 2001) Culture collection is very important for ensuring the overall health of the SCF. These can include faecals, urine, and blood, oral, vent and skin swabs.

8.3 Routine Treatments

Due to the high quarantine surrounding SCF there are no routine treatments or vaccinations needed.

8.4 Known Health Problems

The only known health problem for SCF is Chytrid Fungus

Signs of Disease

- Neurological signs - abnormal posture
- Absent reflexes
- Abnormal behaviours - nocturnal frogs in sunlight, lacking flee response, fitting when handled
- Thickened epidermis
- Underlying dermal inflammation
- Excessive sloughing
- Anorexia
- Lethargy
- Discoloured skin
- Hyperemia of pale skin may be noted

Causes

- Chytridiomycosis is caused by Batrachochytrium dendrobatidis
- Causes a high incidence of morbidity and mortality in captive and wild amphibians
- The species of amphibian depends on the severity of Chytrid
- Environmental factors determine the severity
- Low temperatures increase severity
- Uses keratin as its substrate
- Environmental stress
- Global warming or increased exposure to UV radiation

Treatments

- Chytrid has only recently been diagnosed, little is known about how to control it
- Some success in treating dendrobatid frogs using 1% suspension of itraconazole
- Fluconazole and Itraconazole are promising but effective regimes need to be established

Prevention

- Threat abatement plan is being developed and recommends extending and reinforcing current quarantine and handling protocols, control of human and amphibian movement
- Disinfecting equipment and enclosures
- High heat on soils and water to kill bacteria
- Ensuring disease is identified where ever it is found
- Phasing out import of amphibians
- Identify and manage environmental factors
- Wearing latex disposable gloves, changing them for each handling
- Beware not to splash water on facial areas
- Give frogs a betadine bath for 4 minutes every 3 days (1 part povidone 10% iodine per 100 parts water in small bowl, sit frog in it without getting it in its eyes or nostrils)
- Not taking frogs from the wild during winter time when Chytrid is prevalent
- Avoid obtaining or disposing of any frog in the winter. If you have to, give betadine baths for at least a week before hand
- Quarantine received frogs for at least two weeks, giving betadine baths

8.5 Quarantine Requirements

The Southern Corroboree Frog has its own quarantine within the container.

Corroboree Frog Quarantine

The Corroboree Frog Holding Facility is a high level quarantine area, accessible only to a small number of trained Herpetofauna Division staff. The quarantine procedures currently in place include;

- The container is tended to first thing in the morning, before working with any other species.
- Before entering the container, staff wash their hands thoroughly.
- Upon opening the container door, work boots are removed and left outside, and quarantine gumboots (which are kept just inside the door) are put on.
- A surgery gown (hanging just inside the door) is put on.
- Disposable gloves are worn when working within the container, and changed regularly as required (see Barrier Nursing below).
- The adult frogs are always tended first (they have been in quarantine for a minimum of three years), followed by the three different spawn/tadpole populations (collected from the wild in Feb. 2006).

Barrier Nursing

There are four quarantine 'units' within the container, which require strict barrier nursing; the adult frog display enclosure, and the three different spawn/tadpole populations (from three provenances, labeled Site 1, 2 & 3). These four units are to be strictly quarantined **from each other**, and require gloves to be changed between working with each unit, **AND** any equipment within the container. (McFadden & Harlow 2005 unpublished)

Note: The above, are the quarantine procedures currently used at Taronga Zoo. The reason for this strict quarantine is to totally eliminate the risk of the Southern Corroboree Frogs catching pathogens in captivity and to quarantine them from other groups of frogs within the container that may jeopardize their health or potential for re-introduction

Wright and Whitaker suggest that immediately upon arrival each frog should be weighed and assessed. If this is not possible, an accurate weight should be obtained within 48 hours. A careful examination of the skin, for discolouration, masses, or other lesions suggestive of parasites or other infections need to be eliminated. Any lesions should be sampled and evaluated.

Soon after arrival a fecal sample should be submitted for parasite evaluation including acid-fast stain, direct exam and floatation. Cryptosporidium should be investigated also. They do suggest a more conservative approach to the quarantine of amphibians based upon the results of at least three clear samples obtained from individuals every 5 days. A minimum of 30 days quarantine is recommended for any amphibian that arrives with clean fecal samples, although a 60 day quarantine period is more reasonable. Detailed husbandry records should be kept in conjunction with medical records and any deaths are autopsied.

9 Behaviour

9.1 Activity

This depends on the time of year. During the winter Southern Corroboree Frog goes into brumation, moving away from the breeding sites and in to the surrounding heath and woodland. Where it will burrow amongst the mosses and hide under fallen tree litter, logs and dense ground cover.

9.2 Social Behaviour

The Southern Corroboree Frog's generally only come together during mating. However they are not a solitary species, living in close approximation to each other. The males will call out to attract females and scare off other males.

9.3 Reproductive Behaviour

The Southern Corroboree Frog is a seasonal breeder, the male will move into the breeding areas in early summer and will call during January and February attracting females by calling out to them, attracting her to the edge of his sphagnum bog so she can lay her eggs and he can fertilise them in amplexus. The males will then stay in the bog calling to other females so that he may continue to mate. He will then leave the bog in late February moving into winter habitat.

9.4 Bathing

Bathing has not been observed in Southern Corroboree Frog as it is a terrestrial frog species. Southern Corroboree Frog will use its fore legs to rub over its body to clean its self and remove dead skin cells.

9.5 Behavioural Problems

No captive behavioural problems have been noted in Southern Corroboree Frog.

9.6 Signs of Stress

No signs of stress have been noted in Southern Corroboree Frog.

9.7 Behavioural Enrichment

The adult exhibit tank was designed so that the Southern Corroboree Frog could burrow amongst the sphagnum moss, with the gap built into the exhibit between the front glass and the incline of the substrate emulating a sphagnum bog.

As the weather warms and the Southern Corroboree Frog starts to eat again pin head crickets which will be placed in the exhibit for the frogs to forage for of their own accord. For frog species Behavioural Enrichment is not very effective beyond innate behaviours.

9.8 Introductions and Removals

By introducing different females to the males we hope that it will stimulate a mating response, also by moving around the Southern Corroboree Frogs into different enclosures. Male scents stimulate other males to be dominating in their environment and to thus start breeding.

The Frogs metamorphosed in captivity or have lived in captivity for a number of years, having already been through a complete quarantine they can be introduced to each other, however the Frogs will be kept within their regions.

9.9 Intraspecific Compatibility

Putting two males together in an EAPA standard sized exhibit the males would not injure each other however they would call and one would be dominate over the other.

9.10 Interspecific Compatibility

The males Southern Corroboree Frogs will send out a threatening call to scare other males off from his sphagnum bog nest. He will then call out to the females, once she has laid her eggs and he has fertilized them he will stay and protect them till the end of February, and the weather conditions start to change. In the wild the Southern Corroboree Frog is the only species found within the region. The Northern Corroboree Frog is also an Alpine frog however there are ranges separating the two species, eliminating any cross breeding.

9.11 Suitability to Captivity

Southern Corroboree Frog is a new species to captivity and to exhibit. However by emulating its habitat in the wild through Gerry Marantelli's design of the refrigerated shipping container we are successfully able to display tadpoles and adult frogs. Due to the decline in wild Southern Corroboree Frogs it is hoped that between Amphibian Research Center, Tippenbella Nature Reserve, Healesville Sanctuary, and Melbourne and Taronga Zoo's, successfully breeding of these frogs in captivity will improve their chances in the wild.

10 Breeding

10.1 Mating System

The male Southern Corroboree Frog will sit in the Sphagnum moss bog where he will call females to him. Once she has decided on a mate he will grasp her in amplexus. She will lay her eggs into the nest while the male fertilises them, he will sit in the bog guarding the eggs until the first cold weather comes. He will call to other females and may have many partners lay their eggs in his bog.



Male caring for eggs in sphagnum moss.
Photo © David Hunter. Used with permission.

10.2 Ease of Breeding

In the wild the Southern Corroboree Frog tends to breed quite well. However in captivity there has been little success outside of Amphibian Research Center. It is easier at this time for the wild population to breed and then for us to raise the spawn in captivity.

10.3 Reproductive Condition

The female Southern Corroboree Frog like most frog species is slightly larger than the male. However in captivity due to the abundance of food that can be supplied to the frogs as opposed to them hunting for it on their own, males and females are of a more similar size. Following the captive diet, food will need to be increased during the summer months not only for reproduction but also for building fat for the winter months.

10.4 Techniques Used to Control Breeding

At this time we are still working out triggers of successful breeding of the Southern Corroboree Frog. However one of the triggers that we are working on includes temperature changes for changing seasons.

10.5 Occurrence of Hybrids

There are no known occurrences of hybrids. The Northern Corroboree Frog is the only other Alpine Frog, and is the only frog that is in close proximity to the Southern Corroboree Frog, however there are mountain ranges separating the two species.

10.6 Timing of Breeding

The Southern Corroboree Frog has a short breeding season because it lives in such cold environments. In the summer months males call from concealed sites in sphagnum bogs and mating occurs in depressions in the sphagnum moss. The females lay their eggs in nests that are hollowed out near the roots of sphagnum. The embryos develop inside the eggs and the tadpoles hatch out when the winter rains or the melting snow (in spring) flood the nest.

10.7 Age at First Breeding and Last Breeding

The minimum age at which females are suspected to first reproduce is 4-6 years.

10.8 Ability to Breed Every Year

The females will breed each year if she finds a male she deems a suitable partner.

10.9 Ability to Breed More than Once Per Year

The Southern Corroboree Frog male can fertilise a number of female's eggs. The female however will only spawn once. The average number of eggs deposited per adult female per year is 10-30 eggs per female per year.

10.10 Nesting, Hollow or Other Requirements

Moist Sphagnum bog is needed for Southern Corroboree Frog to nest in. Once the eggs have been fertilised and are starting to grow, the eggs can be moved onto a plastic basket with each egg individually sitting just in the water, receiving moisture and temperatures similar to that in the wild for continued growth.



Artificial Nesting site for the incubation of Southern Corroboree Frog
Photos © Michael McFadden. Used with Permission.

10.11 Breeding Diet

The dietary requirements and feeding schedule is in section 6.1, includes an increase of crickets for summer months which are the breeding months. It is intended that breeding of Southern Corroboree Frog happen as soon as possible and all husbandry is aimed at getting successful results. Purchased through Pisces Enterprises Live Food Supplies pin head crickets cost \$2.95 per 100 crickets. So if one frog is eating

30 crickets per week

x 52 weeks

= 1560 total number of crickets needed

÷ 100 crickets per container

= 15.6 containers of crickets

x\$ 2.95 per container of cricket

=\$46.02 total cost per year.

10.12 Incubation Period

The eggs, once fertilized by the male, will stay under the sphagnum mosses from late summer until the snows begin to melt. The eggs need approximately seven months under the snow to slowly grow within the jelly shell, until they emerge from the egg and move into the watery bogs where they will begin to metamorphose into juvenile frogs. As the eggs in the container are sitting on the surface of the tadpole tanks the eggs will stay situated in this manner as they grow, falling through the plastic mesh on hatching, into the tank water which emulates the watery bogs of the Snowy Mountains in which they would metamorphose.

10.13 Clutch Size

Each female may lay between 10-30 eggs.

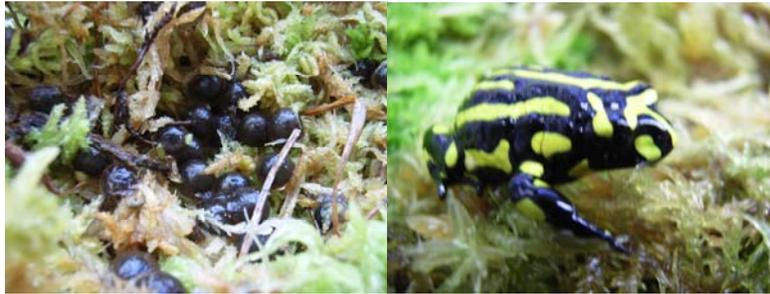
10.14 Age at Weaning

No weaning involved. They are a precocial species.

10.15 Age of Removal from Parents

The eggs can be taken from the laying site as soon as the male has moved into his winter habitat, generally once the temperatures start to drop.

10.16 Growth and Development



Egg's resting in nest site. Metamorphosed Southern Corroboree Frog
Photo's © Michael McFadden. Used with permission

11 Artificial Rearing

11.1 Incubator Type

The Southern Corroboree Frog eggs are placed in a small plastic cutlery drainer basket, separating each egg in the crisscross of the plastic basket. The plastic basket has two plastic tubes attached to it to aid in the floatation of the eggs while they are floating in the cold water of the tadpole tanks inside the container. They are then placed in the tadpole tank where they will float on top of water filtered through the Reverse Osmosis water and Alpine silt.



Captive Incubation site

Photo's © Michael McFadden. Used with permission.

11.2 Incubation Temperature and Humidity

The incubation temperature is maintained through the ambient temperature of the inside of the container. The temperatures vary depending on the season.

Container Air Temperature Control

- Winter (June to August), the container will be maintained between 2°C and 5°C.
- Spring (September to November) the temperature will be set at 14°C.
- Summer (December to February) the temperature will be set at 18°C
- Autumn (March to May) temperature will be set at 14°C.

With the humidity at 100%, as the Southern Corroboree Frog eggs are continuously touching water.

11.3 Desired % Egg Mass Loss

This is currently unknown; however there are thoughts that they may gain weight as the tadpole grows within the egg and absorbs water, hydrating the egg. (*Pers. Obs. M. McFadden Taronga Zoo*)

11.4 Hatching Temperature and Humidity

This is the same as the incubation temperatures and humidity. As the Southern Corroboree Frog is an Alpine frog and the eggs being laid in sphagnum moss just before the snow starts to fall.

Container Air Temperature Control

- Winter (June to August), the container will be maintained between 2°C and 5°C.
- Spring (September to November) the temperature will be set at 14°C.
- Summer (December to February) the temperature will be set at 18°C
- Autumn (March to May) temperature will be set at 14°C.

(McFadden & Harlow 2006 Unpublished)

The tadpole will hatch from its egg and will drop through the plastic into the water, where it will live until it metamorphoses, at which time the metamorphosing tadpole is moved into pet packs with a substrate of Sphagnum moss, and placed in the holding banks at the back of the container.

11.5 Normal Pip to Hatch Interval

This can be immediate but may take up to 2 days. There are two membranes that the tadpole has to get through to emerge out of the egg.

11.6 Diet and Feeding Routine

Tadpoles will be fed throughout all seasons until metamorphosis. Frozen endive or lettuce will be offered every two to three days, or as needed. Tadpoles will also be offered a range of good quality vegetable-based fish flakes with a high algal content. e.g. Sera brand. (McFadden and Harlow unpublished 2006)

11.7 Specific Requirements

For Southern Corroboree Frog tadpole's specific requirements are low temperatures, water, substrate such as silt in the bottom of the tadpole tank for growing natural algae as a food source for the tadpoles to eat.

However when metamorphosing, the juvenile frogs need access to land and a watery bog area. This is achieved by drilling holes into one end of the pet pack for drainage, the other end is padded in Alpine sphagnum moss which is kept damp and is sprayed each day with filtered water which then breaks up all fecal matter washing it away.

11.8 Data Recording

Data on the Southern Corroboree Frog is kept in a daily diary format. The diary is kept in the container and has all information recorded daily.

Records are kept on all happenings,

- Daily Feeding
- The look and health of the eggs, tadpoles, and frogs
- Container and water temperatures
- Deaths and births
- Metamorphosing of tadpoles to frogs.

Data is also kept on the weights and lengths of all age frogs. These are taken monthly to avoid stressing the frogs.

11.9 Identification Methods

The tadpoles are not given arks numbers until the have metamorphosed. Digital photos are taken of dorsal and ventral markings and are kept as a group in the tadpole tank depending on the region the eggs came from. They are also kept in numbered pet packs for easy and distant identification.

11.10 Hygiene

There are four 250 L glass tadpole aquariums in the container, each with a substrate of silt collected from Alpine sphagnum bogs.

Tadpoles go through a 10% water change daily, ensuring that the water remains clean.

An Automated sprayer system connected to a reverse osmosis water reservoir is programmed to deliver a 10% water change each day. Gloves must be worn inside the container and are required to be changed between working with each unit, **AND** any equipment within the container. The Corroboree Frog Holding Facility is a high level quarantine area, accessible only to a small number of trained Herpetofauna Division staff. The quarantine procedures currently in place include;

- The container is tended to first thing in the morning, before working with any other species.
- Before entering the container, staff wash their hands thoroughly.
- Upon opening the container door, work boots are removed and left outside, and quarantine gumboots (which are kept just inside the door) are put on.
- A surgery gown (hanging just inside the door) is put on.
- Disposable gloves are worn when working within the container, and changed regularly as required (see Barrier Nursing below).
- The adult frogs are always tended first (they have been in quarantine for a minimum of three years), followed by the three different spawn/tadpole populations (collected from the wild in Feb. 2006).

As stated before these are the quarantine procedures currently used at Taronga Zoo. Strict quarantine is in place as we wish to totally eliminate the risk of the Southern Corroboree Frogs catching pathogens in captivity and to quarantine them from other groups of frogs within the container that may jeopardize their health or potential for re-introduction.

Chemicals have not been used inside the container since before the arrival of the frogs and will not be used within the container at any time there are frog's insitu.

11.11 Behavioural Considerations

Behavioural considerations for tadpoles are that they need to have food available at all times.

Placing silt in the bottom of the tadpole tank encourages algae to grow giving the tadpole's important nutrition to their diet. It also gives them something to hide in amongst.

For the frogs they need to have access to land and water for natural behaviours, such as swimming, burrowing and foraging for live food.

11.12 Weaning

There are no weaning of Southern Corroboree Frog, however when metamorphosing the tadpoles will not eat for up to a week as they get their nutrition from the reabsorption of their tails.

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To Every One everywhere aiding in the conservation of Southern and Northern Corroboree Frogs. *Pseudophryne corroboree* and *Pseudophryne pengilleyi*.

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Glossary

Ambient Temperature the temperature of the immediate surroundings or the environment of a captive animal.

Amplexus the sexual embrace of male amphibians upon female amphibians, one such is the male grasping the female around her waist just above the back legs, amplexus may last a few hours to several weeks. In this position he is able to fertilise her eggs. Fertilisation is done outside the body. The female will deposit her eggs and at the same time the male will expel sperm onto the eggs.

Brumation A condition of torpor during extended periods of low temperatures; a state of inactivity during which the metabolic processes are greatly reduced but without actual hibernation.

Captive Breeding the breeding or rearing of one or more species under controlled conditions.

Clutch Collective noun for a full complement of eggs laid by a single female at one time.

Dorsal Relating to the upper surfaces; the back or spinal part of the body.

Fossorial Burrowing; describing species that live largely below the soil or beneath ground vegetation, or their skeletons and limbs which are adapted for digging or burrowing.

Habitat The particular region, characterized by certain features such as vegetation, climate and topography, where an animal or plant lives.

Longitudinal Of, or relating to, length; located or running along the length.

Metamorphosis The rapid transformation occurring in an amphibian when the larva takes on the physical appearance of the adult. In anurans the most obvious sign is loss of tail and rapid growth of the legs.

Metatarsal Tubercle A prominent knob like projection present on the hind foot of many anurans and used by certain species as a spade for digging.

Montane Of, relating to, or inhabiting, mountains or mountainous regions.

Myobatrachidae Family of the Anura, inhabiting Australia. 106 species in 20 genera.

New World The Americas

Quarantine A period, or place, of isolation for newly acquired specimens in order to prevent the spread of disease or parasites.

Seasonal Breeder An amphibian species that, in captivity, will only breed during a particular time of the year, as opposed to other species that may breed at any time.

Tadpole The larva of an anuran. A tadpole is characterized by a rudder-like, finned tail and, in the early days, external gills, on an egg shaped body.

Vent The hind opening located on the undersurface of the body at the beginning of the tail; the external entrance/ exit of the cloaca.

Vocalisation Vocal intercourse within, and between species, the most well known examples being the noisy breeding calls of frogs.

(Wareham, D.C. 1993)

14 Appendix

Cricket

Pisces Enterprises Pty Ltd

PO Box 200

Kenmore QLD 4069

AUSTRALIA

1800 351 839

info@piscesenterprises.com

www.piscesenterprises.com

Latex Gloves

Elite Business Supplies

PO Box 478

Granville NSW 2142

1300 661 541

www.elitebusinesssupplies.com.au

Shipping Container

ACR Australia Shipping Containers

PO Box 694

Modbury SA 5092

08 8289 9333

www.containers.arcaustralia.com

Sera VipaChips

The Reef Shop

PO Box 249

Deer Park VIC 3023

0424041923

www.reefshop.com.au

Reverse Osmosis Filters etc.

The Reef Shop

PO Box 249

Deer Park VIC 3023

0424041923

www.reefshop.com.au

1. Introduction

Pseudophryne corroboree

Taxonomy	
Kingdom	ANIMALIA
Phylum	CHORDATA
Class	AMPHIBIA
Order	ANURA
Family	MYOBATRACHIDAE
Common Name/s	CORROBOREE FROG (E)
Species Authority	Moore, 1953
Assessment Information	
Red List Category & Criteria	CR A2ace+3ce; B2ab(ii,iii,iv,v); C1 ver 3.1 (2001)
Year Assessed	2004
Assessor/s	Gillespie, G., Robertson, P. & Lemckert, F.
Evaluator/s	Stuart, S., Chanson, J. & Cox, N. (Global Amphibian Assessment Coordinating Team)
Justification	Listed as Critically Endangered because of an observed drastic population decline estimated to be more than 80% over the last ten years, and a projected decline of more than 80% over the next ten years, perhaps due to chytridiomycosis; and because its area of occupancy is less than 10 km ² , its distribution is severely fragmented, and there is continuing decline in its area of occupancy, in the extent and quality of its habitat, in the number of subpopulations and in the number of mature individuals; and because its population size is estimated to number fewer than 250 mature individuals and there is an expected continuing decline of at least 25% within three years or one generation.
History	1994 - Vulnerable (Groombridge 1994) 1996 - Endangered (Baillie and Groombridge 1996) 2001 - Critically Endangered (IUCN 2002)
Summary Documentation	
System	Terrestrial; Freshwater
Major Habitat/s (terms)	1.4 Forest - Temperate 3.7 Shrubland - Subtropical/Tropical High Altitude 4.7 Grassland - Subtropical/Tropical High Altitude

<p>Major Threat/s (terms)</p>	<p>5.4 Wetland - Bogs, Marshes, Swamps, Fens, Peatlands 5.10 Wetland - Tundra Wetlands</p> <p>1.4.3 Habitat Loss/Degradation - Infrastructure development - Tourism/recreation (ongoing)</p> <p>1.5 Habitat Loss/Degradation - Invasive alien species (present, future)</p> <p>6.1.1 Pollution (affecting habitat and/or species) - Atmospheric pollution - Global warming/oceanic warming (ongoing)</p> <p>6.1.3 Pollution (affecting habitat and/or species) - Atmospheric pollution - Ozone hole effects (ongoing)</p> <p>7.4 Natural disasters - Wildfire (ongoing)</p> <p>8.5 Changes in native species dynamics - Pathogens/parasites (ongoing)</p> <p>12 Unknown (past, present)</p>
<p>Population Trend (terms)</p> <p>Conservation Action/s (terms)</p>	<p>1.1.1 Policy-based actions - Management plans - Development (in place)</p> <p>1.1.2 Policy-based actions - Management plans - Implementation (in place)</p> <p>1.2.1.2 Policy-based actions - Legislation - Development - National level (in place)</p> <p>1.2.1.3 Policy-based actions - Legislation - Development - Sub-national level (in place)</p> <p>1.2.2.2 Policy-based actions - Legislation - Implementation - National level (in place)</p> <p>1.2.2.3 Policy-based actions - Legislation - Implementation - Sub-national level (in place)</p> <p>1.3.1 Policy-based actions - Community management - Governance (in place)</p> <p>1.3.2 Policy-based actions - Community management - Resource stewardship (in place)</p> <p>2.2 Communication and Education - Awareness (in place)</p> <p>3.2 Research actions - Population numbers and range (in place)</p> <p>3.3 Research actions - Biology and Ecology (in place, needed)</p> <p>3.4 Research actions - Habitat status (in place)</p> <p>3.5 Research actions - Threats (needed)</p> <p>3.8 Research actions - Conservation measures (needed)</p> <p>3.9 Research actions - Trends/Monitoring (in place)</p> <p>4.1 Habitat and site-based actions - Maintenance/Conservation (in place)</p> <p>4.4.1 Habitat and site-based actions - Protected areas - Identification of new protected areas (in place)</p>

- 4.4.2 Habitat and site-based actions - Protected areas - Establishment (in place)
- 4.4.3 Habitat and site-based actions - Protected areas - Management (in place)
- 4.4.4 Habitat and site-based actions - Protected areas - Expansion (in place)
- 5.1 Species-based actions - Re-introductions (in place, needed)
- 5.4 Species-based actions - Recovery management (in place)
- 5.5 Species-based actions - Disease, pathogen, parasite management (in place, needed)
- 5.7.1 Species-based actions - Ex situ conservation actions - Captive breeding/Artificial propagation (in place)

Citation: Gillespie, G., Robertson, P. & Lemckert, F. 2004. *Pseudophryne corroboree*. In: IUCN 2006. 2006 IUCN Red List of Threatened Species. <www.iucnredlist.org>. Downloaded on 28 September 2006

5.2 Record Keeping

CODES FOR USE WITH DAILY REPORT SHEETS

(Initially based on those used at Taronga Zoo, adapted to include foreign zoos such as Jersey, and broadened to include Wildlife Sanctuaries and Rescue Centers)

- ACQ** = **ACQUISITION** Any importation from outside the collection, public donation, or capture from grounds or from the wild.
- B/H** = **BIRTH/HATCHING BIRDS**: generally recorded as hatch date. If date of leaving the nest is used it must be noted as such under Information column.
MARSUPIALS: The date on which the animal is 'permanently out of the pouch', or the day a juvenile is thrown from the pouch.
PLACENTALS: The day on which they are born.
- D/30** = **DEATH WITHIN 30 DAYS** Death/euthanasia within 30 days of birth, hatching or acquisition
- D/E** = **DEATH, ESTABLISHED** Death/euthanasia of any animal which has been resident in the collection for longer than 30 days
- DIS** = **DISPOSITION** Includes exports from the collection, releases, sales, escapes.
- BRD** = **BREEDING** Reproductive details/ observations. Any nesting, laying of eggs, estrus, menstruations, mating, courtship, pouch checks, sexing of previously unsexed individuals or any other reproductive matter
- INT** = **INTERNAL MOVEMENT/ TRANSFER** any movement of an animal from its residing enclosure, be it within a section or to a different section. Transfers/exports out of the collection NOT included.
- TAG** = **TAGGING** Animal identification by banding, tagging, notching, tattooing, naming or any other method of identification.
- W/L** = **WEIGHT/LENGTH** Weight or length measurements
- Rx/ Tx** = **TREATMENT** Any medical treatment administered to animals, either by Vets, or continuing treatments administered by animal care staff. Include observations of anything related to treatment. Flag if veterinary examination is required. Use VET code.
- VET** = **VET EXAMINATION REQUIRED** Note if veterinary treatment/examination is required
- OTH** = **OTHER** Any notable observation made in reference to daily routine or animals, e.g. behaviour, change to routine etc Also anything else of interest e.g. animal management procedures, diet change, maintenance etc.

Crickets are purchased through Pisces Live Food Supplies pin head crickets cost \$2.95 per 100 crickets. So if one frog is eating

$$\begin{aligned} & 30 \text{ crickets per week} \\ & \times 52 \text{ weeks} \\ & = 1560 \text{ total number of crickets needed} \\ & \div 100 \text{ crickets per container} \\ & = 15.6 \text{ containers of crickets} \\ & \times \$ 2.95 \text{ per container of cricket} \\ & = \$46.02 \text{ total cost per year.} \end{aligned}$$

From: David.Hunter@environment.nsw.gov.au
Sent: Wednesday, 18 April 2007 9:59 AM
To: Richards, Natacha
Subject: Re: Southern Corroboree Frog

That's fine with me,

Regards, Dave.

David Hunter
Threatened Species Officer
Environment Protection & Regulation Division
Department of Environment & Conservation (NSW)
PO Box 472 Tumut NSW 2720
Ph (02) 6947 7078 Fax (02) 6947 4170

From: Richards, Natacha
Sent: Monday, 16 April 2007 3:14 PM
To: 'David.Hunter@environment.nsw.gov.au'
Subject: Southern Corroboree Frog

Dear Mr. Hunter,

My name is Natacha and I am a Keeper at Taronga Zoo.
I am currently writing my Husbandry Manual for Captive Animal Management Cert II on the Southern Corroboree Frog.
And I was wondering if I could use a couple of your photos for my manual. I have attached the photos that I wish to use.
Although my HM has been written for TAFE I believe that it will be kept at Taronga with no other reproduction allowed.



David Hunter
Photos For HM.doc..

Thank you for your time.

Regards,
Natacha

Natacha Richards
Life Science Events Staff Coordinator
Australia Fauna Precinct
Taronga Zoo
AUSTRALIA
Phone: + 61 02 99784670
Fax: + 61 02 99784508
Email: natacha.richards@zoo.nsw

From: Evans, Murray [Murray.Evans@act.gov.au]

Sent: Monday, 23 April 2007 9:20 AM

To: Richards, Natacha

Subject: RE:

Hi Natacha,

No problems adding the manual to your bibliography. Any chance we could get a copy (electronic) of your Cert III manual when finished?

cheers,

Murray

-----Original Message-----

From: Richards, Natacha [mailto:natacha.richards@zoo.nsw.gov.au]

Sent: Monday, 16 April 2007 3:24 PM

To: Evans, Murray

Subject:

Dear Mr. Evans,

My name is Natacha and I am a keeper at Taronga Zoo.

I am currently doing my Husbandry Manual For Captive Animal Management Cert III at TAFE on the Southern Corroboree Frog and I was given your Water Procedures Manual to read. I have not used quotes from this manual, but have read it as I understand that it was not for general reading I would like your permission to still add your document into my bibliography.

This would be greatly appreciated.

And I thank you for your time.

Regards,

Natacha

Natacha Richards

Life Science Events Staff Coordinator

Australia Fauna Precinct

Taronga Zoo

AUSTRALIA

Phone: + 61 02 99784670

Fax: + 61 02 99784508

Email: natacha.richards@zoo.nsw.gov.au

CALENDAR for SOUTHERN CORROBOREE FROG 2007

Jan	Feb	March	April	May	June	July	August	Sept	Oct	Nov	Dec
	Refridgeration service						Refridgeration Service				
Change UVB2.0 ReptiSun lights			Change UVB2.0 ReptiSun lights			Change UVB2.0 ReptiSun lights		Change UVB2.0 ReptiSun lights			Change UVB2.0 ReptiSun lights
Wash through R/O Filters			Wash through R/O Filters			Wash through R/O Filters		Wash through R/O Filters			Wash through R/O Filters
		Replace R/O filters				Replace R/O filters		Replace R/O filters			Replace R/O filters
			Water Testing Sent Off- Labs						Water Testing Sent Off- Labs		
Inhouse Ph Testing of water fortnightly, unless tadpoles are in tanks, testing done weekly											
					Faecals						Faecals

Replace R/O filters

CONTAINER REQUIREMENT 45

Gymnophiones or Caecilians are measured by total length (TL).

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

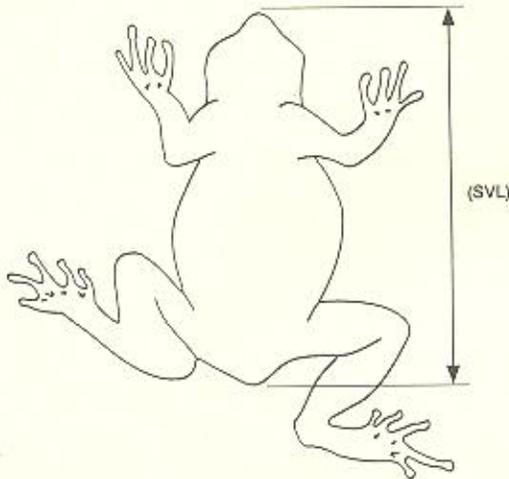
Applicable to Amphibians

See *USG Exceptions in Chapter 2*.

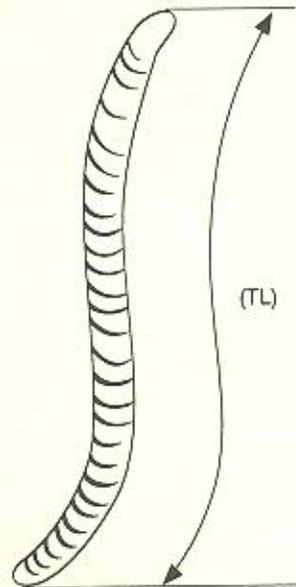
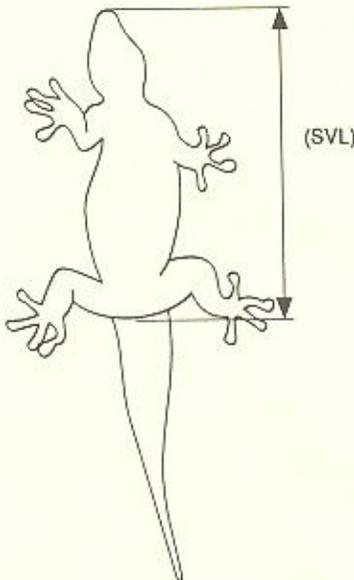
The following instructions must be complied with in addition to the principles laid down in the General Container Requirements for Reptiles and Amphibians.

Measurement

Frogs and toads should be measured by snout-to-vent length (SVL).



Tailed amphibians (salamanders, newts, etc.) should be measured by snout-to-vent length (SVL).



Specific Requirements

Damp Packing for Amphibians

All amphibians require moist substrate to maintain species specific humidity during the whole time of transport. Due to their sensitive skins no burlap (hessian) or other abrasive materials are allowed.

The maximum number of animals per bag or container can not be enlarged even when larger bags or containers are used.

Packing Density for Frogs and Toads in Moistened Cloth Bags

The bags should never be packed suspended, but rather should be packed laying flat.

Snout-vent-length (SVL)	Maximum no. of animals per bag	Minimum bag size
> 15 cm (6 in)	1	30 × 45 cm (12 × 18 in) bag
> 12.5–15 cm (5–6 in)	6	30 × 45 cm (12 × 18 in) bag
> 5–12.5 cm (2–5 in)	25	30 × 45 cm (12 × 18 in) bag
> 3.75–5 cm (1.5–2 in)	50	30 × 45 cm (12 × 18 in) bag
≤ 3.75 cm (1.5 in)	100	30 × 45 cm (12 × 18 in) bag