

Husbandry Guidelines for Tawny Frogmouth

Podargus strigoides

(Aves: Podargidae)



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DISCLAIMER

The following document contains guidelines, for the care of Tawny Frogmouths (*Podargus strigoides*) in captivity based on scientific research of wild animals and experience of captive husbandry. The author of the following guidelines and cannot be, and are not, legally, financially or in any other way, responsible for the application of techniques described within this document. When undertaking any procedures or techniques outlined in this document, it is up to individual workers to assess the unique circumstances of their situation, apply common sense, and subsequently apply any procedures or techniques at their own risk. In all cases, the reader of this document are cautioned not to use this handbook as an exact step-by-step guide, but rather as a starting reference point for further work.

OCCUPATIONAL HEALTH AND SAFETY RISKS

In captivity the Tawny Frogmouth is generally a very placid bird and can be categorised as Low Risk\Innocuous. However in certain circumstances they may become unafraid of humans and even aggressive at feeding times, swooping at and attempting to bite a keepers head. The beak of a Tawny Frogmouth is broad and has quite a powerful bite. Furthermore the tip of the beak curves down to a sharp point which could break the skin if one is bitten. The greatest danger would be if an aggressive bird were to attack the face of a keeper. This could result in eye damage however it is very rare for a Tawny Frogmouth to display such extreme aggressive behaviour.

Many Tawny Frogmouths in captivity require hand feeding. This is due to the fact that Tawny Frogmouths in the wild often use their camouflage and sit still waiting for food to come to them. However in some instances they can be seen hunting flying insects that have been attracted by artificial light sources. The necessity of hand feeding can present risks to the feeder especially if the bird displays aggressive behaviour. Precautions can be taken such as the wearing of leather gloves to prevent a miss directed bite from injuring the keeper. For more aggressive Tawny Frogmouth individuals which fly at the keeper, conditioning can be employed. Such techniques can be as simple as gently picking up the bird off the ground after it has swooped and placing it back on the perch before feeding. In this way after a short period of time the bird will learn that feeding will only take place when it is sitting on its perch.

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1 INTRODUCTION

1.1 ASMP CATEGORY

Not part of any regional management program.

1.2 IUCN CATEGORY

LC (Least Concern).

1.3 EA CATEGORY

The Tawny Frogmouth is not classified as a threatened species. Furthermore in Australia there are currently no standards for the exhibition of *Caprimulgiformes* (*nightjars*).

1.4 NZ AND PNG CATEGORIES AND LEGISLATION

1.5 WILD POPULATION MANAGEMENT

There are no management strategies for wild populations for the tawny Frogmouth as these birds are very common and widespread across all of Australia.

1.6 SPECIES COORDINATOR

According to the 2008 ASMP there is no species coordinator for the Tawny Frogmouth.

1.7 STUDBOOK HOLDER

Mark Myers, mark.myers@zoo.org.

2 TAXONOMY

2.1 NOMENCLATURE

Class: *Aves*

Order: *Caprimulgiformes*

Family: *Podargidae*

Genus: *Podargus*

Species: *strigoides*

2.2 SUBSPECIES

Podargus strigoides brachypterus

Podargus strigoides phalaenoides

Podargus strigoides strigoides

(<http://www.itis.gov/servlet/SingleRpt/>)

2.3 RECENT SYNONYMS

Spanish: Podargo australiano

Italian: Podargo strigoide

2.4 OTHER COMMON NAMES

The most frequently used common name for *Podargus strigoides* other than Tawny Frogmouth is *Mopoke*, which it shares with the Boobook Owl (*Ninox novaeseelandiae*).

Other names include: *Freckled Frogmouth, Moreport, Night Hawk and Short Winged Podargus.*

3 NATURAL HISTORY

Podargus strigoides was first classified in 1801 by an ornithologist named John Latham. These birds are often mistaken for an owl because they both are nocturnal, eat insects, have large eyes and soft feathers for silent flight as well as and they have bristles or "whiskers" around their bills. However *Podargus strigoides* are in fact a Frogmouth. Frogmouths are the largest of the Nightjar family. The Tawny Frogmouth differs from owls in several ways; Tawny Frogmouth's do not possess strong legs and powerful talons like an owl and instead, prefer to catch their prey with their beak. Owls will eat animals and birds up to their own size and sometimes larger, while frogmouths are almost exclusively insectivorous. The eyes on an Owl face fully forward whilst frogmouths' eyes face mostly to the side. Owls have either a full or partial facial disk, while frogmouths do not. Owls have large asymmetrical ears, while frogmouths do not and owls have twelve tail feathers whilst frogmouths have ten.



Figure 3.1: This photo taken by Stephen Snow in 2001 is a perfect representation of the camouflage, provided by a Tawny Frogmouth's plumage.

Tawny Frogmouths are noted for their outstanding camouflage (*Fig 3.1*), which helps protect them from predators during the day. When roosting during daylight hours a Tawny Frogmouth will stretch itself out amongst the branches and remain motionless, appearing to blend in with its surroundings. A Tawny Frogmouth prefers to hunt by remaining motionless in a tree and observing ground dwelling insects and rodents. When they see an insect or small rodent, they pounce on it from above and attack using their beak. Tawny Frogmouths are also known in some cases to actively hunt large moths and other flying insects which have been attracted by artificial light sources in suburban areas. They catch these insects in their beaks mid-flight. The beak and mouth of a Tawny Frogmouth is significantly different to those of owls in that they are much larger relative

to the size of the bird's head. Frogmouths have wide gapes, revealing a deep yellow mouth and throat and is similar in appearance to that of a frog, hence the name 'frogmouth'.

Several studies have been performed on the nesting behaviour as well as the development of juvenile Tawny Frogmouths. One such study was conducted by Körtner and Geiser (1999). Their study found that during nesting, only the male attended the nest and incubated the eggs in the day. By night, both male and female would remain on the nest. The males would only leave briefly for a few hours each night to feed before returning to the nest. Once the eggs had hatched, the males and females alternated roles periodically, taking it in turns to hunt from nearby trees. Incubation lasted between 28 and 30 days and the mass of new hatchlings was approximately 19 g. The young gained on average 8.3 g per day and mass increased in a linear fashion until fledging. Körtner and Geiser (1999) observed that fledging occurred simultaneously for siblings between 26 and 30 days after hatching. At the point of fledging the chicks had a mass of about 250 g. In some cases the younger sibling roosted on the ground for several days, because it could not fly strongly.

Although the Tawny Frogmouth is a common species, (even in many urban and built up areas) it has been studied very little, either in the wild or captivity. Most captive studies are centred around feeding methods and rehabilitation of injured birds. In captivity further research would be greatly desirable to determine a method of replicating a more natural environment. In most captive situations Tawny Frogmouths require hand feeding. Living this inactive lifestyle can lead to weight gain if their food intake is not monitored correctly. However despite an apparent dependence on carers in captivity, radio-tracking studies have shown that they feed themselves again once released.

3.1 MORPHOMETRICS

3.1.1 MASS AND BASIC BODY MEASUREMENTS

Tawny Frogmouths display significant variation in size and weight characteristics depending on subspecies and geographic location. Generally speaking, *Podargus s. strigoides* can display up to 200% greater weight and 40% greater wingspan than its smaller, northern counterpart. On average male weights range from 440 grams to 600 grams, and females from 300 grams to 555 grams (Kaplan 2007).

Wingspan: Males – up to 570 mm

Females – up to 520 mm

Beak Length: Males – 60 - 65 mm

Females – 58 – 62 mm

Head to Tail Body Length: 435 – 515 mm

3.1.2 SEXUAL DIMORPHISM

Podargus strigoides males and females share almost identical plumage. However, slight colour variations between males and females in the subspecies *P. s. strigoides* have been noted where males are almost always grey and females may have a slight chestnut colour. Sexual differences can also be distinguished by examining the shape of their beaks. The beak of a male is often flatter, more exposed and triangular in shape than that of a female. As well as this, significant size and weight differences exist between the sexes. These can be very differences are difficult to distinguish when there aren't two birds of opposite sex, sitting together for comparison and even then, one would have to get close enough to the birds to examine them in more detail. Furthermore these dimorphic characteristics cannot be relied upon in all cases to determine the sex of individuals. Therefore I would consider Tawny Frogmouths to be monomorphic.

3.1.3 DISTINGUISHING FEATURES

- There are no outstanding markings and Tawny Frogmouths are softly mottled grey and brown above, often with more brown on the shoulders and wing-coverts. The wing quills are dark brown with white spots and are only visible when the wings are spread. The tail is grey with dark grey to brown bars. Underparts are grey with darker streaks. The bill (*Fig 3.2*) is broad and hooked and in some cases can be almost hidden by long facial bristles. An alternate plumage phase can occur where the grey parts are replaced by red-brown colours.

- The eye of a Tawny Frogmouth (As seen in the Fig 3.2) is yellow as is the inside of the mouth and throat. However across some of the subspecies the eye colour can vary from a pale yellow to a deep orange.
- Tawny Frogmouths in the northern parts of Australia are often smaller than their counterparts in south eastern regions.
- Australia is home to two other species of Frogmouth. These are the Papuan Frogmouth, *P. papuensis*, which is confined to the Cape York Peninsula and is larger, with an orange-red eye. The other species is the Marbled Frogmouth, *P. ocellatus*, which is similar in size to the Tawny Frogmouth, however is only found in the rainforests of far north Queensland and on the Queensland-New South Wales border. The Marbled Frogmouth has an orange-yellow eye both the Marbled and Papuan Frogmouths are found in New Guinea.



Figure 3.2: Profile view of Tawny Frogmouth' head and beak (image modified from Kaplan 2007, pg 91).

3.2 DISTRIBUTION AND HABITAT

Podargus strigoides prefers to live in wooded areas that contain clearings. They can however be found at the fringes of wet tropical forests, and occasionally in trees in urban areas, parks and even gardens. Tawny Frogmouths however avoid dense rainforests which can inhibit their hunting ability and treeless deserts. During the day they roost in trees using their colouring and body shape to camouflage themselves against the branches.

Podargus strigoides is widespread and can be found throughout almost all of the Australian mainland and Tasmania as seen in *Figure 3.3*. As well as this, they have been recorded on several Australian off shore islands.



Figure 3.3: Distribution of the Tawny Frogmouth (<http://www.birdsinbackyards.net>).

3.3 CONSERVATION STATUS

Podargus strigoides is classified by the IUCN as LC (Least Concern) due to the large, wild population and widespread distribution throughout Australia. However the widespread use of insecticides and rodent poisons pose a significant risk to the Tawny Frogmouth. Often the poison that is used to kill these perceived pests can still be present when they are consumed by a Tawny Frogmouths. This frequently results in the death of the bird as a result of the toxins in the rodents or insects. Furthermore Tawny Frogmouths are slow to return to flight after landing on the ground or perching. This combined with their preferred method of hunting ground dwelling prey, makes them vulnerable to attack from introduced predators such as foxes and cats. As well as this, the insects which are often attracted by street lamps and car headlights have a tendency to attract Tawny Frogmouths as well, resulting in the injury and often death of birds from the collision.

3.4 LONGEVITY

3.4.1 IN THE WILD

There have been very few detailed studies on the longevity of *Podargus strigoides* in the wild. Banding records from birds which have been recaptured for study have found that maximum ages ranged from 12 to 14 years. This is an exceptional achievement considering only about 30% of Tawny Frogmouth offspring ever survive their first year and reach adulthood. However these ages are determined from the date at which the bird was banded and not from hatching (Kaplan 2007).

3.4.2 IN CAPTIVITY

The lifespan of birds in captivity can vary considerably depending on captive conditions and feeding regimes. As a result, maximum life spans for certain species in a captive situation can be either significantly less or significantly greater than those expected in wild birds. Captive statistics on the longevity of the Tawny Frogmouth are quite rare, but those that do exist point to maximum ages ranging from 10 to 13 years.

3.4.3 TECHNIQUES USED TO DETERMINE AGE IN ADULTS

The most readily used technique for determining the age of Tawny Frogmouth specimens is through banding when they are young. This allows a record of their age to be easily accessible to any who capture the bird. This method however is very limited and only allows the age of banded birds to be determined.

4 HOUSING REQUIREMENTS

4.1 EXHIBIT/ENCLOSURE DESIGN

Although Tawny Frogmouths are a nightjar, it is recommended that they be treated as a raptor because of their physiological and behavioural similarities to many owls. Housing requirements for Tawny Frogmouths are not discussed in the Exhibited Animals Protection Act, however this does not entail that there are no standards when keeping these birds. Therefore it would be most wise, when constructing an exhibit for a Tawny Frogmouth, to consider the standards for a bird of similar lifestyle and size, such as the Barn Owl (*Tyto alba*). Both are nocturnal and have a similar method of hunting for their prey. However the Tawny Frogmouth is not as active as the Barn Owl which has often resulted in significantly smaller enclosures being constructed.

What many fail to take into consideration is that even though Tawny Frogmouths seem almost permanently still during the day, at night they will fly around their enclosure, searching for a high roost from which to hunt. This aspect of their behaviour needs to be considered when designing an enclosure for a Tawny Frogmouth. Roosting sights need to be constructed out of branches of suitable width (minimum of 10 centimetres) and should have sufficient bark remaining to allow the bird's to grip easily. Unlike other nightjars and raptors, Tawny Frogmouths do not need a pond from which to drink and bathe. All their bodily water requirements are extracted from their food. However it is still advisable to have an area of the enclosure that allows the birds to access the rain.

If the Tawny Frogmouth is being housed in a nocturnal house then it is important to ensure that the lighting system allows for a correct day night cycle for these birds. Otherwise, serious behavioural problems can occur as a result of being in permanent darkness. Furthermore if being housed indoors on a permanent basis, it is important to ensure that there is a system in place where the Tawny Frogmouths can have access to simulated rain for the purpose of bathing. This can exist in many forms, the simplest of which is a hose with a misting ability.

4.2 HOLDING AREA DESIGN

Tawny Frogmouths are quite passive birds and do not need a sophisticated holding area. For temporary relocation during events such as renovations, a large cage in which there is enough space for the bird to fully extend its wings in all directions would suffice. For longer term holding, a larger cage would be needed and should allow for strait line flight of at least two metres and sufficient height (at least two metres) to allow the bird to mimic its natural, night time hunting behaviour. These holding enclosures should have sufficient perch space at varying heights, positioned in a way that does not hinder movement.

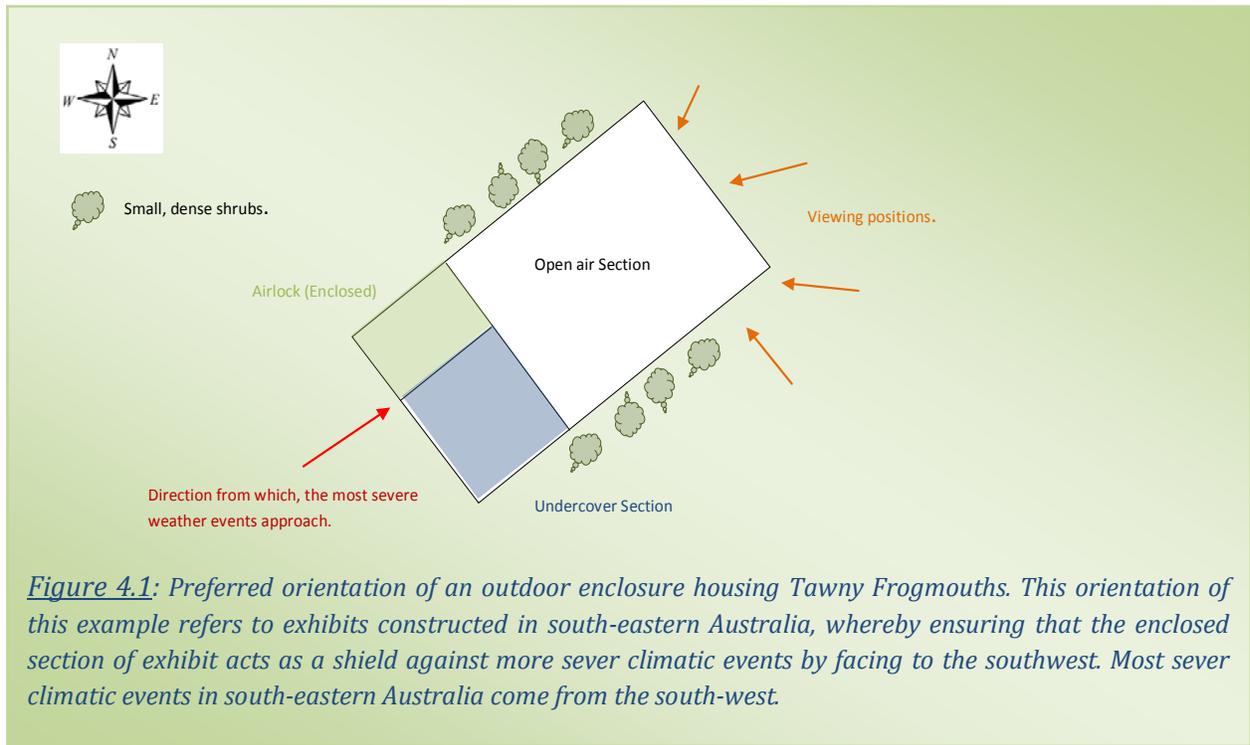
4.3 SPATIAL REQUIREMENTS

There are no listed spatial requirements for the order *Caprimulgiformes* of any kind under the Exhibited Animals Protection Act. Therefore it is recommended that the standards for the Barn Owl be followed as a proxy as both animals are similar in size and habits.

The recommended dimensions for an enclosure which is to house a Tawny Frogmouth should have a width and height of at least 3 metres with a length of no less than 6 metres. This will allow for a sufficient amount of flight space when the birds in the enclosure are active at night.

4.4 POSITION OF ENCLOSURES

If one is constructing an outdoor exhibit for a Tawny Frogmouth, the position and aspect are not of vital importance to the wellbeing of the bird. Being nocturnal these birds do not require a great deal of exposure to sunlight and they have an outstanding ability to withstand climatic events such as rain and wind. However to provide a greater degree of comfort to these birds, it is recommended that enclosures be positioned in the manner show in *Figure 4.1*.



Tawny Frogmouths do not have to be housed outdoors. It is possible to house them in a nocturnal house where they may be viewed during their active nocturnal state. In this case, the enclosure would need to be completely indoors where the day night cycle can be controlled through the use of artificial lighting, thus ensuring the maintenance of a true cycle.

4.5 WEATHER PROTECTION

Weather protection in the form of a small sheltered area should be provided with adequate perch space for the birds being housed. This can take the form of an undercover area that is sufficiently enclosed to provide shelter from wind and rain. However in many cases a Tawny Frogmouth may choose not to use such shelter, preferring instead to remain in its favourite roosting perch. Even during some of the more severe weather events, Tawny Frogmouths will remain completely exposed to the elements, being affected little by such conditions. These birds are able to achieve this by having a thick layer in insulating feathers which are capable of protecting them from some of the most extreme weather and climatic conditions in Australia by being water proof as well as insulating. This waterproofing is achieved by a type of feather that sheds a fine waxy powder. The

powder consists of small granules of keratin which are shed by powder-down feathers (*Kaplan 2007*).

A more effective method of protecting an enclosure from severe climatic events whilst adding a natural appearance, would be to position trees that only grow to a few metres high and have thick, evergreen foliage, around the flanks exhibit as shown in *Figure 4.1*. These would primarily be to protect the birds against severe wind storms, against which Tawny Frogmouths are not as well equip to cope.

4.6 TEMPERATURE REQUIREMENTS

Tawny Frogmouths are found in a range of environments across the Australian continent and can tolerate a wide temperature variation. While their feathers are capable of insulating the bird almost completely from many climatic extremes, Tawny Frogmouths are also capable of adjusting their own body temperature to assist in coping.

In summer, with temperatures regularly exceeding 30°C, Tawny Frogmouths will remain in their stationary camouflage pose, without seeking cooler perches. Only when the internal body temperature of a Tawny Frogmouth increases by more than 4°C to 5°C will a bird open its mouth and begin to pant (*Kaplan 2007*). At this stage a Tawny Frogmouth will stimulate blood vessels in the mouth to release a type of mucus, which when the bird breaths, helps to reduce the temperature of the blood flowing through them. This in turn reduces the birds overall body temperature.

When it comes to enduring colder temperatures, Tawny Frogmouths have the ability to place their bodies in a state of torpor, where by their body temperature can drop to as low as 29°C. In the wild this not only allows them to cope with the cold but also reduced their metabolic rate and thus increases energy efficiency. It is like a form of hibernation but is only used by the birds for a very short period of time, often during the colder temperatures of the night (*Körtner et al 2001*). This allows Tawny Frogmouths to live in environments where night time temperatures can drop as low as -13°C.

4.7 SUBSTRATE

The substrate of a Tawny Frogmouth enclosure is not of vital importance to the bird. However mulch is commonly used to provide a natural look in the exhibit. This substrate should be placed over a solid cement floor which allows for adequate drainage. The substrate itself must be cleaned on a weekly basis to ensure hygienic conditions for the birds.

4.8 NEST BOXES AND/OR BEDDING MATERIAL

Tawny Frogmouths do not use hollows in tree trunks for either nesting or roosting, as a result, in captivity they do not need to be provided with a nest box. In the wild, a Tawny Frogmouth pair will construct their nests in the forks of trees. These nests are often of flimsy construction, being little more than a collection of stick and leaves which have been bundled together and arranged in the shape of a nest. The size of the nest itself often depends on the size of the branches in which it is being built, however on average they are around 30 cm in diameter (*Kaplan 2007*).

The loose stick used in the construction, are often not much thicker than 5-6 mm and are piled across each other. The centre of the nest is often slightly depressed and is composed of leaf litter and grass stems to soften it. Often Tawny Frogmouths will reuse the same nesting site, or used the discarded nests of other birds, provided that they are large enough (*Kaplan 2007*).

In captivity it is necessary to provide the raw nesting materials as well as a secure branch in which they can construct their nest. The fork in the branch must be close to the trunk and it would be advantageous to secure a small plastic or ceramic dish in this position, upon which the birds can construct their nest. Being positioned close to the trunk of the tree, allows the Tawny Frogmouths to feel safer and camouflaged up against it as they incubate the eggs.

4.9 ENCLOSURE FURNISHINGS

Tawny Frogmouths require adequate branches placed at varying heights and positions around the enclosure so that they have a wide selection of daily roosting sites. In most captive situations Tawny Frogmouths choose and utilise only one roosting site, however they should always be given

the option of others, if for instance there is a change in weather rendering one position too exposed. The perches should not be aligned in such a way as to impede the flight of the bird and should be placed to allow varying degrees of exposure to the public and the elements. Furthermore the perches should be at least 5cm thick and of rough texture to allow the birds to grip onto them (*Körtner and Geiser 1999*).

In captivity it is quite common for Tawny Frogmouths to roost very close to, but not on the ground. Furniture such as large rocks and stumps should be placed around the exhibit, allowing the birds to roost at least 50 cm above the ground.

5 GENERAL HUSBANDRY

5.1 HYGIENE AND CLEANING

Tawny Frogmouths spend much of their time in the branches or on perches above the ground. It is therefore vital to the health of these birds that the perches are kept clean. After a few days of housing a new Tawny Frogmouth it will become clear where the bird's favourite perching sites are. These must be cleaned on a daily basis, being sure to remove all excrement that has accumulated. It is preferable that these favoured perches, be scrubbed and disinfected at least on a weekly basis to prevent the build up of bacteria and parasites which could intern infect the bird. Other perches should be washed down and scrubbed with water to remove any faecal matter on a daily basis to maintain a hygienic environment and disinfected at least once a fortnight.

The use of bleach as a disinfecting agent is not recommended as any traces could adversely affect the relatively soft feet of a Tawny Frogmouth. Milder agents such as diluted eucalyptus disinfectant should be used. All disinfecting agents must be washed off the perches and surfaces once they have been cleaned.

5.2 RECORD KEEPING

It is important that healthy and injured Tawny Frogmouths that are being kept in captivity, either for display or to nurse back to health, are monitored closely. Furthermore, the ability to detect any deterioration in health as soon as possible, allows for immediate treatment to begin, hopefully before it is too late. All records about injured Tawny Frogmouths or any birds for that matter should include the following information:

- Date animal was found –
- Where it was found –
- Species – In this case Tawny Frogmouth, but if identification is incorrect then the treatment (in the case of an injured bird) and/or diet that follows may very well do more harm than good.

- Estimated age and weight – Weight is often a good indication of the health of a bird. For instance if a bird in a captive situation is under weight than it is a good indication that it has not been feeding correctly and steps must be taken to rectify the problem.
- Injuries and their possible causes – Tawny Frogmouths are frequently injured by vehicles in urban areas as they attempt to catch insects on the road which have been attracted by street lights and car headlights. This often results in many Tawny Frogmouths being taken into captivity for treatment.
- Date of release –
- Method of release –
- Release site –
- Feed intake – it is important to know if an injured or captive bird is eating. Often, individual meals may be too large or the bird could be refusing food resulting in the need to re-evaluate the feeding regime.
- Body measurements – Are often to determine if the bird is a sub-species or a juvenile.
- Toileting –
- Unusual behaviour – Records detailing characteristics such as flight ability and enthusiasm for food, can provide an important indication on the rate of recovery.
- Diet – A specific diet may be required for the bird based on age, weight and or nutritional needs which may have resulted from starvation or poisoning.
- Veterinary care – Detailing what care has been given and in the case of some form of transfer or different member of staff taking over, what future care is recommended or needed.

5.3 METHODS OF IDENTIFICATION

In a captive situation the most common method of identifying individual Tawny Frogmouths is through the use of leg banding. If only two birds and kept in a single exhibit, they can in some instances be distinguished from one another by slight variations in the tone of the plumage, i.e one may be a lighter colour than the other. However, most adult Tawny Frogmouths possess a very similar appearance and hence the use of artificial marking methods such as leg bands is necessary.

In a study conducted by Körtner and Geiser (1999), individual Tawny Frogmouths were tagged with small radio transmitters which were fitted onto the bird's back. This system has been used by a number of scientific studies and allows not only the identification, but also the tracking of movement through the home range of individual wild and re-released Tawny Frogmouths.

5.4 ROUTINE DATA COLLECTION

An example of routine data collection is the study conducted by Körtner and Geiser (1999), which was primarily based on the rate of growth of Tawny Frogmouth chicks in the nest until they fledged. In this study they made frequent measurements of the weight of individual chicks from several nests and were able to plot this data against time to provide an accurate indication of the rate of chick development.

Similar systems as well as the measuring of beak, wing and feather lengths may be employed to monitor the development of young which are involved in captive breeding programs. Breeding, either in captivity or as part of a study of a wild population, recording events such as mating, egg laying and hatching can provide valuable insight into aspects such as duration of incubation and rearing. Recording these events can also allow the record keepers to compare their data to that of other studies to determine if there have been any similarities or differences in the timing of reproductive events.

6 FEEDING REQUIREMENTS

6.1 DIET IN THE WILD

The wild diet of *Podargus strigoides* can be quite varied depending on the time of year and the availability of food. The majority of this diet however consists of invertebrates such as snails, slugs, cockroaches, moths, millipedes, centipedes and Christmas beetles. As much as 78% of the natural diet of the Tawny Frogmouth is insects, with spiders and centipedes making up only 18%. The remaining 4% consist of terrestrial vertebrates such as frogs, lizards and mice (Kaplan 2007).

6.2 CAPTIVE DIET

In captivity, the diet of a Tawny Frogmouth is often quite simple, consisting of whole mice, cut up day old chicks, insects such as mealworms, crickets and cockroaches, and a variety of meat mixes which will be discussed later. Most institutions feed these birds almost entirely on cut up day old chicks or adult mice. However it should be noted that Tawny Frogmouths are primarily insectivorous, as such, their diet in captivity should consist primarily of small invertebrates.

Being nocturnal birds, Tawny Frogmouths should be fed at night, in order to try and simulate the natural feeding cycle of the animal. However this is not always practical and in such cases it is recommended that Tawny Frogmouth's be fed either in the early morning or late afternoon.

When feeding meat mix to a Tawny Frogmouth, there are several ways of preparing it. The following are three examples of meat mixes which are utilised by the Queensland Environmental Protection Agency (EPA) as a portion of the diet for Tawny Frogmouths.

The first mix consists of:

- 100g low fat mince (preferably preservative free, mince up heart is best);
- 1 finely chopped hard-boiled egg (include the finely ground shell); and
- 1 heaped tablespoon of Wombaroo Insectivore mix (see Appendix 1).

The second mix contains:

- 100 g low fat mince (minced heart is best);
- 1 finely chopped hard-boiled egg (include the finely ground shell);
- 1 heaped teaspoon of ground dog kibble;
- 1 heaped teaspoon of unprocessed bran;
- 1 pinch of calcium powder (*see Appendix 3*); and
- 1 pinch of bird multivitamin (*see Appendix 2*).

The third mix utilised is somewhat simpler, consisting of small pieces of heart which have been rolled in a small coating of insectivore mix (<http://www.epa.qld.gov.au/>).

Tawny Frogmouths are very efficient at regulating body water levels and as a result, they do not need to drink, instead getting all the water they need from their food. Therefore it is vitally important that food items such as meat mix are dipped in water prior to being fed to the bird (*Kaplan 2007*).

6.3 SUPPLEMENTS

Few supplements are required for a Tawny Frogmouth as their food generally consists of whole animals, which provide calcium in the bones and many vitamins in the bodily organs. However when feeding meat mix, it is recommended that calcium supplements be added (*see Appendix 3*). The addition of multivitamins (*see Appendix 2 for details*) to frozen food items is especially important in order to replace vitamins in the food that have been destroyed by the freezing process.

6.4 PRESENTATION OF FOOD

The presentation of food items for Tawny Frogmouth's is fairly crucial. In captivity it is very difficult to simulate the natural feeding behaviour of these birds. As a result it is often necessary to hand feed them. This can be achieved by placing the food directly above the bird's head. In most cases a Tawny Frogmouth will open its mouth (gape) when food is placed above them, in which case one simply needs to place the food item in the bird's mouth. It should then swallow the food item whole.

In some circumstances a Tawny Frogmouth may not gape at the food item that is being presented. In this case one should stroke the bristles which protrude from the top of the bird's beak. At this a Tawny Frogmouth will gape only briefly, but this should be sufficient to place the food in its mouth.

7 HANDLING AND TRANSPORT

7.1 TIMING OF CAPTURE AND HANDLING

Tawny Frogmouths are active during the night and roost in the trees during the day. Attempting to capture these birds when they are most active is quite difficult and can be quite stressful to them. However during the day as they are roosting, Tawny Frogmouths will rarely move from their perch even if touched or threatened, as they attempt to camouflage themselves against their surroundings. Performing the capture and handling of Tawny Frogmouths during the day (preferably early morning) is far easier for the keepers involved and less stressful on the bird and can generally be achieved in a relatively short space of time.

7.2 CATCHING BAGS

Catching bags can be employed for Tawny Frogmouths when performing tasks such as examinations and banding in the field. The bags should be constructed of a nylon fabric that is loose enough to allow for sufficient air flow. The preferable size is about that of a normal pillow case which will allow for sufficient material to be used for restrain if necessary.

7.3 CAPTURE AND RESTRAINT TECHNIQUES

Although often mistaken for an owl, Tawny Frogmouths have a significant physiological difference in that they lack sharp, powerful talons. In reality the feet and legs of a Tawny Frogmouths are quite weak and are used by the birds for little more than securing themselves on a perch. The most hazardous part of a Tawny Frogmouth's anatomy is its beak which comes to a sharp point on its tip and had the ability to clamp down on an object.

Capturing a Tawny Frogmouth is a relatively simple task and would not require more than two people. During the day time when the bird is roosting they will sit quietly as they are approached. Even in the wild, Tawny Frogmouths will move little when a human approaches their position.

Indeed I have even come within centimetres of a wild Tawny Frogmouth and the bird still did not move from its perch.

There are several methods of capturing a Tawny Frogmouth. The first is the simplest, but can be the most traumatic for the bird. It involves slipping a net over the bird while it is roosting on a perch. This allows the keeper to gain a greater degree of control over the bird. By gently moving the net to the ground and orientating the bird so that it is facing away to avoid being bitten, the keeper can place both hands around the birds' mid section in what is known as the two-handed grip. This grip is achieved by firmly but gently grasping the bird with the hands being placed either side so that the wings are held against the bird's body by the keeper's palms. The thumbs should be placed on the bird's backbone at the level of the scapulae or shoulder and the fingers curled around the breast and abdomen, with the legs tucked up against the underside of the bird. The two-handed grip allows the keeper complete control over the wings and allows for relative ease of examination, however if the keeper's grip is too tight, it will constrict the bird's breathing and suffocate it. This technique is illustrated in Figure 7.1 below.



Figure 7.1: Two handed method of restraining and handling a Tawny Frogmouth.

The other method of capture is simpler, quicker and less traumatic for the bird. It involves approaching the bird from behind and slowly but firmly applying the two-handed grip directly to the bird while it is roosting. In my experience I have found that Tawny Frogmouths will rarely resist this method and it can be readily employed should the need arise.

7.4 WEIGHING AND EXAMINATION

When performing a physical examination, the two-handed grip as explained in section 7.3 allows for the greatest degree of control over the bird. The ease of application of the two-handed grip also makes it ideal for this purpose. When examining the interior of the mouth of a Tawny Frogmouth one only needs to stroke the bristles above the bird's beak. At this action a Tawny Frogmouth will always tilt its head back and gape widely.

In some cases Tawny Frogmouths will not need any form of restraint to perform a weight measurement. They can simply be sat on the scales and the measurement read. However this should not be taken as a given rule for these birds and it is quite possible that restraint will be required. The simplest and most stress free method of restraining a Tawny Frogmouth for a weight measurement is to have a narrow towel that can be wrapped around the bird in such a way that it performs the same role as the two-handed grip. One must ensure that the towel is firm enough to restrain the bird's wings but not so tight as to restrict breathing or cause discomfort. The bird should be continually observed for open mouth panting which can indicate that it is having difficulty breathing.

7.5 RELEASE

When releasing a Tawny Frogmouth into an enclosure it is important to ensure that the bird has a clear flight path with no immediate obstacles. Release should take place in the late afternoon just before dusk. Being nocturnal, release at dusk will give the bird a full night to fly around and become accustomed to its new enclosure.

When the transport box containing a Tawny Frogmouth is placed into the enclosure it should be opened from behind, so that the bird does not see any people and has a clear view of the

majority of the enclosure. One should not attempt to remove the bird from the box, instead allowing it to leave freely when it is ready to do so.

7.6 TRANSPORT REQUIREMENTS

When transporting Tawny Frogmouths the box must be clearly and correctly labelled. These labels must not block any of the ventilation and should conform to International Air Transport Authority standards, providing details of the animal and the sender (*IATA 2000*).

7.6.1 BOX DESIGN

A box that is to transport a Tawny Frogmouth should be constructed out of untreated plywood. The container should have a length and width of at least 50cm. This will allow the bird to turn around easily without touching any of the sides. The box can be compartmentalised, thus increasing its length and ability to transport more than one bird. However for the purpose of ease of transport, this length must not exceed 91cm. The height must permit the birds to stand on a perch naturally without their head touching the roof or their tail on the floor. I would recommend a clearance of at least 5cm, due to the nature of Tawny Frogmouths to take a variety of postures while sitting.

The plywood walls should be no thinner than 0.6cm and 75% of the front must be of wooden or wire bars 1.2cm apart of strong wire mesh with a diameter of 1.2cm. A false wire mesh floor can be utilised if placed 2.5cm above the bottom of the container to allow the excrement to pass through. The frame must be constructed of 2cm x 4cm solid wood, with the roof and floor being of 1.2cm thick plywood (*IATA 2000*). The interior of the roof must be lined with a non-destructible soft padding.

These size, thickness and design standards must be met in order to safely transport a Tawny Frogmouth. In addition handle bars must be provided as shown in *Figure 7.2* to allow for easy manual handling. The basic design should be similar to that as shown in the figure below, however the compartmentalised variant is optional for transporting multiple birds.

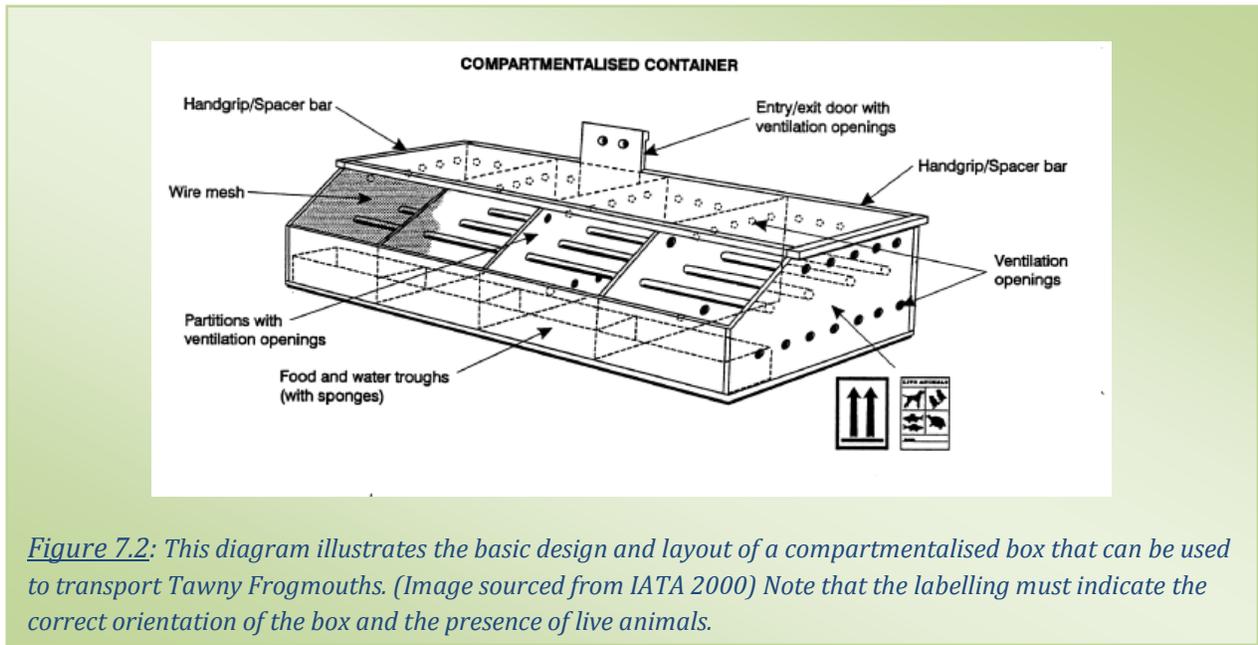


Figure 7.2: This diagram illustrates the basic design and layout of a compartmentalised box that can be used to transport Tawny Frogmouths. (Image sourced from IATA 2000) Note that the labelling must indicate the correct orientation of the box and the presence of live animals.

7.6.2 FURNISHINGS

Very little furnishing is needed for a box that is to contain and transport a Tawny Frogmouth. A single perch should be provided per box or compartment and should be between 5cm and 10cm thick as Tawny Frogmouths prefer to perch on larger, thicker branches in the wild (*Kaplan 2007*).

7.6.3 WATER AND FOOD

If a Tawny Frogmouth is to be transported, it should receive a feeding at least two hours prior to dispatch to reduce the chances of regurgitation. Food items such as day old chicks, mice or meat mix should not be fed prior to, or during transport also due to the potential for regurgitation.

The initial feeding should consist of soaked biscuit meal and dried insects. There is little point in placing this or any other food item in the box with a Tawny Frogmouth as they will not consume such foods on their own. The prior feeding should be done by hand as is normal for captive Tawny Frogmouths ensuring that the biscuit meal is soaked, as Tawny Frogmouths get their water requirements from their food. However, this said, the IATA Live Animal Regulations 2000 still require that water be provided during transit. To prevent the water from spilling, a small container constructed of non-toxic materials (plastics are preferable) should be fastened to the floor of the box. This container should be shallow enough to allow the bird to reach in easily and should contain a moistened sponge from which the bird can drink if thirsty.

If a Tawny Frogmouth is to be transported for a period of longer than 24 hours, then it should be fed during transit. As previously mentioned, Tawny Frogmouths will not eat food that is placed in a stationary container and will need to be hand fed every 24 hours (*IATA 2000*).

7.6.4 ANIMALS PER BOX

The number of Tawny Frogmouths placed in each box depends on the temperament of each bird. Most Tawny Frogmouths are quite placid and up to three could potentially be placed in a box together. In many cases in an exhibit Tawny Frogmouths will nestle together for security. However on occasions these birds can become aggressive towards each other, especially if confined in an enclosed space for a protracted period of time. For the purposes of safety and comfort for the bird, I would recommend only one Tawny Frogmouth per box or compartment.

7.6.5 TIMING OF TRANSPORTATION

The transport of a Tawny Frogmouth should take place so as to ensure that the bird does not go for more than 24 hours without food. If this is not possible then a keeper should accompany the bird to ensure that it is fed during the transport.

8 HEALTH REQUIREMENTS

8.1 DAILY HEALTH CHECKS

It is imperative to make observations of the wellbeing of captive Tawny Frogmouths on a daily basis, be it during feeding and/or cleaning procedures. One should always be aware of the alertness and posture of these birds. Wings should be neatly tucked away as with any roosting bird and they should be in their classic, erect form as seen in *Figure 8.1*, or eagerly awaiting feeding with vivid eyes.

In some cases Tawny Frogmouths will refuse food for short periods if the climatic conditions are colder than normal. This is however nothing to be concerned about so long as they do not refuse to feed for more than two days in a row. During cold conditions Tawny Frogmouths can place themselves in a temporary state of torpor which results in a slowed metabolic rate. This state however, normally only lasts during the night and early morning where it is coldest. Therefore it is advisable, when housing Tawny Frogmouths outdoors, to feed them later in the day during the colder months of the year (*Körtner et al 2001*).

The feathers of Tawny Frogmouths are capable of insulating them from the cold and are waterproof. Therefore as with all birds, their feather condition is of vital importance, particularly if they are being housed outdoors where they are exposed to changing climatic conditions.

Included in daily checks should be a brief examination of the beak condition. Injuries to the beak must be identified and treated seriously and immediately. In most cases beak



Figure 8.1



Figure 8.2: Interior of a healthy Tawny Frogmouth's beak.

damage will heal without complications, however if left untreated, the healing process may result in deformities in the shape of the beak. These may result in an inability of the beak to close or function correctly. The interior of the beak should also be examined. Tawny Frogmouths can readily be hand fed by holding the food above their head. They will open their gape wide allowing keepers to see their mouth easily as seen in *Figure 8.2*. It should appear yellow to orange and clean, with no accumulated residues. The bottom interior and throat should also be moist. Drying out and the build up of residues from its food can occur if the beak has been damaged and is unable to close correctly (*Kaplan 2007*).

For individuals working with Tawny Frogmouths it is important to know the temperament of each individual bird where possible. This will allow any subtle changes in their behaviour that could have been caused by environment or illness to be observed and recorded. In addition, examination of the faeces of these birds for any obvious signs of blood or abnormalities in consistency should be conducted.

8.2 DETAILED PHYSICAL EXAMINATION

8.2.1 CHEMICAL RESTRAINT

The safest and most practical method of chemically restraining Tawny Frogmouths is through the use of an inhaled gaseous agent via a mask accompanied by the use of intubation. The most common agent used for this purpose is Isoflurane with consistencies beginning at 3% and then maintained at 15.-2% once the bird is unconscious. The only danger with the use of a gaseous agent in any bird is the size of the animal's trachea. The anaesthetist must be certain to use a tracheal tube of exactly the correct size otherwise damage to the tracheal cartilage could result in permanent disruption of the bird's airway.

8.2.2 PHYSICAL EXAMINATION

When performing a detailed physical examination, there are a variety factors that should be addressed. First of all, taking the temperature of Tawny Frogmouths will not yield any conclusive result on the health of the bird in captivity. This is due to the fact that these birds can vary their

own body temperature by up to 5°C depending on the prevailing environmental conditions (Körtner *et al* 2001). The eyes should be examined to ensure that they are clear, undamaged and free from cataracts which can occur in older tawny Frogmouths. Cataracts can be detected by the presence of a bluish tint and clouding of the eyes.

Feeling the condition around the keel bone and weighing are important for captive Tawny Frogmouths. Due to the necessity of hand feeding in many circumstances, it is common for these birds to become overweight resulting in a diminished ability to fly and long term health risks if they remain overweight. Conversely it is also common for Tawny Frogmouths to be underfed or fed an incorrect diet, resulting in malnourishment and weight loss. It is therefore important to detect these problems as soon as possible so that the dietary regime can be altered (Kaplan 2007).

Feather condition across the bird's body should be examined for any abnormalities in condition. Particular attention should be paid to the tail feathers which are prone to damage if the bird's roost on or near the ground. Damage to the tail feathers can adversely affect a Tawny Frogmouth's ability to fly, which could result in injuring itself if startled. Furthermore if the tail feathers are damaged, it is often an indicator that that particular bird is currently unable to fly and measures should be taken to house it in a way that will minimise damage to these feathers. An examination for flat flies should be conducted as these parasites live within the feathers of many birds of prey including Tawny Frogmouths.

The underside of the tail feathers and the downy feathers around the vent should be clean and free of faecal build up. All of the feathers on the wings, dorsal and ventral sections of the bird should overlap neatly to cover the bird's whole body. Furthermore when sprayed with a fine mist of water, the droplets should bead off the feathers as though there were coated in a layer of oil. This aspect of the Tawny Frogmouth's feathers is necessary if they are to be housed



Figure 8.3: Side view of a Tawny Frogmouth's beak (image modified from Kaplan 2007, pg 91).



Figure 8.4: Front view of a Tawny Frogmouth's beak (image taken by author).

outside where they will be exposed to the weather. A lack of preening by a Tawny Frogmouth can prevent the powder-down feathers which are responsible for this waterproofing, from shedding their particles across the rest of the feathers (*Kaplan 2007*).

The beak of a Tawny Frogmouth should be examined closely both on the exterior and the interior. On the exterior one should assess if the beak is capable of closing fully. When closed fully the maxilla (top) and mandible (bottom) should fit together perfectly with nothing obstructing it as seen in *Figure 8.3*. As well as this, the beak should be symmetrical when looking front on as highlighted in *Figure 8.4* below. If the beak has been damaged, it is common place for abnormal growth to take place where the outer keratin sheath has tried to heal. This may result in obstructions or deformities, preventing the bird's beak from closing correctly. Such obstructions can gently be filed down using a nailfile until the maxilla and mandible fit together correctly. The mandible itself is not a continuously solid unit but a triangular frame over which skin is stretched, covering its entire width and length. This area is prone to injury and should be examined both on the interior and exterior (*Kaplan 2007*).

The interior of the beak, mouth and throat of a Tawny Frogmouth should be examined thoroughly to ensure that it remains moist and is free from any damage and residues as shown in *Figure 8.4*. The build up of residue within the mouth of a Tawny Frogmouth can have dire ramifications. This commonly occurs when a bird cannot close its mouth correctly and any pieces of food items that remain are able to dry out and harden, causing obstruction and infection. The airway should also be examined to ensure there are no signs of damage or obstruction and that there is not excess production of saliva or mucus that could be hampering the Tawny Frogmouth's ability to breathe.

A Tawny Frogmouth's feet should be examined carefully to ensure that they have not been injured. These birds rely heavily on their feet for remaining perched on branches even during the windiest storms. They have four digits with three forward and one behind. The feet of a Tawny Frogmouth are covered by near equal segments of scales. These are very pronounced, allowing any injury to be easily seen (*Kaplan 2007*). The soles of the feet should also be examined to determine if there is any injury that could prevent the bird from perching normally.

8.3 ROUTINE TREATMENTS

Food should be treated with calcium powder, particularly if feeding insects or meat mix which do not contain a high amount of calcium. This is of great importance during the breeding season when females may have developing eggs. It is also necessary for the healthy bone development of young. As well as this, the addition of bird multivitamin supplements should be added to the food, particularly when a Tawny Frogmouth has been stressed either by a transfer or injury. Multivitamins powders such as Ornithon are important to help bolster the immune system. Faecal samples should be collected annually for analysis for parasites and any diseases (<http://www.epa.qld.gov.au/>).

8.4 KNOWN HEALTH PROBLEMS

Parasitic

Angiostrongyliasis

Aetiology – *Angiostrongylus cantonensis* is a nematode which manifests itself as lungworm in rats and mice. The eggs of the parasite are shed in the faeces of infected rodents. In Tawny Frogmouths however the parasite infests the central nervous system. The birds become infected with parasite by eating slugs and snails, which actively consume the faeces of rodents and are therefore the intermediate host of this parasite (Rose 2005).

Clinical Signs – Early signs include weakness and an inability to fly. Later stages result in infected birds displaying an inability to perch or even right themselves (Kaplan 2007).

Treatment – As yet there is no satisfactory treatment for this parasite in Tawny Frogmouths. The cuticle of the nematode retains many antigens which means killing the worms can result in release of antigens which cause a severe host immune response (Rose 2005).

Prevention – Prevention of this parasitic infection in captive Tawny Frogmouths can be achieved by controlling the bird's food intake, thus preventing them from consuming infected items. As well as this, it is imperative that the feral rodent population in the area be controlled to help prevent the movement of this parasite. There is always a small chance that Tawny Frogmouths will try to

consume feral mice in the enclosure. Therefore it is important to avoid the use of poisons in their control.

Hippoboscid Flies

Aetiology – These are a genus of fly which are parasitic in nature. They live in the plumage of Tawny Frogmouths and other birds of prey and are capable of biting. As such they are capable of acting as a vector in the transmission of disease. These flies will infest and bite humans, but do not seem to remain on human hosts for prolonged periods (*Rose 2005*).

Treatment – Any flies can be killed by spraying the birds with permethrin. Thorough cleaning of the premises and destruction of the debris are essential for control.

Prevention – Spraying the enclosure with permethrin when coupled with cleaning will alleviate the infestation and should prevent any further.

Protozoal

Toxoplasmosis

Aetiology – *Toxoplasma gondii* is a protozoa which can cause toxoplasmosis in Tawny Frogmouths. This disease can be fatal if not treated.

Clinical Signs – Tawny Frogmouths that have contracted Toxoplasmosis are characterised by appearing depressed and fluffed. Protozoal cysts resembling those of *T. gondii* have observed in the absence of inflammation during routine histologic examination of nervous tissue of Tawny Frogmouths (*Rose 2005*). However by this stage it is far too late to treat and in some cases there may be no displayed signs of illness.

Treatment – This disease can be treated with anti-protozoal drugs such as Pyrimethamine, Leucovorin or Sulfadiazine. All are a form of antibiotic and must be proscribed by a vet. Another drug called Diclazuril was found to have a remarkable ability to treat birds in Hawaii which were highly infected with toxoplasmosis (*Work et al 2000*).

Prevention – Freezing of food items (day old chicks can carry cysts as can minced meat) to -20oC for 2 days will kill any *T. gondii* cysts.

Toxic Ingestion

Organochlorine Toxicity

Aetiology – The primary source of poisoning in Tawny Frogmouths are chlorinated hydrocarbons which are used primarily as insecticides. The widespread use of heptachlor, aldrin, and dieldrin for domestic cockroach and termite control has provided a persistent environmental source of these toxins for Tawny Frogmouths (*Rose 2005*).

Clinical Signs – Tawny frogmouths with organochlorine toxicity often abandon their nocturnal habits and are active during the day. Most affected birds are found weak, and unable to fly. Leg extension, head tilt and droopy or closed eyes are noted. Dilated pupils which combined with being active during the day often results in blindness. Tawny frogmouths with organochlorine toxicity may be extremely excitable or may have central nervous system depression. Highly excitable birds often convulse in response to stimuli and vocalise repeatedly. Birds with central nervous system depression however are recumbent with a dazed appearance. Such toxication almost always results in the death of the bird (*Rose 2005*).

Treatment – There is no effective treatment for organochlorine toxicity. Seizures may be controlled with intravenous or intramuscular diazepam. Atropine may be administered, in low doses, to reduce the effects of excessive stimulation of the parasympathetic nervous system (*Rose 2005*).

Prevention – In captive population organochlorine toxicity can be prevented simply by avoiding the use of any form of pesticide within the largest possible area of the exhibit. However organochlorine compounds can remain persistent in the environment for years.

8.5 QUARANTINE REQUIREMENTS

When quarantining a Tawny Frogmouth it is imperative to clean and thoroughly disinfect cages, aviaries, bowls and other accessories at least every day. One should avoid mixing feed and water

dishes amongst other cages and aviaries. The stress of an injury and capture is very likely to cause the bird's immune system to decrease in effectiveness thus vitamin supplements should be added to food and water to assist in recovery. Tawny Frogmouths should be housed individually and cages should be separated with solid dividers. One should not let diseased birds cough, sneeze or defaecate on each other.

Birds suspected of being infected with toxoplasmosis should remain in quarantine for a minimum of three weeks and diagnostic tests on faecal and blood samples should be performed. The maximum level of hygiene should be employed when dealing with Tawny Frogmouths infected with toxoplasmosis as this is a zoonotic disease. PPE such as gloves and facemask should be worn while cleaning, handling or administering treatments. Serious thought should be given to euthanizing Tawny Frogmouths that have been infected with *Angiostrongylus* due to the fact that there is no effective treatment and the effect of the parasite is so debilitating for infected birds.

A Tawny Frogmouth should remain in quarantine for a minimum of three weeks in which time faecal samples should be collected and analysed for any traces of disease and parasite infestation. Feeding should continue to occur on a daily basis using a diet as described in Section 6.

9 BEHAVIOUR

9.1 ACTIVITY

Tawny Frogmouths are not the most active of birds. The vast majority of their time, even when awake, is spent perching. This is mostly due to their hunting strategy of being sit and wait predators. Tawny Frogmouths are nocturnal and during the day will roost in the classic erect camouflage posture as displayed in *Figure 9.1*. During the daylight hours, this posture will be maintained without fail in most wild Tawny Frogmouths. However in captivity, due to the nature of having to feed during the day, these birds will often abandon this posture periodically upon the sight of humans, who they associate with feeding. When choosing a roosting sight, Tawny Frogmouths will often attempt to find a branch or area where they can best camouflage themselves. This should be kept in mind when housing these birds as it would be far less stressful for them if they are able to find a daytime roosting sight in which they feel comfortable (*Körtner and Geiser 1999a*).



Figure 9.1

Night time roosting behaviour in Tawny Frogmouths often beings at dusk where these birds will attempt to find a good vantage point several metres above the ground, from which they can see prey. By dawn Tawny Frogmouths will have returned to one of their daytime roosts. When perching at night it has been observed that Tawny Frogmouths will not bother with adopting the camouflage posture. Instead they sit in a more hunched fashion peering at the ground for anything that comes their way. Although in general these birds are sit and wait predators, it has become increasingly common for them to be seen actively hunting and catching moths and flying insects which are attracted to artificial light sources in urban areas (*Kaplan 2007*).

Tawny Frogmouths do not form close social groups. In fact in the wild it is quite rare to see more than two tawny Frogmouths together. Most unpaired Tawny Frogmouths are solitary while those with mates tend to remain close together or at least within the same territory.

During the colder months Tawny Frogmouths will from time to time place their bodies into a temporary state of torpor. This is often accompanied in captivity with a disinterest in food for short periods of time. This is a trait from the wild in which the Tawny Frogmouth is trying to maximise the efficiency of existing energy reserves in a time that is often associated with a decline in the amount of available food (*Kaplan 2007*).

9.2 SOCIAL BEHAVIOUR

Being mostly solitary, Tawny Frogmouths display very little social behaviour in the wild. In captivity, Tawny Frogmouths housed together will generally seek out each other and during the day will often be seen roosting very close together or even side by side. *Körtner and Geiser 1999a* comment that during the summer months Tawny Frogmouths often roosted in small family groups, all huddled together on one branch, indicating a certain level of social behaviour between family members.

9.3 REPRODUCTIVE BEHAVIOUR

Before and during the breeding season, males and females perform vocal duets. These are generally a sequence of calls that alternate between the male and the female. Male and female Tawny Frogmouth pairs will also work together to build a nest, beginning in late August to early September. Once their simple nest has been constructed both the male and female take turns to sit on the nest and incubate the eggs. In almost all cases, the male will incubate during the day and the female will incubate during the night. During this time the male will enter a state known as the brooding trance in which he sits on the nest but does not adopt a camouflage posture. Furthermore he will be almost completely unresponsive to any outside activities or threats. During this state the pupils of the male will contract and he will sit completely still on the nest until dusk when it is time for the female to take over incubation duties. This behaviour almost seems to invite

attack, however remaining completely motionless during the daylight hours the male effectively conceals the presence of either chick or eggs on the nest, thus helping to protect the young from harm (*Kaplan 2007*).

The female behaviour during incubation is much different from that of the males. In general she will react to even the slightest disturbance by fluffing out her feathers in an attempt to make herself look as large as possible in an attempt to scare off any potential predators. Furthermore the patterns on the feathers become arranged in the form of a threat display as she follows the predator or threat with her eyes (*Kaplan 2007*).

9.4 BATHING

In the wild Tawny Frogmouths will not actively seek out any form of water source for the purpose of drinking or bathing. In fact even when it rains, most Tawny Frogmouths will remain in their classic, erect camouflage posture. However in captivity I have observed that Tawny Frogmouths display a fondness for a fine mist spray, particularly during the summer months. During these activities the birds will spread out their wings to immerse themselves in the light misty spray.

9.5 BEHAVIOURAL PROBLEMS

Tawny Frogmouths are generally very placid birds in captivity and as such do not suffer from a great deal of behavioural problems. The main problems that do exist such as aggression are often as a result of ill treatment. In these cases a Tawny Frogmouth can become quite aggressive towards keepers who enter the exhibit. Such aggression may be confined to simply attempting to bite the keeper but can extend to flying at and attacking the keeper. Such behaviour can be prevented by maintaining ethical treatment of these birds. Often too much contact with the public can also be an activator of this kind of aggressive behaviour. In such cases I would advise that more aggressive birds be relocated to off exhibit areas so that they might get a reprieve from excessive human contact.

If a Tawny Frogmouth has come from the wild for whatever reason it may take time for it to recognise the food that is being fed. To help with this, most Tawny Frogmouths will gape when the bristles above its beak are stroked, at which point the food item can be placed in the birds mouth. It may take some time for the Tawny Frogmouth to become used to this method of feeding but sooner or later it will come to associate humans with food and will recognise the artificial foods that are being given to it (Kaplan 2007).

9.6 SIGNS OF STRESS

The Tawny Frogmouth is a very vocal bird with a variety of sounds which describe different emotions. The most common vocal signals produced by Tawny Frogmouths are highlighted in the table from Kaplan 2007 in Figure 9.2 below. These birds tend to show several levels of stress. The most common sign is a short, quiet cackling. This indicated a low level of annoyance most commonly associated with handling and/or being pestered by other birds within the exhibit.

<u>Whisper Communications*</u>	<u>Adult Calls</u>	<u>Nestling and Juveniles</u>
Purring (like a cat) <i>(nestling - adult)</i>	Contact oom	Most whisper communication plus:
Crying (soft whimper) <i>(nestling - adult)</i>	Breeding season oom	Begging calls (short and soft often like quiet gurgling)
Hunger (whimper plus accents) <i>(nestling - adult)</i>	Duetting (oom and reply)	Begging calls strong and long
Annoyance (sharp little cackles) <i>(juvenile - adult)</i>	Scream (fear, very loud)	Screams (begging - higher frequency than adults)
Courting (bell like purrs) <i>(adults only)</i>	Scream (threat, loud)	Screams (fear - higher frequency than adults)
Warning 'oom' (long, low hush) <i>(Adults only)</i>	Screech (attack/mob-sharp)	
<i>*Inaudible beyond 1 metre</i>	Alarm (slow cackle)	

Since this vocalisation only indicates a low level of annoyance it has a tendency to be heard quite commonly by keepers. The highest stress indicator in Tawny Frogmouths is very distinct. It is generally very loud and is described as a high pitched, blood curdling scream. This scream is often used as an attempt to try and scare off a predator and in captivity is often associated with an extremely high level of anxiety. This scream can often be accompanied by aggression as the bird lunges at an intruder and attempt to bite with its powerful beak (*Kaplan 2007*).

9.7 BEHAVIOURAL ENRICHMENT

There are a variety of ways in which enrichment for Tawny Frogmouths can be employed to try and encourage natural behaviour. If being housed outdoors, a small light can be placed within the exhibit to attract small insects upon which the Tawny Frogmouths can hunt and feed upon. In addition, natural live foods such as slugs and snails can be added to the exhibit to allow the tawny Frogmouths to perch and pounce upon them. As well as this there must be adequate perches available for roosting both at night and during the day. The provision of a light mist spray from time to time, particularly if being housed indoors can help to simulate natural environmental conditions such as rain that would be experienced from time to time, allowing the Tawny Frogmouths to bathe (<http://www.dpi.nsw.gov.au/>).

9.8 INTRODUCTIONS AND REMOVALS

New Tawny Frogmouths are not at risk of carrying diseases which can be spread to others in an exhibit. Furthermore there is little chance of aggression between new individuals and an established population. One must bear in mind however the fact that in most cases these birds are solitary (*Kaplan 2007*). Therefore it would be advisable to ensure that all birds in an exhibit have the ability to roost sufficiently apart from one another. Furthermore the addition of visual barriers within the exhibit would be advisable to give the Tawnys the ability to feel alone should they desire.

9.9 INTRASPECIFIC COMPATIBILITY

In almost all cases Tawny Frogmouths are placid and accepting of new individuals within their enclosure. I would still recommend however that a soft introduction approach be adopted to help all individuals acclimatise to the approach of the new arrival. Furthermore there should be plenty of perching opportunities available should the new individual want to roost away from the others within the exhibit.

9.10 INTERSPECIFIC COMPATIBILITY

In many cases Tawny Frogmouths can be housed in multispecies exhibits. The Tawny Frogmouths themselves pose little to no threat to most other bird species. Small birds such as finches should not be housed in the same exhibit as Tawny Frogmouths as there is a possibility that they may be consumed. Furthermore birds such as noisy miners should not be housed with Tawny Frogmouths as they will most likely hound and pester them constantly, causing increased levels of stress for both species (*Kaplan 2007*). Tawny Frogmouths can be housed with other small owl species as well, such as Boobook owls and barn owls. Due to the size of the Tawny Frogmouth they will not become prey. However these birds should not be housed with owls larger than a barn owl (*or similar species*) due to the risk of conflict and severe injury to the Frogmouth.

9.11 SUITABILITY TO CAPTIVITY

In almost all cases Tawny Frogmouths adapt to captivity remarkably well. I have observed that even injured birds which are brought in for the purpose of rehabilitation become accustomed to captivity. In many cases it appears that they are dependent on their carers who have to feed them by hand, however once released they return to their natural hunting and roosting behaviour. Furthermore, Tawny Frogmouths show virtually no aggression towards other birds in exhibits (*Körtner and Geiser 1999*).

10 BREEDING

10.1 MATING SYSTEM

Tawny Frogmouths are monogamous breeders, often pairing in their first or second breeding season. The bonding between individual pairs is extremely strong and will often last for the entire life of the bird. Outside the breeding season Tawny Frogmouths act and hunt in a solitary fashion, but the pair will still occupy the same territory. As the breeding season commences Tawny Frogmouth pairs will roost closer together or in many cases, right next to each other, leaning up against one another during the daylight hours (*Kaplan 2007*).

10.2 EASE OF BREEDING

Breeding of Tawny Frogmouths in captivity is dependent on a number of factors, most of all being the presence of a viable breeding pair. Due to the monogamous nature of these birds, it can often be difficult to introduce two new individuals to one another where bonding and acceptance can take months, particularly if an existing viable pair had been split up by death or the need to increase genetic diversity within the collection. However once a new pair has been established, breeding will readily take place.

10.3 REPRODUCTIVE CONDITION

10.3.1 FEMALES

During the breeding season it is imperative that females receive sufficient food to help her to develop the eggs. As well as this it is important to ensure the addition of calcium to prevent her body from sacrificing her own bodily reserves. During breeding females will often be eager for food and should readily accept anything that is offered. One must always keep a close eye on the condition of the female during the rearing stages where she may sacrifice her own food to give to the developing chick. During this time it would be advantageous to increase the amount of food being offered to the adult birds.

10.3.2 MALES

During incubation of the eggs, the behaviour of male Tawny Frogmouth's changes considerably. They enter a trance like state called the brooding trance where they may not continue to accept food for the duration of the incubation. During brooding, males would often sit on the nest during the day and hunt for food at night, so it is important to ensure that it is possible to offer the male food items once the female has taken over the night time incubation duties.

10.4 TECHNIQUES USED TO CONTROL BREEDING

If one desires to prevent breeding of Tawny Frogmouths in captivity there are two simple methods that can be employed to achieve this. The first is to simply separate the males from the females. Even if this means housing Tawny Frogmouths as individuals, this will not affect their activity or behaviour as these birds are mostly solitary in the wild. The second method of breeding prevention in Tawny Frogmouths is to remove and destroy any eggs as soon as they are laid. This has the advantage of keeping multiple birds together in the exhibit, but can potentially result in unwanted breeding if the nest is not discovered in time to prevent the young from hatching.

10.5 OCCURRENCE OF HYBRIDS

In the wild the Tawny Frogmouth subspecies have a tendency to hybridise. In the east of Australia *P.s. brachypterus* hybridises with *P.s. strigoides* whilst in north-eastern Queensland *P.s. strigoides* hybridises with *P.s. phalaenoides*. In general the vast majority hybridisation occurs is where the ranges of the individual subspecies overlap. Hybridisation is also common place in captivity where due to the extensive breeding of Tawny Frogmouths. There are no known hybrids between Tawny Frogmouths and other species in the *Podargus* genus (McCarthy 2006).

10.6 TIMING OF BREEDING

Tawny Frogmouths are seasonal, breeding only once per year. First breeding behaviour such as nest building can begin as early as late August to early September. In some cases the breeding

period can range from September through to late December depending on factors such as temperature. In most cases it is believed that the breeding response is brought on by an increase in temperature coupled with an increasing amount of daylight (*Kaplan 2007*).

January	February	March	April	May	June
July	August <i>Nest Building Begins.</i>	September <i>Eggs laid.</i>	October <i>Eggs Hatch.</i>	November <i>Chicks Fledge.</i>	December <i>Chicks Weaned.</i>

10.7 AGE AT FIRST BREEDING AND LAST BREEDING

Typically Tawny Frogmouths reach sexual maturity at around 1 year, usually prior to the commencement of the next breeding season after they have hatched. Although they may be physically ready to breed at this stage, finding a mate and establishing a territory can in some cases be difficult. However in captivity, a Tawny Frogmouth can be capable of breeding at an age of only eight to nine months. Provided that both members of the breeding pair survive, Tawny Frogmouths can continue to breed once a year until they die (*Kaplan 2007*).

Due to the monogamous nature of Tawny Frogmouths, when one member of the pair dies or is removed from the exhibit, the other will often ignore any other potential partners. Reintroduction of new mates can occur but it will often take several months before they accept each other and are willing to breed together. The determination of an exact time frame it not possible as some Tawny Frogmouths may accept a new mate immediately whereas others may not accept a new mate at all.

10.8 ABILITY TO BREED EVERY YEAR

Tawny Frogmouths are seasonal breeders and given the right conditions and the availability of food, these birds have the ability to breed on a yearly basis (*Kaplan 2007*).

10.9 ABILITY TO BREED MORE THAN ONCE PER YEAR

Tawny Frogmouths will rarely breed more than once per year. Even if there is sufficient food and the first clutch is removed to be artificially raised (*Kaplan 2007*).

10.10 NESTING, HOLLOW OR OTHER REQUIREMENTS

Tawny Frogmouths construct simple stick nests in the boughs of thick branches. These nests are often of very simple construction consisting of little more than a few sticks arranged in the shape of a nest and some leaves on the top for padding. In the absence of suitably thick branches, I have observed captive Tawny Frogmouths construct their nest amongst moderately sized rocks, not 30 centimetres above the ground. Tawny Frogmouths have been seen constructing their nests in abandoned Chough, Magpie and Currawong nests. To simulate this in captivity it is possible to provide a shallow bowl or plate, about 30 centimetres in diameter, secured in branches about 2 to 3 metres above the ground (*Körtner and Geiser 1999*).

In order to construct their nests, Tawny Frogmouths only require leaves such as those dropped by a eucalyptus tree and thin twigs that are only 10 to 15 centimetres in length. This as well as a platform such as a bowl or plate previously described will allow them to construct their simple nest. Both the male and female will work together to construct the nest.

10.11 BREEDING DIET

During the breeding season it is recommended that calcium supplements be added to the diet to allow for full and correct formation of the egg without any detriment to the female. Once the eggs have hatched and the parents are caring for the young it is recommended that the size of the food

items offered be reduced. This is particularly important when feeding items such as whole mice. The parent birds should be given moist meat mix as described in *Section 6*. This should be mixed with mealworms or cockroaches, a small amount of calcium powder and vitamin supplements. Furthermore when given to the adult Tawny Frogmouths, the mix should be in small pieces not more than 1 centimetre wide. The use of meat mix is the safest option when Tawny Frogmouths are rearing young, as it can easily be torn into smaller pieces for the chick (<http://www.epa.qld.gov.au/>).

10.12 INCUBATION PERIOD

Incubation of Tawny Frogmouth eggs has a fairly small range of between 27 and 31 days (*Kaplan 2007*). Incubation of the eggs is shared by both the male and female. In general the male will incubate the egg during the day and the female will incubate at night (*Körtner and Geiser 1999*). This has been confirmed by my own observations of Tawny Frogmouths in captivity.

10.13 CLUTCH SIZE

Tawny Frogmouths do not produce large clutches. Furthermore the eggs are not produced all at once, instead there is a gap of one to two days between the laying of each egg. Tawny Frogmouths can lay up to three eggs in a clutch but this is not very common. On average a female will only lay two eggs and in most cases only one chick will hatch or survive from the two (*Kaplan 2007*).

10.14 AGE AT FLEDGING

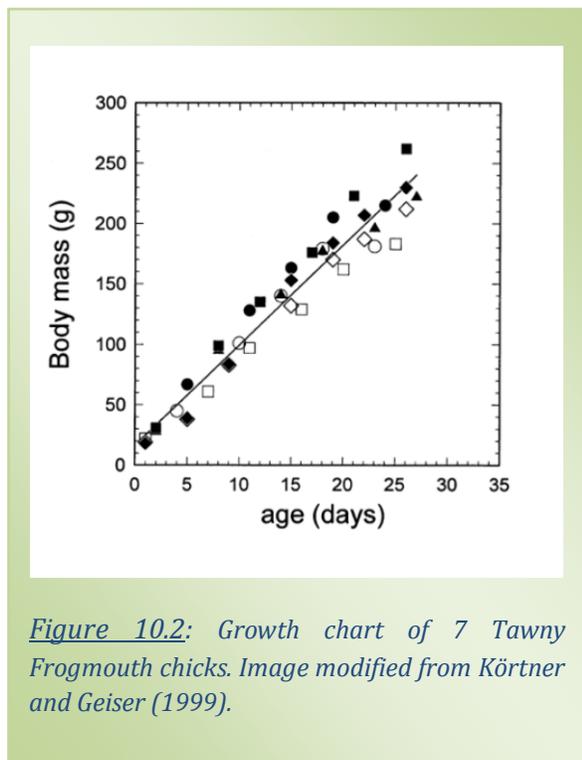
After hatching, Tawny Frogmouth chicks will remain on the nest for between 27-31 days at which point they will begin to take their first short flights with the parents. Although there may be multiple chicks hatched several days apart, they will all fledge at the same time. This can result in the youngest falling to the ground as it is still unable to fly. In most cases however the parents will still continue to feed the grounded chick until it is able to fly on its own (*Kaplan 2007*).

10.15 AGE OF REMOVAL FROM PARENTS

There is little reliable data on the timing of Tawny Frogmouth chicks dispersal and is different in almost all cases. In general, after fledging, Tawny Frogmouth chicks can remain dependent on their parents for anything up to four weeks. At which point they will no longer be fed by and roost with the adults. In some cases the chicks will remain within the home territory of its parents whilst still acting independently. A lack of studies in this area mean that it is not known what mechanisms play a part in the dispersal of the chicks, whether it is aggression from the parents or instinctual behaviour of the chicks (Kaplan 2007).

10.16 GROWTH AND DEVELOPMENT

Upon hatching Tawny Frogmouth chicks can weigh between 17-19 grams. In a study conducted by Körtner and Geiser (1999) it was found that on average Tawny Frogmouth chicks gain around 8.3 grams per day. As such the growth in all cases was found to be linear for the period of around 30



days between hatching and fledging. This is illustrated more clearly in *Figure 10.2*, which shows the mass increase during development of seven Tawny Frogmouth chicks. This is an average study of Tawny Frogmouth chicks within a fairly localised area. Due to the large size variation of Tawny Frogmouths across Australia is not possible to create a standardised chart of the size increase of the bird's features during development. In general, upon hatching a Tawny Frogmouth chick will be about the same size as the beak of its parents. When they hatch they have a full coat of white down and are essentially altricial, being totally dependent on the parent birds for feeding. Tawny Frogmouth chicks develop fairly slowly, and by the time of fledging, still may only weigh

half as much as an adult bird (*Kaplan 2007*).

After about ten days the classic mottled camouflage patterns begin to appear on the chick, whilst still retaining a mostly downy appearance. This down will be retained for around six weeks after hatching (two weeks or so after fledging) before full adult feathers begin to appear on the chick (*Kaplan 2007*).

11 ARTIFICIAL REARING

11.1 INCUBATOR TYPE

A commonly used form of incubator for birds eggs is the Brinsea Octagon 20 ECO Incubator which includes wet bulb thermometer and an auto turn, fan forced air system allowing for circulation of air creating a constant temperature. The incubator has soft steel dividers giving better air flow through the machine and helps avoid damage to the egg during turning.

Kaplan (2007) observed that in multiple, wild breeding Tawny Frogmouths the eggs were only turned when one parent took over the incubation shift. Essentially this means that Tawny Frogmouth eggs only need to be turned once every twelve hours. However studies conducted by Kuehler and Good (1990) found that that increasing the frequency of egg turning s did not hinder the success rate.

This particular incubator type controls temperature accurately with proportional band electronic controller with easy tamper-proof adjustment. A flashing indicator shows that the incubation temperature is controlling steadily and temperature is monitored with a conventional but accurate liquid in glass thermometer. Throughout the incubator air is circulated by a long life computer grade fan, coupled with a unique grill with optimised air diffusers which leads to extremely even air temperature throughout the egg chamber.



Figure 11.1: Brinsea 20 ECO Octagon Incubator. (<http://www.brinsea.co.uk/>)

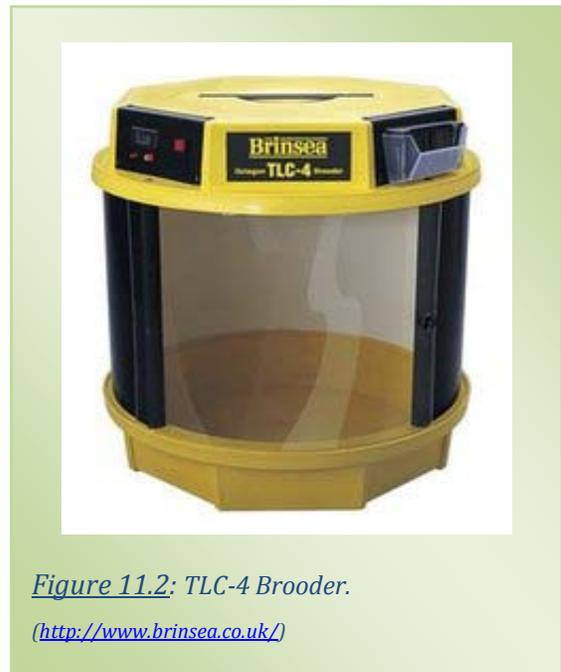


Figure 11.2: TLC-4 Brooder. (<http://www.brinsea.co.uk/>)

Fresh air is controlled with a vent slider and humidity is provided by water in two reservoirs in the base (<http://www.brinsea.co.uk/>).

11.2 INCUBATION TEMPERATURES AND HUMIDITY

Kuehler and Good (1990) found that incubating Tawny Frogmouth eggs at the following temperature and humidity; *Dry Bulb* – 37.2°C, *Wet Bulb* – 30-31.1°C, *Relative Humidity* – 61.5%, resulted in the highest hatching success rate in the eggs.

11.3 DESIRED % EGG MASS LOSS

During the normal 28 – 31 day incubation period it would be expected the Tawny Frogmouth egg would lose 13.5%. Any more than this will result in the egg dehydrating and decreasing the chance of hatching exponentially (*Kuehler and Good 1990*).

11.4 HATCHING TEMPERATURE AND HUMIDITY

During hatching the temperature needs to be lowered slightly to, however humidity has to be raised to minimise the risk of dehydration; *Dry Bulb* – 36.9°C, *Wet Bulb* – 31.1 – 32.2°C, *Relative Humidity* – 69%.

11.5 NORMAL PIP TO HATCH INTERVAL

Tawny Frogmouths don't emerge from their egg in the same fashion as other birds. Most birds hatch by cutting a circle in the blunt end of the egg with their egg tooth. Tawny Frogmouths hatch by dividing the egg in half along the axis. The pip to hatch interval in Tawny Frogmouths can vary significantly from 23 hours to 42 hours depending on the size of the egg, thickness of the shell and strength of the chick (*Kaplan 2007*).

11.6 BROODER TYPES/DESIGN

This brooder type is of the same brand as the previously mentioned incubator (*Seen in Figure 11.2*), with similar electronic temperature control and fan ventilation system that allows for even temperature distribution throughout the entire chamber. Housed within the ventilation system are a series of air filters which serve to remove harmful bacteria and fungi, thus minimising the risk of respiratory infections at this early stage of development. Humidity is controlled in much the same way as the incubator utilizing a wet and a dry bulb thermometer.

11.7 BROODER TEMPERATURES

The brooder should be set to the hatching temperature of 36.9°C for the newly hatched chick. This temperature should be gradually reduced by about 1°C per day until it is at about 25°C (*Holland <http://www.cmag.org.nz/>*).

11.8 DIET AND FEEDING ROUTINE

There are a number of diets that can be offered to juvenile Tawny Frogmouths from hatching. However there are two that I would tend to prefer for their ability to be divided into portions suitable for a juvenile Tawny Frogmouth without risking compromising the dietary content.

The first Consists of the following ingredients;

- 100g low fat mince (preferably preservative free; or mince up heart)
- 1 finely chopped hard-boiled egg (include the finely ground shell)
- 1 heaped tablespoon of Wombaroo Insectivore rearing mix

This should be mixed to form a moist crumble and fed in small portions (balls less than 1 centimetre in width) to the chick (<http://www.epa.qld.gov.au/>).

The second mixture is very similar to the first and consists of;

- 100 g low fat mince (minced heart is best)
- 1 finely chopped hard-boiled egg (include the finely ground shell)
- 1 heaped teaspoon of ground dog kibble
- 1 heaped teaspoon of unprocessed bran
- 1 pinch of calcium powder
- 1 pinch of Ornithon (or other bird multivitamin)

Once again this should be mixed to form a moist crumble and fed in small portions (balls less than 1 centimetre in width) to the chick (<http://www.epa.qld.gov.au/>).

It is of vital importance to ensure that the mixtures are moist as the Tawny Frogmouth relies on obtaining water from its food. In the nest when being raised by the parent, the first feeding would take place about 24 hours after hatching. As such I would recommend that the same be done in an artificial setting.

Until the chick opens its eyes it will be necessary to stimulate it to open its mouth for food. This can be done by very gently tapping the beak. When the chick opens its mouth it will then be possible to place a small piece of the food mix into its mouth. The pieces must be kept smaller than 1 cm in diameter. Although the Tawny chick would be able to take slightly larger food items, it is better to be safe than sorry. One to two small balls of the mixture of this size should be fed to the chick 3 times a day (*Kaplan 2007*).

As the chick gets older the regularity of the feedings should be maintained, simply increasing the size of the food items gradually as the chick grows.

11.9 SPECIFIC REQUIREMENTS

Tawny Frogmouth chicks generally fledge at about 30 days of age however in the wild their parents would spend several months teaching them how to hunt and survive. As such if a Tawny Frogmouth orphan is to be re-released into the wild I would recommend that it be raised by a foster parent of the same species. This will ensure that they have the necessary 'education' so to speak. Furthermore this will reduce the risk of imprinting on the chick.

11.10 PINIONING REQUIREMENTS

Pinioning is not required or recommended for Tawny Frogmouths. Generally speaking they are very placid birds and in my experience the same result can be achieved simply through wing clipping which does not permanently affect the bird's ability to fly.

11.11 DATA RECORDING

During the incubation process it is important to ensure that constant weights of the egg are being made to ensure that it is not losing too much weight and to allow for adjustments that may need to be made to the humidity as a result. Weight loss of the egg should be linear over the incubation period and comes to a mass loss of about 0.482 – 0.435% per day. I won't speculate as to the exact mass measurements of this as Tawny Frogmouth eggs can vary in size by almost a third depending on the subspecies and region from which they originate.

Furthermore once the chick has hatched, weights must be taken at least every second day to ensure that it is gaining weight in a linear fashion, as shown in *Figure 11.3*. All in all this mass gain of the chick should be linear.

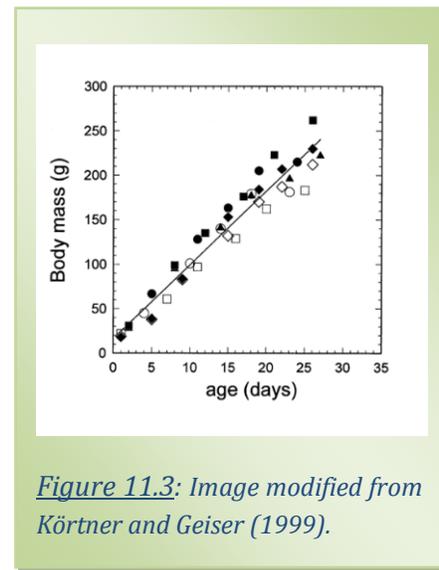


Figure 11.3: Image modified from Körtner and Geiser (1999).

11.12 IDENTIFICATION METHODS

Individual chick in a single clutch can be identified from one another based on size. Tawny Frogmouth eggs hatch at intervals of 2 – 3 days resulting in significant and easily visible size differences between the chicks. Chicks that are from different clutches can be identified using temporary plastic leg bands. These are easily removable as the birds grow or when they are released.

11.13 HYGIENE

It is important to ensure that the brooder and the nest are kept as clean as possible. Bedding material should be changed daily to prevent excess faecal build up and the brooder should be cleaned at least once a week to prevent the build up of bacteria within the chamber.

11.14 BEHAVIOURAL CONSIDERATIONS

Serious issues can exist when Tawny Frogmouths are being hand raised. These birds pair up for life and sexual imprinting can occur as they have a tendency to perceive their human carer as a potential mate. This is more of an issue with males than females. This issue can be reversed through training with an adult Frogmouth of the opposite sex. When hand rearing Tawny Frogmouths to minimise the potential for imprinting I would recommend raising the chick in a group. Even if the others in the group are adults this will work in the favour of the chick as it will almost completely nullify the chance of any imprinting (*Kaplan and Rogers2001*).

11.15 USE OF FOSTER SPECIES

The only other species of Frogmouth that could potentially be used as fosters are the Marbled and the Papuan Frogmouths. These however are significantly rarer than the Tawny Frogmouth. Tawny Frogmouths themselves are a very common species as such it would be far easier and more practical to find other parents of the same species. In many cases other Tawny Frogmouths will willingly care for orphaned chicks almost immediately upon introduction (*Kaplan 2007*).

11.16 WEANING

Tawny Frogmouth chicks will fledge at between 27 – 31 days after hatching but will continue to need feeding for at least three weeks after this stage. In many cases the young will remain with the parents for quite some time so it is important to ensure that the young is slowly weaned onto more natural foods such as mice.

About a week prior to fledging, insects such as mealworms and cockroaches should be added to the daily feeding mix. Once the bird has fledged live foods such as cockroaches and snails (both natural wild food items) added to the cage at night will help to encourage natural hunting behaviour. The chick must be observed to ensure that it is trying to actively hunt these new food items.

11.17 REHABILITATION PROCEDURES

Rehabilitation of Tawny Frogmouths can be greatly improved with the presence of another healthy, adult bird. The young or inexperienced bird will be able to gain experience from the older one. As well as that, adult Tawny Frogmouths, particularly breeding pairs will instinctively care for other young birds. It is important in these circumstances to ensure that the diet is as close to the natural wild diet as possible, particularly if the bird is intended for release.

12 ACKNOWLEDGEMENTS

Thanks go to Symbio Wildlife Park for allowing me access to the Tawny Frogmouths within their collection for the purpose of writing this manual.

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15 GLOSSARY

16 APPENDIX

Appendix 1: Wombaroo Insectivore Mix

Website: http://www.wombaroo.com.au/insectivore_rearing_mix.htm

Ingredients: Whey protein, soy protein, meat meal, fish meal, blood meal, cereal bran, lysine, methionine, vegetable oils, omega-3 and omega-6 fatty acids, vitamins A, B₁, B₂, B₆, B₁₂, C, D₃, E, K, nicotinamide, pantothenic acid, biotin, folic acid, choline, inositol, calcium, phosphorus, potassium, sodium, magnesium, zinc, iron, manganese, copper, iodine, selenium.

Analysis:

Min Crude Protein	52%
Min Crude Fat	12%
Max Fibre	5%
Max Salt	0.8%

Appendix 2: Passwell Bird Multivitamin Supplement

Website: <http://www.wombaroo.com.au/multivite%20for%20birds.htm>

Ingredients:

Retinol (Vitamin A)	300 mg	Phytomenadione (Vitamin K)	1400 mg
Thiamine (Vitamin B ₁)	12000 mg	Biotin	150 mg
Riboflavin (Vitamin B ₂)	10000 mg	Folic Acid	1100 mg
Niacin (Vitamin B ₃)	30000 mg	Copper (Cu)	100 mg
Pantothenic Acid (Vitamin B ₅)	15000 mg	Iodine (I)	40 mg
Pyridoxine (Vitamin B ₆)	6000 mg	Potassium (K)	5000 mg
Ascorbic Acid (Vitamin C)	35000 mg	Magnesium (Mg)	2000 mg
Cyanocobalamin (Vitamin B ₁₂)	26 mg	Manganese (Mn)	1000 mg
Cholecalciferol (Vitamin D ₃)	17 mg	Selenium (Se)	10 mg
d-a-tocopherol (Vitamin E)	30000 mg	Zinc (Zn)	2000 mg

Directions for Use: To supplement the diet of all birds, where levels of vitamins and minerals are low. Contains anti-oxidants to enhance the health of birds. May be added to water, soaked seed, or food preparations. Prepare fresh daily. Store below 30°C.

Dosage:

In Drinking Water: Add 1g per litre of water

In Soaked Seed: Add 2g per kg of soaked seed. Ensure that Multi-Vite is well mixed into any food preparations.

Appendix 3: Avi-Cal Plus

Website: www.avitec.com

Analysis: Calcium 96%

Minerals 3%

Vitamins 1%

Ingredients: calcium phosphate, calcium carbonate, steamed bone meal, oyster shell grit, iodide salt, yeast, Nutra-vets Special Milk Protein Concentrate, diabasic calcium phosphate USP, liver powder, d-alpha tocopherol acetate, magnesium oxide USP, ascorbic acid USP, ferrous fumarate USP, choline chloride, paraaminobenzoic acid NF, Vitamin A acetate USP, d-calcium pantothenate USP, pyridoxine hydrochloride USP, inositol carithaxanthin NF, zinc oxide USP, citrus biflavanoids complex, Hesperidine complex, beta carotene FCC, cholecalciferol (Vitamin D3) USP, Rutin NF, Folic Acid USP, sodium selenite, potassium iodide USP, Menadione NF (source of Vitamin K), Cyanacobalamin concentrate USP (source of Vitamin B12), biotin, silicon oxide.