

Code of Practice

Wildlife management

Captive reptile and amphibian husbandry

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Nature Conservation Act 1992



Table of Content

1. About this code	5
2. Reptiles and amphibians of Queensland	6
3. Definitions	6
4. Aims of herpetology	6
5. Purpose of code	7
6. Acquisition of reptiles and amphibians	7
7. Selling and giving away reptiles and amphibians	8
8. Take from the wild	8
9. Repatriation of the progeny of wild-caught amphibians	9
10. Requirements for safe transport	10
Containers	10
Thermoregulation.....	12
Airfreight	12
11. Records	13
12. Collection of feed skinks	13
13. Euthanasia	14
14. Captive husbandry	15
Hygiene	15
Thermal biology	15
Water requirements	16
Behaviour of healthy animals.....	17
Management of social behaviours in captivity	18
Photoperiod	18
Housing requirements.....	19
15. Amphibians	19
Eggs and tadpoles	19
Housing	19
Diet	20
Frogs	20
Behaviour of healthy frogs	20
Housing	21
Diet	22
Captive breeding of frogs	23
16. Reptiles	23
Freshwater turtles	23
Housing	23
Diet	24
Lizards	25
Housing	25
Diet	26

Dragon lizards (Family Agamidae).....	27
Housing	27
Diet	28
Monitors and goannas (Family Varanidae)	28
Housing	29
Skinks (Family Scincidae).....	29
Housing	30
Diet	30
Geckoes (Family Geckonidae).....	31
Housing	31
Diet	32
Legless lizards (Family Pygopodidae).....	32
Housing	33
Diet	33
Snakes (Families Typhlopidae, Boidae, Acrochordidae, Colubridae, Elapidae, Hydrophiidae and Laticaudidae)	33
Housing	34
Blind snakes (Family Typhlopidae)	35
Housing	35
Diet	35
Pythons (Family Boidae).....	36
Housing	36
Diet	37
Aquatic and semi-aquatic snakes (Families Acrochordidae (file snakes), Colubridae (Homalopsids), Laticaudidae (sea kraits) and Hydrophidae (sea snakes)).....	38
Housing	39
Diet	39
Elapids and terrestrial colubrids (Families Elapidae and Colubridae).....	40
Housing	40
Diet	42
17. Dangerous snakes	43
Security requirements for dangerous snakes	43
Equipment required for handling venomous snakes.....	44
Standards for the captive maintenance of dangerous snakes	45

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1. About this code

This code provides minimum acceptable standards for the taking, keeping and use of reptiles and amphibians in Queensland. It also outlines some of the conditions for the conduct of persons involved in the taking, keeping and use of herpetofauna in Queensland. Requirements concerning captive husbandry, transport of herpetofauna and collecting procedures can be found in the Table of Contents.

This code is intended as a resource for recreational keepers, but may be useful to many types of people, including herpetologists, animal welfare experts and researchers.

This code should not be read in isolation. It must be read in conjunction with the *Nature Conservation Act 1992* ('the Act'), the *Nature Conservation (Wildlife Management) Regulation 2006* ('the Wildlife Management Regulation'), the *Nature Conservation (Administration) Regulation 2017* ('the Administration Regulation'), the *Nature Conservation (Wildlife) Regulation 2006* ('the wildlife Regulation'), the *Animal Care and Protection Act 2001* and any other relevant legislation.

The Act provides that a person must not take, keep or use a protected animal unless the person is an authorised person or the person is authorised under the Act.

A person wishing to keep and use reptiles or amphibians for recreational purposes needs a recreational wildlife licence. Licence holders should make sure they are familiar with the relevant sections in the Act and the Regulation.

The *Animal Care and Protection Act 2001* deals with matters such as cruelty, duty of care to animals, feeding of live prey to animals and humane killing of animals. These are all issues of importance to persons keeping animals in captivity.

People who keep reptiles and amphibians also need to consider other laws, including those made by local government that may deal with the keeping and use of animals (including reptiles and amphibians). If you obtain a licence under the Act that does not specify a limit on the number of animals that you may keep under the licence, local government may still limit the number of animals you may keep within their respective jurisdiction. If you are uncertain about the laws that apply in your local area you should contact your local council.

This code is based on the knowledge and technology available at the time of publication. To maintain high standards of animal welfare and avoid personal injury, it is essential that a commonsense approach prevail at all times when dealing with reptiles and amphibians.

The basic behavioural, anatomical and physiological needs of various reptiles and amphibians are considered in this code.

The importance of knowledge of the particular species involved cannot be overemphasised. A sound knowledge of particular species enables the early detection of signs of distress and disease, so that the cause can be identified, and prompt, appropriate remedial action taken.

The basic requirements for the wellbeing of native animals are:

- a) appropriate and sufficient food and water to sustain health and vitality;
- b) sufficient area with appropriate environmental features to maintain their well-being and in which they can exhibit normal behaviour;
- c) protection from predation;
- d) protection from injury and disease, including providing veterinary treatment;
- e) protection from extremes of climate, particularly when young or injured; and

- f) protection from pain, distress and suffering.

2. Reptiles and amphibians of Queensland

General information:

Queensland has the largest number of species of frogs and reptiles of any Australian state. Cogger (1992) lists as occurring in Queensland – 110 species of frogs, 17 species of turtles, 248 species of lizards, 107 species of snakes (including sea snakes) and two species of crocodiles.

This code is designed to provide basic information on the requirements of captive herpetofauna but does not provide specific information for each of the 484 species.

The herpetofauna of Queensland includes many rare and localised species of amphibian and reptiles, as well as abundant and widespread species. Some species range widely throughout the state, e.g. Gould's monitor, *Varanus gouldii*, while others are restricted to localised areas, e.g. green python, *Morelia viridis*.

The herpetofauna of Queensland also includes some of the most dangerous land snakes in the world, Australia's largest python species and the richest communities of rainforest species. The ecology, natural history and conservation status of many of these animals are poorly known and additional species are continually being discovered and described.

Although the use of scientific names has been kept to a minimum in this code, it is sometimes necessary and often convenient to refer to an animal by its scientific name. Many species of Australian herpetofauna do not presently have recognised common names and it is only by referring to the scientific name that we can accurately identify particular animals.

The novice recreational reptile keeper is encouraged not to be intimidated by the seemingly incomprehensible Latin or Greek names which often identify a distinctive feature of the species or an interesting aspect of the animals history. In learning more about the reptiles and amphibians of Australia, the scientific names are a vital tool for communication.

3. Definitions

In this Code of Practice –

adult	where minimum cage sizes are described for adult specimens, an adult reptile or amphibian means any individual whose snout-vent length or total length falls within the size recorded for that species in Cogger (1992).
herpetofauna	any species of frogs, lizards, snakes or turtles including their eggs, tadpoles or other non-adult forms and is used as a substitute for the term 'reptiles and amphibians'.
herpetology	the breeding and keeping of reptiles and amphibians in captivity for non-commercial, or hobby purposes.
minimum standards	minimum requirements that must be complied with to ensure the likelihood of escape, injury or ill-health to captive herpetofauna is minimised.

Other terms are defined in the Act and the Regulations.

4. Aims of herpetology

The aims of herpetology are the:

- a) maintenance of herpetofauna in a captive environment;

- b) acquisition of knowledge of the biology and behavioural ecology of herpetofauna through the study of reptiles and amphibians in captivity; and
- c) maintenance of the genetic integrity through sound captive breeding management
- d) conservation of various species and particularly those whose numbers are falling in the wild.

5. Purpose of code

The purpose of this code is to:

- a) provide standards for the safe housing and maintenance of native reptiles and amphibians in captivity, which ensure that the likelihood for escape of, injury or illness to the herpetofauna is minimised; and
- b) describe protocols for the collection and repatriation of native reptiles and amphibians, in order to protect and conserve wild populations.

6. Acquisition of reptiles and amphibians

General information:

- It is recommended that any person wishing to acquire herpetofauna for the first time should learn as much as possible about the species before acquiring any animal. Reputable breeders will not supply animals to people who do not hold the necessary licence and demonstrate or possess an appropriate level of knowledge, skills and experience.
- It is important that recreational and educational value is not mistakenly linked to rarity. Since least concern species are frequently hardier in captive situations than some threatened species, keepers' efforts should be directed at those animals most likely to thrive rather than towards 'prestigious' species.
- Holders of a recreational wildlife licence should plan and structure acquisitions towards the study of aspects of the life history of the species held (e.g. social behaviour, growth, reproductive biology and welfare needs).
- Care is needed when acquiring captive herpetofauna to ensure that the individuals to be acquired are free from disease and external parasites. Some parasites, which affect reptiles in captivity, include the native red or orange mites that feed off body tissue and the snake mite (*Ophionyssus natricis*) that feeds off blood tissue. While parasites of any nature will affect the behaviour and stress levels of a captive reptile, the snake mite can cause severe health issues leading to the death of reptiles if left untreated.
- Snake mites reproduce very quickly and build up to high numbers, causing infections from their feeding, especially within nostrils, skin folds and eyes. If left untreated, they have a serious effect on both snakes and lizards (there is evidence that the mite may be a vector for disease transfer and may be very difficult to eliminate when not kept in check).
- Early detection of parasitic infestation is vital to ensure the health and well-being of captive reptiles and amphibians. Where mites have been present in a collection, keepers should conduct regular close inspections of all specimens for the early indications of mite infestation (tiny white spots, raised scales, body or snout-rubbing).

Minimum Standards:

- People who acquire a new specimen must quarantine the animal from other captive reptiles or amphibians for a minimum period of seven days.

- To minimise the likelihood of spread of disease, both from wild stock to captive stock and vice versa, animals taken from the wild under a damage mitigation permit or a rehabilitation permit must not be housed with captive-bred animals.
- Animals must be inspected thoroughly for parasites (including native red or orange mites and the snake mite) under bright light within 24 hours of acquisition.
- If any parasitic infestation is detected or the animal shows signs of illness, the animal must immediately be taken to a registered veterinarian, preferably a veterinarian who specialises in reptiles and amphibians for advice and treatment, and all housing material and cage furniture must be sterilised.
- Diseases that are relatively recent arrivals to Australia may pose a serious threat to Australian native reptiles and amphibians. Any person who suspects that one or more reptile or amphibian in their collection may have any form of exotic reptile disease (e.g. inclusion body disease or ophidian paramyxovirus) must quarantine their collection immediately and notify the Department of Environment and ().
- Housing material and cage 'furniture' that is being moved from one cage to another, particularly between different keepers' residences, must be inspected thoroughly and sterilised before placement in an animals' enclosure.

7. Selling and giving away reptiles and amphibians

General information:

- Herpetofauna must not be sold or given to any person who does not have the appropriate licence or the appropriate skills necessary for the proper care of that animal. It is also illegal to buy or accept wildlife from another person who is not lawfully keeping the animal.
- It is illegal to sell and give away, or buy and accept a protected animal if the animal shows signs of illness or injury, without the written approval of the chief executive. A reptile that has a parasitic infection will ordinarily show signs of illness.
- Movement of herpetofauna across state boundaries is subject to the law of both jurisdictions. Consult the relevant conservation authorities for advice on permits for the interstate movement of herpetofauna.

8. Take from the wild

General information:

- The Wildlife Management Regulation authorises the collection of a limited range of amphibians from the wild without a licence. This authority applies to unlicensed persons only and allows the person to take least concern amphibians from the persons' own land and keep them on their own land.
- The collector needs to understand that captive maintenance of the specimen taken may require substantial effort as well as time and money. Conditions outlined in section 9 of this code, *Repatriation of the progeny of wild caught amphibians*, will apply to the release of captive specimens and the keeper must be familiar with these before taking any specimen from the wild.
- Collectors should only take sub-adult specimens. Importantly, collectors should avoid taking specimens of breeding age or gravid (pregnant) females from the wild, as they will contribute to the maintenance of the wild frog population.

Minimum standards:

- A person must not take any species of amphibian from the wild without a sound knowledge of the particular requirements of that species in captivity.
- Amphibians should only be taken from areas where the species exists in abundant and secure populations, rather than from areas with fragmented or remnant populations.
- Collectors must collect amphibians in a way that avoids damage to the animals themselves, their population and their habitat. In particular, collectors should avoid destructive collecting practices such as damaging, turning or lifting rocks or vegetation.
- Not all amphibians are suitable for captivity. Some individuals within a species may be more susceptible to stress than others. Subject to any specific requirements about the release of wildlife to the wild, any animal showing excessive signs of stress must be returned to the original place of collection.
- Repatriation of Australia's native amphibians are threatened by a pathogenic fungus, *Batrachochytrium dendrobatidis*, known as amphibian chytrid fungus, which causes the progeny infection known as chytridiomycosis. Keepers must be aware of this disease and its symptoms and have an intimate knowledge of the Threat Abatement Plan – "Infection of amphibians with chytrid fungus resulting in chytridiomycosis" developed by the Australian Department of Environment and Heritage under the *Environment Protection and Biodiversity Conservation Act 1999* when considering taking wild amphibians.

9. Repatriation of the progeny of wild-caught amphibians

General information:

- In general, the release of native animals that have been kept or bred in captivity is an offence, unless acting under a licence that authorises the release of wildlife, or a special approval of the chief executive. In relation to amphibians however, under the Wildlife Management Regulation, a person who does not hold a licence, permit or other authority may take and keep a least concern amphibian from the wild. The amphibian is to be kept on the persons own property for their own enjoyment. The person must release all progeny of wild-caught amphibians in their care within 7 days after the offsprings' metamorphosis, under the conditions described below. This code provides some information to ensure that the way in which amphibians are released to the wild will not impact on wild populations.

Under the Regulation, a person who does not hold a licence, permit or other authority may take and keep a common amphibian on the person's own property and must release all captive-bred progeny of amphibians in their care within 14 days of the birth or hatching, under the conditions described below.

Minimum standards:

- The genetic integrity of wild populations is important to maintain the distinctiveness of regional populations, and may be critical in protecting that population from disease and decline. Consequently, it is important the progeny of wild -caught amphibians are returned to the wild:
 - on the same property where the mother was captured, as near as possible to the point of capture; and
 - in a healthy, disease-free state.
- If doubt exists concerning the health of a specimen, it must not be released unless an experienced person (e.g. veterinarian or biologist) provides expert verification of sound health. (See chapter 8 'Take from the wild' regarding 'chytridiomycosis')

- Generally, where the isolated raising of tadpoles, or the brief maintenance of a single wild-caught animal is all that is involved, there will be little risk in returning the metamorphosed frogs to the collecting site – that is, provided that the animals have been kept in clean containers and care has been taken not to expose the animals to any exotic pathogens.
- More risk is posed where a collection contains animals from various captive sources and where there is a history of captive disease.
- In such cases, where an agreement exists in relation to the repatriation of the animals, the keeper must impose quarantine measures, and an experienced veterinarian must provide a clear bill of health before releasing captive-bred specimens into any wild population.
- Quarantine in this case means the maintenance of the pregnant animal or incubating eggs in a separate room and the use of isolation methods in husbandry; these include cleaning, maintenance and feeding of the quarantined animal with separate or sterilised equipment, and maintenance of the newly born or hatched animals in quarantine.
- The ability to hold a specimen separately from any existing captive collection is a useful precautionary measure for amateur herpetologists concerned with the successful long-term maintenance of captive herpetofauna.
- When the preceding measures have been strictly followed, and the amphibians to be released have received a clear bill of health, it is possible to release them in the area from which the parents originated.
- Juvenile herpetofauna are subject to high levels of predation in the wild, so care needs to be taken to optimise the chance of survival.
- Release the animals close to cover while they are at a body temperature which permits normal escape behaviour.
- Choose release sites which are suitable microhabitat, and which have adequate cover.
- Release the animals away from roads, at spaced intervals, and at a time of day that permits normal behaviour (e.g. at night for nocturnal species).

10. Requirements for safe transport

Containers

General information:

- Transportation of reptiles and amphibians can cause stress to the animal. Careful planning to minimise the impact on the animal must be considered before consigning animals for transport and commencing the journey.
- The main principle of safe transport for animals is to minimise the period the animal spends in transit or in its transit container.
- The Wildlife Management Regulation sets out the requirement for labelling of containers for the transporting of wildlife. The relevant sections should be read in conjunction with the following sections of this code.

Minimum standards:

- Containers must be:

- free of loose thread or other imperfections that may enable an animal to become entangled or injured;
- free of holes or any other possible escape routes;
- locked or secured to prevent the animal from getting loose in transit or otherwise being interfered with by another person;
- washed out or replaced daily, as waste materials accumulating in bags can injure or kill the occupants; and
- of a suitable size and design to move an animal, whilst ensuring that it is not overcrowded and that it does not become overheated during transportation.
- Frogs must be transported:
 - in moist substrate;
 - no more than one frog should be placed in a container; and
 - frogs should not be transported in wet bags, which can suffocate animals.
- Turtles must be transported:
 - in containers with a damp substrate;
 - individually or, if more than one animal is to be transported in the same container, the container should be partitioned to prevent the animals' shells from becoming damaged; and
 - in an upright position. Care should be taken to ensure that turtles cannot turn over to a position where they would be unable to right themselves.
- Aquatic snakes (families Hydrophiidae, Laticaudidae or Arafuridae) must be transported in damp cloth bags with sufficient padding inside the bag to prevent the snake suffocating.
- Transporting lizards and terrestrial snakes:
 - lizards and non-venomous terrestrial snakes must be transported in secure cloth bags, with attention paid to the following:
 - o for long-term transport (greater than three hours) larger goannas (monitors) must be individually accommodated in stout bags of jute or canvas, as they will easily tear lighter fabric with their powerful claws;
 - o in the case of short-term transport (less than three hours) two or three similar sized individuals of the same species may be placed in the same cloth bag; and
 - o care must be taken to ensure that any animals transported in the same enclosure are compatible and are not members of species likely to injure or eat each other.
 - venomous snakes require special treatment for safe transport because of the potential threat they pose to people who open the container. In particular:
 - o only one snake must be placed in each bag for transport; and
 - o bags containing dangerously venomous snakes must be securely tied and placed inside another securely tied bag. Bags containing dangerous snakes must be placed in a secure container with rigid walls and a locked lid. This will minimise the risk of injury to other people because venomous snakes are capable of biting through cloth bags; and

- o the outer container must be labelled and in particular must specify the name of the species, the number of animals it contains and the fact that the animal is a dangerous snake.

Thermoregulation

General information:

- Maintenance of appropriate temperature levels is critical for the safe and humane transport of live herpetofauna. If the thermal environment is not suitable, animals may suffer stress or die in extreme conditions.
- Ideal transport temperatures for reptiles vary according to species. Generally, no reptile being transported should be exposed to temperatures higher than 30 deg. or lower than 12 deg.
- Frogs should generally not be exposed to temperatures higher than 25 deg. or lower than 12 deg.
- The control of temperature is best achieved by placing the bags containing live herpetofauna in an insulated container (e.g. polystyrene esky).
- It is desirable to avoid transporting herpetofauna in cars for long distances during extremely hot weather. If possible, animals should be transported as airfreight during temperature extremes.

Minimum standards:

- The temperature inside an animal's transport container should be monitored using a thermometer placed in the container with the animals, especially during hot conditions (>30 deg. ambient temperature).
- Live animals in bags must not be stacked upon each other but can be placed in separate rigid cardboard containers in the same insulated container.
- Containers must not be left in the sun or in parked cars in the sun, even for brief periods.
- Animals must be provided water during transport only if it is likely that the time required for transport will be in excess of one day, or for a shorter period on particularly hot days (>30 deg. ambient temperature).
- During periods of extreme heat, ice must be placed into the insulated container in a place where the animal cannot come into direct contact with it. If it is not possible to place ice into the container with an animal, a wet cloth should be placed over the animal to facilitate cooling.

Airfreight

General information:

- The objective of air freighting wildlife is to minimise the amount of time the wildlife spends in transit. Liaison with freight-handling staff and immediate collection of animals at the destination are important in achieving this outcome.
- If animals are to be air freighted the animals should be housed in secure and thermally suitable containers as per the requirements specified in the above sections on *Containers* and *Thermoregulation*.
- Permits to transport animals must be obtained prior to moving the wildlife and should be presented to airline staff and a copy attached to the transport container.
- International Air Transport Association (IATA) rules may also apply to the consignment of animals through airfreight.

Minimum Standards:

- Animals must be packed in a way that minimises undue movement or jarring during flight and landing. If a small specimen travels alone in a large container, empty space around the animal should be packed firmly with crushed newspaper (or similar packing material).
- Containers must be secure to prevent the animals' escape. For some species, such as frogs, small to medium sized lizards, turtles and non-dangerous snakes, a polystyrene container that is taped shut will be adequate to prevent the animals' escape.
- Adequate ventilation, by way of air holes, must be supplied.
- If more than one animal is to be transported, the container must be partitioned to ensure that the animals do not injure or crush each other. Using rigid panels (e.g. cardboard) and masking tape to compartmentalise the interior of a container is suitable.

11. Records

General information:

- The Wildlife Management Regulation and the Wildlife Administration Regulation sets out the requirements for records that must be kept by the holders of a recreational wildlife licence. There is certain information that must be recorded in the record book, including the sex of each animal. The sex of most snakes is difficult to determine and you may require assistance from a veterinary surgeon or other highly experienced reptile keeper to determine this.
- Keepers must also record any birth, death or transaction involving reptiles kept under the licence. This information must be entered into the record book.
- In addition to these requirements, it is recommended that keepers retain the following records:
 - plastron and carapace measurements for each turtle;
 - recording notes and observations on behaviour and health are vital parts of captive husbandry, enabling a chronological record of any patterns or problems that occur; and
 - the place of origin of the individual, when the specimen was acquired, species name, sex, age if known, distinguishing features if any and general condition. Further notes on feeding, fasting, social interaction, breeding and any other aspects of behaviour can be made.

12. Collection of feed skinks

General information:

- Provision is made in the Wildlife Management Regulation for the collection of seven species of least concern skinks as food for exclusively lizard-eating (*saurophagous*) species of herpetofauna, principally small snakes. It should be noted that the Wildlife Management Regulation does not permit the use of frogs as feed animals.
- The seven species of skink are:
 - a) *Carlia pectoralis*;
 - b) *Carlia vivax*;
 - c) *Cryptoblepharus carnabyi*;
 - d) *Cryptoblepharus virgatus*;
 - e) *Ctenotus robustus*;

- f) *Lampropholis delicata*; and
- g) *Morethia boulengeri*.
- Before attempting to maintain in captivity species of herpetofauna which will only accept skinks as prey, it is necessary to understand the following principles:
 - the requirement to take live skinks from the wild for the maintenance of captive herpetofauna places additional pressures on the wild populations of such skinks;
 - the long-term maintenance of a pair of adult yellow-faced whip snakes, *Demansia psammophis*, for example, will require the provision of at least eight to ten skinks per week; any attempt to raise hatchling snakes, which will only eat skinks, consumes large numbers of lizards. Persons undertaking this type of husbandry are obliged to substitute other dietary items as soon as possible, and to behave conservatively and responsibly when taking skinks for this purpose;
 - common tree snakes, *Dendrelaphis punctulata*, may take small fish or eelers (baby eels); and
 - most snakes can be weaned on to pink mice if the mouse is scented initially with crushed skink.

Minimum standards:

- In order to minimise the effects of regular harvesting of local skink populations, the following recommendations must be observed:
 - spread collecting effort over as wide an area as possible – do not continue to take skinks from the same area or population;
 - provide additional cover and food resources for the feed skink population, i.e.:
 - o the provision of additional shelter and egg-laying sites will enhance survival of both individuals and the population;
 - o in practice, this can be accomplished by arranging sheets of cardboard or wet newspaper or other suitable cover around a pile of composting grass clippings or manure in a sunny location, preferably in your backyard; and
 - o the decaying vegetation attracts invertebrates which provide additional food for the skinks and the wet newspaper provides additional egg-laying sites.
 - do not take gravid (pregnant) female skinks;
 - do not take skinks from communal winter refuges;
 - rotate harvests through separate areas/populations; and
 - skinks are vectors for the transmission of nematodes which can be fatal to snakes, so care needs to be taken to recognise infected lizards.
- The presence of a large lump beneath the skin of a skink may indicate the presence of a nematode; however, apparently healthy skinks can also harbour these parasites.
- If your captive skink-eating snakes are dying from nematode infestation, you may have to freeze the food skinks before feeding them, or obtain skinks from another area. In this situation, selecting captive herpetofauna that do not require a diet of skinks may be necessary.

13. Euthanasia

General information:

- There may be times when the most appropriate treatment for a reptile or amphibian is euthanasia. Situations where an animal should be euthanasia include:
 - where the animal is suffering to such an extent that it is unreasonable to keep it alive;
 - where the animal is injured or diseased to a point where it can not reasonably be expected to recover; and
 - where no appropriate treatment for the animal is available.

Minimum standards:

- Whatever the reason for euthanasia, it is important that it is done in such a way to ensure that the animal experiences as little pain as possible. There are two acceptable methods for euthanasing reptiles and amphibians:
 - the first and most preferable method is by lethal injection. This can only be performed by veterinarians or a person trained and authorised for the use of barbiturates; and
 - the other acceptable method is by chilling and freezing. This involves placing the animal in a refrigerator for several hours. The animal will become immobilized and appear to sleep. Once this occurs, the animal can be placed in a freezer and frozen. Under no circumstances is it recommended that reptiles and amphibians be placed in a freezer without prior chilling.

14. Captive husbandry

General information:

- This code does not purport to provide keepers with information about the husbandry and breeding of all of Australia's herpetofauna.
- Keepers, and any person who wishes to become involved in herpetology, are encouraged to contact their local herpetological society to learn more about the practice of herpetology, including obtaining specialist advice about the breeding of reptiles and amphibians.

Hygiene

General information:

- Hygiene is an important factor in maintaining the health and well-being of all reptiles and amphibians.
- Reptiles and amphibians may carry zoonotic diseases – that is, diseases that are capable of being transmitted from animals to people. For example, freshwater turtles may carry strains of the bacteria Salmonella and it is necessary to establish a disciplined approach toward hygiene.
- Always wash your hands after handling reptiles or amphibians and do not eat or drink while cleaning cages or handling herpetofauna.
- Wastewater should be disposed of in accordance with your Local Government guidelines.

Thermal biology

General information:

- Herpetofauna are ectothermic (cold-blooded). This means that they rely upon their surroundings to control their body temperature.
- In contrast to mammals and birds, which maintain a relatively constant temperature, herpetofauna are capable of normal metabolic function over a wide range of temperatures.

- Body temperature is controlled throughout the day by behavioural strategies such as moving in and out of shade, altering body posture and colour and retreating to shelter. This pattern varies with nocturnal herpetofauna and between seasons.
- Captive herpetofauna need to be provided with a range of suitable microclimates so that the individual can select the temperature which best serves their current need.
- Recently fed and gravid (pregnant) animals may seek higher temperatures, while inactive animals may sometimes seek to remain cool, even immersing themselves in water.
- Before placing any reptile in a cage, it is necessary to know the temperature gradients of the cage.
- If captive herpetofauna are forced to experience temperatures substantially outside their preferred ranges, then death or illness may result. To understand what range of temperatures is available in a particular cage, it is necessary to monitor conditions at various locations in the cage with a thermometer for some time before placing an animal in the cage and to recognise the fact that seasonal change may greatly affect these conditions.
- While herpetofauna from most regions will tolerate brief exposure to cold (5-10 deg.), most species will be killed by exposure to excessive heat (>35 deg.) from which they cannot escape.
- A thermostat that turns off the heat source once a set temperature is reached is the best way to control the temperature in heated cages.

Minimum standards:

- Keepers must provide a thermal gradient by placing a heat source at one end or part of the enclosure. This will enable the animal to regulate its own temperature by moving closer to, or further away from, the heat source.
- Keepers must provide a photothermic gradient in an animal's enclosure. Since light intensity is usually linked to heat in wild conditions (that is, the warmest part of the cage should also be the brightest), a light globe usually offers the most appropriate solution. However, this may not be suitable for some secretive or nocturnal species.
- For nocturnal or more secretive species, thermal gradients must be provided in a different manner, usually by heating part of the substrate (floor) or by using coloured light globes (which reptiles generally cannot see).
- Keepers must monitor the temperature of an animal's enclosure to ensure that it conforms to the animal's normal temperature range it would experience. In outdoor enclosures, covered areas such as a pile of rocks or logs or deep burrows (>30cm) can provide animals a refuge from extremes of temperature.

Water requirements

General information:

- Herpetofauna vary widely in their requirements for water. Certain aquatic species (e.g. most file snakes) spend their entire life in water, while others (e.g. desert lizards) may get most of their water needs from their food and seldom encounter water.
- It is vital to know in advance the particular water requirements for any species before it can be properly maintained in captivity.
- Captive terrestrial herpetofauna can usually be provided with a water bowl, sufficiently low that small individuals can easily gain access and leave without drowning.

Minimum standards:

- Fresh water must be supplied for terrestrial species at least two times per week and up to three times per week if the water is becoming regularly soiled.
- Reptiles such as pythons, etc. must have enough fresh water to fully immerse themselves to assist with the process of shedding their skin.
- For hydrophilic (water-loving) species, such as Arafura file snakes, *Acrochordus arafurae*, the water must be kept clean at all times and must be of sufficient volume to enable the animal to exhibit its natural full-immersion behaviour.
- Keepers must regularly monitor the humidity of enclosures. For most species a humidity of 50 percent is sufficient. However, the humidity must be higher (possibly >70 percent) for some species that originate from tropical parts of Australia. Misting or fogging the enclosure can be used to achieve this.
- The humidity level must not be maintained by allowing the substrate to become wet, as this promotes bacterial growth and may lead to scale rot and other skin problems.

Behaviour of healthy animals

General information:

- Behaviour may be one of the greatest indicators of stress or poor welfare in reptiles and amphibians. It is essential for the recreational reptile or amphibian keeper to know what constitutes normal behaviour and appearance of captive animals.
- Any problems with health or adaptation to the environment need to be recognised early.
- Symptoms will not be noticed unless the animal is regularly inspected. This also emphasises the value of keeping records about an animals' behaviour that may assist in early diagnosis of illness, stress or disease. For example, longitudinal folds on the neck of a snake indicate extreme levels of dehydration.
- Individuals that fail to adapt to new conditions can display any or all the following symptoms:
 - failure to accept food for a prolonged period (See advice under individual family headings);
 - continually attempting to escape;
 - abrading (rubbing) the snout, even after the cage front is covered; and
 - exhibiting unusual passivity or torpor.
- The importance of an appropriate diet is crucial in maintaining the general health and well-being of reptiles and amphibians. It is essential to know the dietary requirements of each species before obtaining animals.
- Disease or parasites may also be transmitted to a captive animal through unhygienic food preparation or storage. It is important to ensure that disease or parasites are not introduced by the food used.
- Occasionally new specimens will refuse to eat until they have adapted to a new environment. It is important to be able to recognise the signs of illness such as weight loss and other signs of deterioration in the condition of each individual animal.
- Any frog that displays these behaviours is unlikely to thrive in captive circumstances. If the animal has been taken from the wild and has not been kept with or near other amphibians or reptiles it should be released at the site of capture.
- Herpetofauna generally do not like to be handled. Excessive handling is a common cause of failure to adapt and eventual death.

- While occasional captive-bred and long-term captives will accept more handling than wild-caught animals, it is necessary to keep handling to a practical minimum for most herpetofauna.
- Recently fed snakes tend to regurgitate if handled soon after feeding and snakes and lizards about to shed skin can be permanently scarred if handled during the 'opaque' period.
- The Wildlife Management Regulation does not allow a person to require an animal to do an act the animal would not normally do in the wild. Therefore the use of snakes in 'exotic' entertainment (e.g. strip tease or belly dancing) is illegal as it only demeans the animal and can detrimentally affect its health and well-being.

Management of social behaviours in captivity

Minimum standards:

- It is important that animals maintained in captivity are able to exhibit normal social behaviour. This will contribute to the health and well-being of an animal. Reptile keepers must be fully aware of the social systems of captive herpetofauna to ensure that animals are not injured or killed when they are unable to escape the attentions of dominant conspecifics (other individuals of the same species).
- Keepers must provide an enclosure that allows animals to exhibit normal social interaction. For example, animals that usually live in a solitary manner must be housed separately to other animals of the same species. This will minimise the incidence of fighting, aggression or food deprivation that will affect less dominant animals.
- Keepers must provide close supervision when introducing new animals into an enclosure (including introducing animals of the opposite sex to the enclosure for mating) to ensure that the animals do not fight and inflict injury upon each other.

Photoperiod

General information:

- The annual cycles of lengthening and shortening of daylight and the accompanying changes in temperature provide an important stimulus for wild reptiles and amphibians. For captive specimens to thrive, and especially to reproduce in captivity, some exposure to seasonal variation in day length (photoperiod) and temperature is necessary.
- It does not appear to be essential that the photoperiod regime is that of the specimens' original location. In general, animals kept without the provision of a cycle of varying day length and temperature do not thrive and rarely breed.
- Exposure of captive specimens to a suitable photoperiod is easily achieved by locating indoor cages near a window, however care is required to ensure that proximity to a window does not result in dangerously high temperatures.
- Keepers should position cages or enclosures in a location that allows the animal to experience normal seasonal fluctuations in photoperiod and temperature.

Minimum standards:

- If it is not possible to position a cage or enclosure in a position that exposes it to natural seasonal variation, keepers must provide the animal with an artificial environment that emulates these seasonal variations.

Housing requirements

General information:

- Since there is such variation in the housing requirements of herpetofauna, detailed standards and conditions are mentioned under the individual family headings

Minimum standards:

- Where minimum cage sizes are described in this code, these are the smallest cages in which the herpetofauna specified should be kept.
- However, all housing for captive reptiles and amphibians must be:
 - escape-proof;
 - free from sharp edges or coarse wire;
 - safe for the keeper, by enabling access to the animal without exposing yourself to danger;
 - located/designed so dangerously high temperatures do not occur;
 - large enough to permit normal behaviour and activity by the inhabitants;
 - easy and practical to clean;
 - well illuminated to enable effective and safe husbandry; and
 - well-drained.

15. Amphibians

Eggs and tadpoles

Housing

General information:

- Eggs and tadpoles of most species of Queensland frogs can be kept in watertight containers of sufficient size. Aquaria, large jars and plastic tubs are all potentially suitable, remembering that overcrowding will kill tadpoles. As the tadpoles grow, the density of tadpoles in the container should be reduced. If you intend to raise tadpoles, the density of tadpoles normally found in the wild should guide the optimal stocking density in the enclosure.
- Tadpoles will survive best in water taken from the place they were originally collected. Carefully monitor the chemistry of tank water, as tadpoles do not tolerate chlorinated tap water or water that is highly acidic or alkaline. Ideally, water that is allowed to stand for several days, or water to which water stabilizer has been added is best for tadpoles.
- Shallow, cool water provides the best environment and helps maintain normal oxygen levels. Water should be cleaned before it fouls.
- Tadpoles will develop faster in warm water; however, heated water holds less oxygen than cool water and will foul more quickly, so it must be aerated.
- The speed with which the tank fouls will depend upon the stocking density and whether there is a suitable filter installed (e.g. gravel base and/or a gravel filter.)

Minimum standards:

- As a general guide, an aquarium with dimensions 60cm by 40cm by 40cm (length by width by height), one-third filled with water will support 20-30 small tadpoles (e.g. eastern froglet, *Crinia signifera*, or dwarf tree frog, *Litoria fallax*) or 6-8 large tadpoles (e.g. green tree frog, *Litoria caerulea*, or barred river frogs, *Mixophyes spp.*), providing that adequate food is available and that water quality is maintained.
- Keepers must avoid housing tadpoles taken from different places together. This will help minimise the likelihood of the spread of disease, such as chytridiomycosis, within the captive population.
- Water must be cleaned at least twice a week, or more frequently if it becomes soiled.
- When cleaning the tank, one-third or less of the water in the tank must be replaced at any one time.
- Decorative objects or fixtures must be removed from the tank and irrigated in clean water regularly to avoid soiling.
- As tadpoles begin to metamorphose (change into frogs) they need to be able to leave the water. Some gently sloping solid objects, such as rocks, at water level that rise above the height of the water, must be provided to enable the metamorphlings to climb onto the objects so they don't drown.
- The handling of metamorphlings must be avoided where possible.
- Once the transformation has reached the stage where the forelimbs emerge and the tail begins to be resorbed, the small frogs need to be transferred to a terrestrial cage with a shallow water dish or, if they or their parents came from the wild, they must be released at the original collecting site after a satisfactory vet check.

Diet

General information:

- Tadpoles should be fed a diet of algae or boiled lettuce. Small quantities of dry fish food can be used as a dietary supplement.

Frogs

Behaviour of healthy frogs

General information:

- Healthy frogs are alert animals. The eyes are clear and the skin is moist.
- When frogs are starving the hip girdle is unusually conspicuous.
- Some species (e.g. the toadlets *Pseudophryne spp.* and *Uperoleia spp.*) pretend that they are dead and will remain still, even when placed on their back.
- Others will visibly exude highly toxic skin secretions if they are roughly handled or feel threatened (e.g. the Crucifix toad, *Notaden bennettii*, and related *Notaden spp.*).
- Many Australian frogs produce toxic skin secretions and care is required when handling them. Always wash your hands thoroughly, and take care to avoid putting fingers to your eyes, nose or mouth after handling frogs.

- The movement of amphibians between populations should be avoided. The anthropogenic movement of amphibians from one location to another has been identified as a possible cause of transmission of chytridiomycosis, although the evidence to support this is not conclusive. The infection of amphibians with chytrid fungus resulting in chytridiomycosis has been listed as a key threatening process under the *Environment Protection and Biodiversity Conservation Act 1999* (refer to section 8, *Take from the wild*, of this code).

Housing

General information:

- Cages for frogs should be designed with the welfare and specific natural history of the frog in mind. The type and quality of housing is important in the keeping of frogs, because it will influence how well the animals survive and ensure that they don't escape.
- Aquaria and plastic tubs are suitable containers in which to house most frogs. The more athletic species (e.g. rocket frogs, *Litoria nasuta*, and barred river frogs, *Mixophyes spp.*) can injure themselves by leaping into the cage wall when alarmed. Frogs exhibiting this behaviour are generally unsuited to life in a small enclosure, unless they show evidence of rapid adaptation to confinement.
- Most species of frogs are nocturnal and will generally hide during daylight hours, preferring to emerge and feed at night. Frogs should therefore have access to shelter or retreat sites.
- Many of Australia's frog species escape the effects of drought and excessive heat by spending long periods in an inactive state beneath the ground, digging their way to the surface following heavy seasonal rains. Therefore, it is important that each enclosure has a suitable substrate that fulfils the needs of the species it houses and provides for their natural behaviour.
- For the purposes of recommendations on captive care, the frogs of Queensland are divided arbitrarily into tree frogs and burrowing and terrestrial frogs.

Minimum standards:

- Tree frogs (mostly Hylidae and some Microhylidae):
 - Cage sizes vary according to species and number of frogs. As a general guide, the 60cm by 40cm by 40cm aquarium described above will be the minimum size required to house two adult or four half-grown green tree frogs. Larger frogs require larger enclosures.
 - The enclosure must have a tight fitting lid to ensure that the animals do not escape, as tree frogs are athletic and will invariably climb onto the lid.
 - Keepers must avoid the use of abrasive materials in the enclosure. Hard wire mesh is unsuitable as a material to construct ventilation ducts, as it is likely to cause injury to the frogs. Ventilation ducts can be made from pegboard, shade cloth or soft fibreglass mesh.
 - Cages must include a floor covering (substrate) of clean sand and/or leaf litter to a depth of at least 5cm.
 - There must be open areas on the cage floor where frogs can easily see and catch prey – a flat stone flush with the substrate serves this purpose.
 - A shallow dish of water must be provided. The lip of the container holding the water should be level with the soil.
 - Water must be replaced at least twice per week or more frequently if it becomes soiled.

- Tree frogs climb and must be provided with climbing opportunities. Tree branches, etc. are the most suitable items. Pot plants (real or artificial) are also suitable.
- The humidity of the cage must be maintained at a high level by regularly fogging or misting the enclosure. Do not leave the substrate moist, as this will promote bacterial growth.
- The substrate must be replaced at least once every three months, or more frequently if it becomes soiled or damp. If the cage begins to smell, the substrate should be replaced immediately.
- Frogs from tropical environments (e.g. the white-lipped tree frog, *Litoria infrafrenata*) will often refuse to feed through winter in temperate climates, and for these species the enclosure must be maintained between 15 deg. and 25 deg.
- Cage temperatures must be kept below 25 deg. in general.
- Burrowing and terrestrial frogs (Families Myobatrachidae, Ranidae, some Hylidae and Microhylidae):
 - Most members of the genera *Limnodynastes* and *Cyclorana* and all of the members of the genera *Uperoleia*, *Notaden* and *Neobatrachus* are burrowers. At least 15cm of sandy earth or clay must be provided, with the choice of substrate replicating the species' natural environment.
 - Two or three adults of small and moderate sized species (e.g. *Uperoleia* and *Notaden*) will require a cage 40cm by 40cm floor area.
 - Larger species like *Cyclorana*, will require larger cages – at least 60cm by 60cm floor area for one or two adults.
 - Suitable substrate must be provided in each enclosure, at a depth of at least 15cm. The type of substrate will depend on the species being kept. Suitable substrate should be covered with leaf litter or bark pieces to provide animals an opportunity to hide.
 - To simulate natural behavioural patterns, frogs must be stimulated to emerge from the ground to feed and breed by sprinkling the cage with tepid water in the warmer months.

Diet

General information:

- Captive frogs will often become tame enough to accept food from blunt-ended forceps. Timid individuals will require the prey to move past them before being stimulated to feed.
- It is possible for long-term captives to become obese and such individuals may benefit from more careful rationing of food.
- Insects can be trapped at night with the aid of a bright light positioned over a plastic funnel leading in to a jar or directly to the frog cage.
- Termites and other insects may be gathered in suitable numbers and the insect larvae that occasionally infest breakfast cereals are also suitable food for frogs.
- Some frogs are cannibalistic so, to prevent frogs from eating each other, frogs housed together should be about the same size.

Minimum standards:

- Tree frogs (mostly Hylidae and some Microhylidae):
 - Small frogs eat small insects, such as fruit fly (*Drosophila* spp.) and can be successfully raised on such a diet. These flies can be caught en masse without difficulty.

- Frogs need a varied diet. Although mealworms and cricket colonies, both of which are readily available through pet shops, are readily eaten, a more varied diet is preferable. Some frogs, including the larger tree frogs, can be trained to eat small mice; however, insects should be the main diet. Termites are a significant part of the diet for some burrowing species.
- Food must be introduced into the enclosure when the frogs are active, which is mostly at night. If insects are introduced when the frogs are not active, they may hide under leaf litter where they cannot be found. Alternatively, prey that is active at night should be provided.
- During times of the year when frogs are particularly active, food can be introduced to the enclosure every second night. However, the amount of food must be reduced if it is not being eaten to prevent excess food soiling the enclosure.
- Burrowing and terrestrial frogs (Families Myobatrachidae, Ranidae, some Hylidae and Microhylidae):
 - Food must be offered to the animal with the same frequency the animal is likely to feed in the wild. Toward the end of summer (wet season), frogs must be offered food until they eat no more and then permitted to burrow deeply to resume the inactive phase of their lifecycle and the cage should be allowed to dry out.
 - The diet for burrowing and terrestrial frogs is similar to that for tree frogs; however, some arid zone frogs (e.g. the Crucifix toad) eat large numbers of termites.

Captive breeding of frogs

General information:

- Captive reproduction of amphibians or reptiles should not be undertaken without a suitable plan for the disposal of offspring. The Wildlife Management Regulation prohibits the release of captive-bred frogs other than those taken from the wild or under a licence, permit or other authority that specifically authorises the release of frogs to the wild. Frogs from the wild must be returned to the exact location where they were collected. If any doubt exists concerning this, frogs must not be released (refer to section 8, *Repatriation of the progeny of wild caught amphibians*, of this code).
- It can be very difficult to breed native frogs in captivity. Some species will only breed if the enclosure has particular environmental characteristics. For example, some species will only breed in running water.
- Breeding captive frogs requires a good understanding of the biology of each species, as egg laying sites and mating behaviour vary widely. It is generally difficult to breed frogs in captivity so you should exercise restraint in buying equipment with the expectation of breeding frogs from the outset; it is likely that you won't be successful.
- Many burrowing species deposit eggs in any temporary pond and may lay in the cage if it is flooded to a shallow depth.
- Most tree frogs assemble around suitable creeks or ponds during the breeding season to mate and lay eggs. A cage with circulating water, as described by Cogger (1992), provides the stimulus necessary to breed stream-breeding species of frogs.

16. Reptiles

Freshwater turtles

Housing

General information:

- Turtles live for extremely long periods – before accepting the responsibility of captive maintenance of a turtle, the recreational reptile keeper needs to be aware that this can be a very long-term task.
- If a child loses interest in a pet turtle, the animal must be disposed of to a person with a relevant licence. Under no circumstances should it be released to the wild.
- Large turtles are capable of inflicting serious bites and care is needed in handling them.
- The freshwater turtles of Australia spend most of their lives in water, where they feed, mate and sleep. All turtles leave the water to lay eggs and to bask in the sun. Some turtles are known to travel long distances over land to colonise new water bodies.
- Smaller turtles may be kept indoors in aquaria if provided with a good diet and the opportunity to emerge from the water and bask under a heat lamp and an ultraviolet light of the appropriate spectrum for reptiles. Be careful of high temperatures as baby turtles dehydrate easily.
- A sloping approach is required so turtles can easily leave the water, as it is possible for turtles to drown if they cannot easily leave the water.
- People proposing to keep turtles are encouraged to discuss turtle husbandry with experienced herpetologists or obtain information from literature before purchasing the animal. There are many suitable publications that discuss the husbandry of native turtles.

Minimum standards:

- A turtle must not have a hole drilled in its shell or be tethered in any way. Escape-proof fencing should surround turtle enclosures. Wire mesh is not a suitable fencing material, as turtles may become entangled and injured, and are likely to climb over it.
- Enclosures for freshwater turtles must include areas of water large enough for the animal to fully submerge and move around underwater and an area of dry land.
- An aquarium 60cm by 40cm by 40cm will be required to accommodate a single turtle of 10cm carapace length or less, or two hatchlings. Turtles larger than 10cm carapace length will need larger cages. However, a pond 2m by 2m by 50cm deep, with an equal area of land, will accommodate three turtles with carapace length of 30cm (Cann, 1978), and is preferable.
- Turtles, especially young turtles, must be placed in an area where they are exposed to sunlight or ultraviolet radiation at least three times each week. Importantly, the enclosure must exhibit a photo gradient so that the animal can move into and out of the hottest part of the enclosure to regulate its body temperature. Ultra-violet radiation can be provided by carefully monitored exposure to direct sunlight (glass filters out UV), but care needs to be taken to ensure that the turtle(s) will not overheat and can move into shade when they need to. UV light globes, when used, should be positioned over part of the tank, preferably over a rock or log basking site.
- Water in a turtles' enclosure must be changed or cleaned at least once per week to prevent fouling, or more frequently if water fouls quickly. A filter may be useful to maintain or improve water quality.
- Water chemistry, including pH, must be closely monitored. A pH of 7 is generally recommended (Cann, 1978).

Diet

Minimum standards:

- Young turtles' diets must be supplemented with a suitable calcium to phosphorous ratio (1.2:1.0) to strengthen the shell and minimise the likelihood that its' shell will be misshapen.

- Adult turtles must be fed chopped lean meat to which a vitamin and mineral supplement is occasionally added, or some of the commercially available turtle pellets, which are nutritionally balanced. Uneaten food should be removed from the enclosure quickly to prevent it from fouling the water. Live fish, water snails, algae and water plants will provide additional food items and must be provided where possible.

Lizards

General information:

- The lizard fauna of Queensland includes both the largest and smallest Australian species. It includes lizards that spend most of their lives in water (e.g. Mertens water monitor, *Varanus mertensi*) and desert species that seldom see water, as well as specialised tree-dwelling and crevice-dwelling species and others which spend most of their lives underground.

Housing

General information:

- The interior of cages needs to address the individual requirements of the species in providing shelter sites, perches, feeding areas and access to water. Typical cage designs are depicted in Cogger (1992, p.43) and Bustard (1970, p.143).
- Common to all good cage design is the recognition that access to all parts of the cage is necessary for cleaning and that good husbandry requires good visibility so that the health of occupants can be regularly assessed and any problems recognised early.
- Appropriate cage 'furniture' is vital to successful captive husbandry of herpetofauna and providing suitable furniture requires the keeper to have a good knowledge of the species' particular requirements.
- Correct arrangement of the cage environment is necessary for the occupants to thrive. Lizards need a cage where they can perform a range of natural functions, so aesthetic considerations must take second place to functionality. Several secure shelter sites, perching sites, open areas for foraging and accessible water are necessary.
- To assist in maintaining a suitable thermal environment and for ease of cleaning, smaller lizards are best housed in terrariums; however, they can be housed in outside enclosures. Larger monitors, skinks and dragon lizards should be housed in outdoor enclosures.

Minimum standards:

- Housing and cage 'furniture' must resemble the animals' natural habitat to the greatest extent possible; and
- Cages must be escape-proof and exclude predators. The requirements for indoor and outdoor cages vary. However, generally cages or enclosures must have the following characteristics:
 - any outdoor enclosure must be covered by mesh to protect animals, especially smaller lizards, from predators (for example butcherbirds and kookaburras);
 - the mesh needs to be strong enough to exclude other animals, and cages must be secured against unauthorized access and locked to minimise the likelihood that the animals will be stolen;
 - lizards may injure themselves on wire mesh, so enclosure walls need to be made of a material that the lizards cannot climb (e.g. sheet metal, corrugated iron);
 - monitors and dragon lizards climb very well, so walls for outdoor enclosures for these lizards need to be seamless and slippery. Sheet metal, glass or well-finished fibro-cement can be used, as long

as corners and joins do not provide climbable strips. Alternatively, an inward overhang near the top of the cage wall that the lizards cannot climb may be used;

- many lizards burrow, so the walls of outdoor enclosures should continue below ground level to prevent escape. The depth to which walls are buried depends on the species to be housed. Weigel (1988) recommends a depth of 60cm below ground level for a cage to house large monitor species and lesser depths are needed for other lizards;
- outdoor enclosures need to be located so that lizards have access to the maximum amount of sun available. However, some shade is necessary, particularly during summer. Some species will dig burrows for this purpose while others will need to have stacked rocks, logs or artificial burrows provided;
- cage furniture needs to be carefully selected so that lizards cannot injure themselves – jagged or splintery logs and unstable rock stacks are to be avoided, as well as sheer-sided water dishes in which smaller lizards can drown;
- indoor cages for smaller lizards are easily contrived from aquaria. Metal or wooden cases with a glass front are also suitable and types of moulded plastic enclosures are also available;
- lizards kept indoors must be exposed to periods of light and dark, emulating those that an animal would experience in the wild and within the range of temperatures that the animal would ordinarily experience in its natural habitat; and
- a suitable temperature range is essential. Keepers must provide this either by the use of incandescent lights, some of which provide radiation of similar wavelength to sunlight, or by the use of heating cables beneath the floor. However, bulbs must be installed carefully so that animals cannot burn themselves on the bulb. Heating cables installed beneath the cage are preferable for species that are nocturnal or crepuscular (active at twilight or dusk).

Diet

Minimum standards:

- Water must be provided and must be changed a minimum of two times per week, or more frequently if it is becoming fouled quickly.
- Care is required to ensure that every lizard in a cage receives an adequate amount of food. Dominant individuals frequently deprive other lizards of access to food unless care is taken to provide separate feeding stations and to observe feeding behaviour.
- Suitable food varies according to species. In general, however, most lizards eat a range of substances in the wild, so a variety of food will need to be provided, depending on species.
- Captive lizards generally do well if provided with as much as they will consume twice a week, and a lesser amount once a week. However, keepers must be aware that some species, especially lace monitors, *Varanus varius*, are known to overeat and become obese.
- Lizards that eat well but remain in poor condition may be suffering from intestinal parasites and need to be treated.
- Keepers must observe feeding behaviour to make sure that all animals receive their share of the food. Dominant animals have a tendency to eat and exclude other less dominant animals in the process.
- Lizards must be provided with a varied diet that is suitable for the particular species.

- Food allocation must vary depending upon the captive situation of the animal. In particular, animals kept outdoors and subject to varying seasonal conditions should be fed less frequently during winter months and more during warmer months. This helps to prevent soiling of the enclosure and obesity in animals.
- All monitor species are carnivores, with some larger species scavenging for carrion and smaller species eating insects as well as small vertebrates. A range of foods can be offered including rats, mice, chickens, chopped lean meat and dog food for large species. Smaller species will eat lizards, small mice, cockroaches, grasshoppers and other insects, as well as chopped lean meat and dog food.
- No lizard should be fed in winter unless it can reach sufficiently high body temperatures to accomplish digestion for 6-8 hours each day.
- In practice, lizards in outside enclosures in parts of Queensland that experience cold winters may be permitted to fast for the duration of cold weather without experiencing any ill-effects.
- Lizards kept indoors, under artificially warm conditions may continue to feed or, if they are accustomed to a seasonal fast, may refuse to feed despite adequate temperatures.
- Lizards from tropical or mild areas may feed without interruption as long as adequate temperatures prevail in the cage.

Dragon lizards (Family Agamidae)

General information:

- Healthy dragon lizards are alert animals, with bright eyes, and they move away from the approach of people (unless tame). Normal posture for a dragon lizard involves a head-up, watchful demeanour; however, some species will drop into a cryptic crouching posture at the approach of people. Starved lizards have prominent pelvic bones and depressions in the soft tissues of the head.
- With the notable exception of the angle-headed dragons of the genus *Hypsilurus*, dragon lizards are sun-loving animals, which occur widely throughout Queensland.
- Life history of the dragon lizards is highly varied from the semi-aquatic water dragons of the genus *Physignathus*, to arboreal (tree-dwelling) and terrestrial forms.
- Species reach greatest diversity in the arid and semi-arid parts of Australia where they are predominantly terrestrial.

Minimum standards:

- Keepers must monitor the physical condition of animals, taking note of any behavioural or physiological changes (weight, body condition, etc.), and ensure that animals exhibiting signs or symptoms of illness or injury are afforded proper treatment.

Housing

General information:

- Dragon lizards generally do best in outdoor enclosures that provide exposure to sun. Smaller individuals may be housed successfully in indoor terraria if adequate access to ultra-violet radiation is provided.
- Species that are highly active (e.g. *Lophognathus spp.*) need more space than less active species and consideration must be given to the particular species requirements before housing is chosen.

Minimum standards:

- Cage dimensions:

- Minimum cage sizes vary according to species and the number of lizards kept. The following enclosure dimensions and substrates are suitable for two to three adult dragon lizards of the respective species:
 - o water dragon, *Physignathus lesueri*: 200cm by 200cm by 80cm, must contain water at all times, the larger cage space the better for these active, social lizards;
 - o bearded dragons, *Pogona spp.*: 100cm by 150cm by 80cm, perching sites, groundcover, plus an open area for feeding; and
 - o smaller arid and semi-arid species, *Ctenophorus spp.*, *Tympanocryptis spp.*: 60cm by 50cm by 50cm, well-drained cages with sandy deep substrate, low perching sites (stones, logs) and low groundcover.
- Cage 'furniture' and substrates must take into account the needs of the individual species. In particular:
 - netted dragons, *Ctenophorus nuchalis*, and other species which use shallow burrows as shelter will need at least 7-10cm of sandy earth as substrate as well as several low perching sites. Earless dragons, *Tympanocryptis spp.*, need the provision of low vegetation and stones among which to hide;
 - water dragons will require a pond, branches for perching and adequate space to permit normal behaviour;
 - some species (e.g. water dragons, common bearded dragons) use arboreal perches extensively, often sleeping in such locations, while other species (e.g. inland bearded dragon, *Pogona vitticeps*) may prefer to shelter overnight beneath low vegetation or in leaf litter; and
 - it is important to provide an appropriate thermal environment for dragon lizards. The angle-headed dragons (*Hypsilurus spp.*) occur naturally on the ground and in the lower stories in rainforest and wet eucalypt forests and function at lower temperatures and light intensities and higher relative humidity than other Australian dragon lizards. Virtually all other dragon lizards prefer high optimal temperature ranges for normal function: 25-35 deg. temperatures provide a suitable daytime regime for most dragons.

Diet

General information:

- Most dragon lizards are predominantly insectivorous, with some larger species feeding on vegetation and flowers.

Minimum standards:

- The diet for bearded and water dragons must include live insects (grasshoppers, beetles, cockroaches, crickets, mealworms), small quantities of cat food or slightly moistened dry dog food, small mice, snails, clover, dandelion flowers, chopped lettuce, Asian green vegetables, banana, berry fruits and chopped lean meat. Individuals may prefer certain food types and refuse others, so it is necessary to observe feeding behaviour;
- Smaller species are usually exclusively insectivorous and require ants, termites, crickets, grasshoppers, beetles, etc.; and
- Care is required to ensure that insects used as food for lizards have not been exposed to insecticides.

Monitors and goannas (Family Varanidae)

Housing

General information:

- Goannas and monitors range in size from fairly small animals (~30cm) to large animals up to 1.3m long.
- The largest goannas or monitor lizard species are not well suited for captivity, as these animals require relatively large enclosures. Large goannas and monitors can inflict serious bites and scratches, so should only be kept by experienced keepers.
- While it is possible to maintain and breed these larger species indoors, they are best accommodated outdoors where exposure to sun is readily available and in enclosures which permit them to move around freely.
- Keeping monitors and goannas in a cage is a challenge as they either burrow prodigiously (e.g. sand monitor or Gould's goanna, *Varanus gouldi*) or climb extremely well (e.g. lace monitor).

Minimum standards:

- All monitor species are sun-loving reptiles that prefer relatively high body temperatures for normal function (25-35 deg.). Therefore, enclosures must provide plenty of exposure to sunlight, whilst giving the animals an opportunity to retreat to the shade to cool down.
- For small to medium sized monitors, such as the spiny-tailed or ridge-tailed monitors, *Varanus acanthurus*, a minimum of 90cm by 40cm cage floor area is recommended for an adult pair (Weigel, 1990). Smaller species of monitors can be maintained in indoor enclosures, but will require exposure to UV light.
- Arboreal species of similar adult size to the spiny-tailed monitors (e.g. freckled monitors, *Varanus tristis orientalis*) may be housed in a cage with similar floor area but which must be at least 150cm high to permit normal climbing activities.
- For large monitors, such as the lace monitor or Gould's goanna, the minimum standard outdoor cage size is 300cm by 300cm by 180cm high for two to three adult animals (Weigel, 1988).
- Cage walls need to be of a smooth material that cannot be climbed (e.g. galvanised iron) and to be buried in the ground to a depth of at least 60cm, alternatively, wire the floor at a depth of at least 60cm with a sturdy mesh to inhibit burrowing below that depth.
- Any wire mesh used either in the construction or security of an enclosure must be out of reach of the animals to prevent injury.
- The design of cages and cage 'furniture' varies for each species. However, keepers must provide a captive environment that resembles the animals' natural habitat to the greatest extent possible. For example:
 - spiny-tailed monitors require shelter sites that are structurally similar to the narrow rocky crevices of their preferred microhabitat;
 - arboreal species, such as the freckled monitor, require hollow branches and limbs upon which to climb and to bask; and
 - hydrophilic species, such as the Mertens' water monitor, *Varanus mertensi*, must have a constant area of water in which they can fully immerse and swim. Note, however, that these species tend to defecate in the water and may present a problem for cleaning and maintenance.

Skinks (Family Scincidae)

General information:

- Skinks are the most abundant group of reptiles in Australia, with hundreds of species and wide variation in life history.
- The skink family includes a wide range of species with varied life histories. Many species have reduced limbs and live beneath the surface of the soil. Others are arboreal, semi-aquatic or specialised rock crevice dwellers. Most are diurnal, but some are nocturnal or crepuscular.
- Members of the blue-tongued lizard genus, *Tiliqua spp.*, the shingleback or stumpy-tailed lizard, *Trachydosaurus rugosus*, and members of the genus *Egernia*, Cunningham skinks, *Egernia cunninghami*, land mullets, *Egernia major*, and others, include large omnivorous lizards that are the species most frequently kept in captivity.

Housing

Minimum standards:

- Blue-tongue lizards and shinglebacks are the most common skinks in captivity in Australia. Therefore, these standards deal mainly with the husbandry of those species:
 - blue-tongue lizards and shinglebacks are best housed in spacious outdoor enclosures where access to sun and the provision of appropriate cage furnishings permit virtually natural behaviour to occur;
 - shingleback lizards live in remote and arid parts of inland Australia. It is important that humidity is kept to a minimum in shingleback enclosures;
 - adult pairs of the larger species will require cages at least 100cm by 75cm by 75cm and larger cages are needed to accommodate more individuals;
 - shingleback lizards generally succumb to infectious diseases when housed outdoors in humid coastal districts. This species must be kept outdoors only where its enclosure can be kept dry (this can be achieved by roofing the enclosure and utilising heat pads and other artificial heating devices) or in the drier areas where these lizards naturally occur;
 - members of the blue-tongue lizard genus *Tiliqua* and lizards of the genus *Egernia* are highly social lizards that establish a 'pecking order' in captive situations. Therefore:
 - o care needs to be taken to ensure that dominant lizards do not injure or starve less dominant animals and that less dominant lizards can escape the harmful attention of large aggressive cage mates;
 - o consequently, similar-sized individuals are best maintained together and care is needed to ensure that lizards can feed separately; and
 - o the adults may eat any live young produced in the cage, so gravid females must be removed before they produce young; and
- skinks vary in their healthy appearance and normal posture. However, raised scales and adherent patches of old skin may be signs that a problem exists. Healthy skinks should be capable of normal locomotion and should attempt to escape from people, unless tame.

Diet

General information:

- Food for captive skinks is similar to that recommended for dragon lizards, however, knowledge of the particular requirements of a species is necessary, as some skinks have specialised dietary requirements.

Geckoes (Family Geckonidae)

General information:

- Geckoes are small, soft-bodied nocturnal lizards that occur in a wide range of habitats in Queensland. Many species are arboreal (tree-dwelling), while others live in rock crevices, beneath ground litter or in burrows and earth cracks. In northern parts of Australia, some species of gecko enter buildings and feed on insects that are attracted to lights.

Housing

General information:

- Geckoes are best kept in terrariums that are designed to accommodate the needs of particular species. Any enclosure intended to hold geckoes must have a tight-fitting lid or other cage access door, as these lizards can escape through very narrow openings and most species climb extremely well.
- Rocks for lizard cages should not be removed from native habitats and can be substituted with tiles, bricks or pieces of concrete block.

Minimum standards:

- Housing for geckoes must replicate their natural habitat to the greatest extent possible. This is particularly important if you intend to breed geckoes.
- Geckoes do not usually require large cages to thrive in captivity. A pair of adults of the largest terrestrial geckoes will require a cage 50cm by 30cm by 30cm, but more space will be needed if a greater number of animals are to be kept together. Smaller species do not need large cages but care is required to avoid overcrowding.
- Species of geckoes that in their natural state climb on trees or rocky environments will need higher cages than terrestrial or burrowing kinds.
- Small species and individuals cannot be kept with adult geckoes of the genus *Nephurus*, as these may consume smaller geckoes.
- It is very difficult to successfully maintain more than three or four lizards of any type in one cage.
- As the life histories of geckoes vary considerably between species, the substrates and cage 'furniture' must resemble the animals' natural habitat to the greatest extent possible. Generally:
 - terrestrial geckoes require a substrate of sandy earth and appropriate shelter sites. Substrate for burrowing species must be 8-10cm deep, 3-5cm being adequate for non-burrowers. Crevicedwelling geckoes must be provided with carefully stacked rocks or bark;
 - geckoes which utilise burrows or earth cracks, will benefit from the provision of buried pieces of PVC pipe or upturned terracotta pots, as they may take some time to excavate their own burrows;
 - arboreal geckoes will need suitable shelter sites, like hollow tree limbs or sheets of bark, as well as cage walls of suitable material to climb on;
 - many geckoes can climb glass (e.g. velvet geckoes, *Oedura* spp.), while others cannot (e.g. leaf-tailed geckoes, *Phyllurus* spp.). The former will prefer at least two cage walls to be covered with a climbable surface. This can be accomplished by gluing bark or wood to the wall. In glass cages,

some walls should be covered with solid material, which provides improved sense of security for these lizards, which are often secretive;

- since Australian geckoes generally prefer to be active at night, cages should generally be dimly lit. However, many species have a requirement for ultra violet light, so an artificial UV light source should be provided; and
 - depending on your location, some cages may need to be heated so the animals can thrive. It is preferable that such heating be provided by under floor cables or by using coloured light bulbs (preferably blue or red) rather than by bright globes. This also enables the geckoes to be observed during their active periods.
- Breeding:
 - the hard-shelled eggs of geckoes of the subfamily Gekkoninae (e.g. *Gehyra*) are relatively impervious to water and need only to be maintained at suitable temperatures for development; and
 - eggs of some geckoes differ from the soft-shelled eggs of other Australian lizards in possessing a hard calcareous shell. This means that a different strategy for incubation of eggs is required. Normally the soft-shelled eggs of reptiles absorb large quantities of water during development and grow in size and weight. Incubation of this type of egg requires eggs to be placed in a moist medium for the period of incubation (sand, peat moss, vermiculite).

Diet

General information:

- Most geckoes are insectivorous, with some larger species (e.g. knob-tailed geckoes, *Nephurus spp*) also eating smaller lizards.
- Prey needs to move to stimulate geckoes to feed, so live prey is usually a necessity. Some animals may be persuaded to take dead prey from forceps, in which case seasonally abundant supplies of crickets or other insects can be frozen and later thawed for feeding.
- Before you decide to keep geckoes, you should ensure that you have a reliable supply of live insects. Termites, crickets, mealworms, cockroaches, moths, grasshoppers and other invertebrates are suitable food for geckoes. Food items should be dusted with calcium powder.

Minimum standards:

- There is a tendency for dominant animals to dominate meal times and deprive subordinates of food. Keepers must visually inspect each animal in an enclosure a minimum of two times per week and note any signs or symptoms of illness or injury, in particular evidence of food deprivation in subordinate animals.
- Geckoes must be offered a variety of food items.
- Insects that have not been eaten must be removed from the enclosure to prevent fouling of the enclosure.

Legless lizards (Family Pygopodidae)

General information:

- This is a family of small to moderate sized lizards, which occur throughout Queensland but are poorly known. Legless lizards in the wild are primarily terrestrial and appear to favour environments with low, dense vegetation or ground litter.

- Most are secretive, often nocturnal lizards, which are seldom seen, thus being relatively less suitable as captive animals than some other lizards.
- Legless lizards possess long, fragile tails, which they readily drop when stressed and must be handled very gently and as little as possible.

Housing

General information:

- The two largest species (Burton's legless lizard, *Lialis burtonis*, and the common scaly-foot, *Pygopus lepidopodus*) are active during the day for at least part of the year and can be maintained in captivity, if appropriate conditions are provided.
- Legless lizards can be housed in terraria similar to those used to house other lizards.

Minimum standards:

- A cage 50cm by 30cm by 30cm will be needed to house one or two adults of the largest species, but smaller species will require less space.
- These lizards will emerge from cover to bask, so the provision of radiant heat is appropriate.
- Dense tussocks or other low vegetation are suitable shelter sites.
- Handling of legless lizards should be kept to a minimum to minimize stress.

Diet

General information:

- Detailed dietary data are not known for many species; however, most will consume small invertebrates and must be offered a range of these, including termites, cockroaches, mealworms and small spiders.
- Of the larger species, Burton's legless lizard eats small lizards, while the common scaly-foot feeds mainly upon spiders. All other species of legless lizards are small lizards that feed upon invertebrates of various types.

Minimum standards:

- Burton's legless lizard feeds mainly upon small skinks and geckoes, so can only be kept if adequate supplies of these are easily obtainable;
- The common scaly-foot eats spiders in the wild but will eat other arthropods (including insects) in captivity.

Snakes (Families Typhlopidae, Boidae, Acrochordidae, Colubridae, Elapidae, Hydrophiidae and Laticaudidae)

General information:

- The seven families of snakes native to Australia include great variation in life histories. Members of the family Typhlopidae, known as blind snakes, are small wormlike burrowing snakes that spend most of their lives underground, where they feed upon the eggs and pupae of ants.
- Members of the families Acrochordidae (filesnakes), Hydrophiidae and Laticaudidae (sea snakes) are aquatic snakes of which only the Laticaudids, usually called sea kraits, leave water voluntarily to mate and lay eggs.

- Many of the Australian members of the Colubrid family are aquatic snakes of the sub-family Homalopsinae, which live in streams and estuaries in the north of the continent. Others in the Colubrid family are semi-aquatic snakes and tree snakes.
- Members of the Boidae in Australia include one semi-aquatic species (the water python, *Liasis fuscus*) and a range of species, from the exclusively tree-dwelling green python, *Chondropython viridis*, to species that live in rocky areas, sandy deserts and coastal forests. This family includes the largest snakes in Australia and other species that are adult at <1m in length.
- The largest family of snakes in Australia is the Elapidae, with 65 species presently described. This family includes some of the most toxic land snakes in the world; however, most elapids are small secretive snakes with venom of low toxicity that represent no threat to people. Life histories within this family are also diverse; many species are nocturnal snakes that live beneath ground cover and forage for sleeping skinks at night. Other species include large diurnal snakes occupying a range of terrestrial habitats, while a few species are at least partly arboreal.
- It is preferable that the novice does not attempt to keep species with highly specialised captive requirements, but rather begins the captive maintenance of snakes with hardy species that are likely to be easy to care for and tolerate captive conditions well. In practice, this means that inexperienced people avoid aquatic snakes, highly nervous species and those with special captive requirements.

Dangerous or venomous snakes may only be kept by experienced people who have been issued with the relevant authority to keep restricted species.

Housing

General information:

- Cages need to be constructed in accordance with recommendations regarding security and visibility. Proper heating and photoperiod regimes must be provided.
- Cage interiors will vary according to the requirements of different species. Two different approaches to cage substrates are possible – the use of natural materials, such as smooth gravel, soil and peat moss mixtures, sand and leaf litter; or the use of paper. Either approach is suitable; however, cage hygiene, disease and pest control are more easily managed using a paper substrate.
- Captive management of all snakes is easier if only one individual is housed in each cage.
- Where two or more snakes are kept together, there is always the risk that one snake will consume the other.

Minimum standards:

- Cage interiors:
 - in providing a soil or gravel base, it must be recognized that particles of the substrate adhere to food items and are swallowed by the snake;
 - substrate particles must be small and smooth enough to pass through the intestinal tract without damaging the snake; therefore, sawdust, wood shavings and coarse gravel are unsuitable material for cage substrates;
 - the alternative approach, where newspaper or butchers paper is used, is less aesthetically pleasing but makes cage hygiene simpler and easier. As the paper becomes soiled, it is removed and replaced with clean paper;

- with the use of gravel or sand and litter mix as cage substrate, faecal material and the substrate material immediately beneath it should be removed with a suitable spoon or trowel and the substrate totally replaced when necessary;
 - if pelletised or granular newspaper (recycled newspaper) is used as a substrate, extreme care should be taken to check humidity, as the material is highly desiccating and can dehydrate snakes (particularly young); and
 - if two or more snakes are placed together in one enclosure, e.g. for breeding, it is recommended that the entrance to any hide box provided must be sufficient to permit the thoroughfare of two snakes concurrently.
- Appropriate heating and photoperiod regimes must be provided and preferably only one individual should be housed in each cage.

Blind snakes (Family Typhlopidae)

Housing

General information:

- Blind snakes are burrowing snakes, usually found in loose soil beneath rocks or logs and are only seen above the surface in the wild on warm, rainy nights. Captive conditions are required which recognise these aspects of the life history of blind snakes.
- Blind snakes have been successfully maintained in captivity but are seldom to be seen above the surface.

Minimum standards:

- Blind snakes can be kept in terraria that should include 10–15cm of sandy soil and leaf litter and some flat rock or piece of bark under which to shelter. Blind snakes, in common with other burrowing snakes, can push their way through narrow apertures so cage lids and doors must fit securely without gaps.
- Two adult blind snakes of the larger species (to 60cm) will require a cage with floor space 60cm by 40cm.
- Water must be available at all times.
- The thermal biology of blind snakes is not well known; however, it is likely that these snakes will need warm temperatures (24–29 deg.) for normal metabolic function. Precise thermal requirements will vary according to the origin of the specimen. For example, blind snakes from tropical regions may need slightly different conditions to snakes from the cooler Granite Belt.
- Persons who attempt to keep these and other secretive herpetofauna in captivity must recognise the need to keep disturbance to a minimum and to accept that the welfare of the animal is more important than the keepers' desire for regular observation.
- The need to see captive species which are secretive so as to monitor their health is best accomplished by noting when the animals are most likely to be above the surface (e.g. dusk) and planning to check them at that time.

Diet

General information:

- Blind snakes principally eat termites and the eggs and pupae of ants, so cannot be successfully kept unless a reliable supply of this food is available.

Pythons (Family Boidae)

General information:

- Pythons are popular subjects for captive husbandry as they are non-venomous and generally easily kept. All pythons are capable of inflicting painful bites.
- A healthy python tongue-flicks regularly and the skin should appear glossy. The features of an unhealthy python may include:
 - baggy skin;
 - skin folds along the neck;
 - prominent vertebrae;
 - lumps under the skin resulting from skin worm infestations;
 - uncoordinated movement with the last third of the body;
 - swellings around the head;
 - lesions around the jaws, gums and lips;
 - regular regurgitation of food items;
 - head tilting;
 - cloudy or swollen eyes (outside of opaque period);
 - audible noises during respiration e.g. wheezing; and
 - bubbles or fluid seeping from the nose or mouth.
- Generally, pythons can go off their food from time to time. Experienced keepers often review previous years records to ascertain behavioural patterns (signs of seasonal changes or gravidity). If in doubt, a faecal sample from the snake may be taken to a vet for analysis.

Minimum standards:

- Holding pythons behind the head should be avoided where possible, as the snake often feels threatened. If it is absolutely necessary, keep this handling technique to a minimum and ensure that the body is adequately supported. Very large individuals may require two people to handle them safely.

Housing

General information:

- Cage design for pythons (and most terrestrial snakes) can vary from a simple glass aquarium with a pegboard lid to the more elaborate diorama enclosures used by exhibitors.
- Wooden, metal, fibreglass or plastic cases with a glass panel are suitable housing for pythons. Typical cage designs for these and other snakes can be seen in Cogger (1992) and Weigel (1988).
- In areas with mild winters, pythons can be kept in outdoor enclosures. However, access to harsh wire mesh must be avoided, as pythons will injure themselves if they come into contact with this type of material, so glass or soft screening is needed.
- Management of pythons outdoors is more difficult than in indoor cages and security of outdoor enclosures is more difficult to achieve.

- Cage 'furniture' requirements begin with the necessity to provide a suitable shelter site. Again the choices are between the utilitarian and the aesthetic but taking into account the particular needs of the species.
- All pythons prefer to be able to completely hide from view at least part of the time.

Minimum standards:

- The size of an enclosure varies according to the size of the python. Hatchlings and young pythons can be housed in plastic lunchboxes with a safely ventilated lid (no harsh wire). A small python (<50cm total length) requires a cage at least 20cm by 15cm by 10cm.
- Larger pythons need more space; however, these snakes are predominantly sedentary animals for most of their lives and do not need the space that mammals or birds or more active snakes need. A python of 200cm total length will require a cage with floor space at least 50cm by 100cm.
- The height of a cage will depend upon the species. Pythons that habitually climb (e.g. carpet pythons, *Morelia spilota*) will need the cage to be 90cm high or more, while essentially terrestrial species like the black-headed python, *Aspidites melanocephalus*, will need a cage height of 50cm.
- If more than one python is to be kept in a cage, the floor area must be increased by 50 percent for each additional snake.
- While some long-term captives become secure enough to remain on view much of the time, provision of a secure and suitable hiding place is the first consideration necessary for the successful maintenance of all captive snakes. In particular:
 - such shelter can be provided in the form of hollow logs, bark, stacked rocks or by PVC pipe, cardboard or wooden boxes with appropriate entry and exit holes cut in the sides;
 - care is required that rocks cannot fall upon the python and that the snake can easily enter and leave the hide, even with a large meal in the gut. More than one access hole is necessary as occasionally a python will enter a hide box and roll it over, thus becoming trapped inside;
 - if the python has just fed and temperatures in the hide box become uncomfortably high, the snake may regurgitate or die if it cannot leave the shelter; and
 - narrow hollow logs are unsuitable if removal of the python from this shelter is excessively difficult.
- Logs or other cage furniture must be as smooth as possible, as snakes can be injured by becoming caught in narrow crevices or impaled on splinters. Keepers should be aware that logs and other coarsely textured objects could harbour mites.
- Pythons that climb and use arboreal perches need the provision of suitable branches for this purpose.
- Some species (e.g. carpet pythons and amethystine pythons, *Morelia amethystina*) appear to need to spend periods totally immersed in water. Such species need to be provided with water bowls large enough for this purpose.
- Wet cages are undesirable as skin diseases will result.

Diet

General information:

- In the wild, pythons eat a wide range of prey items, from lizards and snakes to flying foxes and other bats. Most species of Australian pythons can be maintained in captivity on a diet of freshly killed mice, rats or birds (e.g. pigeons, chickens).

- Problems in getting captive pythons to accept food are common when the snakes' needs are not well understood. Reptile keepers who are experienced in the captive maintenance of snakes employ a range of strategies to induce feeding in reluctant snakes.
- Some captive snakes need to be fed lizards or offered live prey at first but occasionally individuals will simply refuse to accept food and may require assisted feeding for a period. Acceptance of food varies according to the individual. It is accepted that hatchlings should be left to adjust to their surroundings first. This can take from four weeks from the initial shed for children's pythons, *Antaresia (Liasis) childreni*, to 10 weeks for black-headed pythons.
- Snakes are equipped to go without food for long periods from the hatch date. This phase in their lives is about finding an environment they feel secure in and getting as far away from their siblings as possible.
- Once the neonate is settled in its enclosure, the keeper can commence introducing simple food items such as pink mice left near the hide. Scenting may be necessary with skink tail or fish.
- Food offered depends on the size of the python. As pythons grow, larger food is required. Healthy adult pythons can go without food for lengthy periods without harm and sexually active male pythons may refuse food throughout the duration of the breeding season. Gravid (pregnant) female pythons will usually refuse to feed throughout the entire period of pregnancy and incubation.
- Pythons and other snakes that are preparing to shed their skin will usually not feed. If a python is in good physical condition, occasional refusal of food is not cause for concern.

Minimum standards:

- Wild pythons usually kill their prey; however, it is preferable to feed freshly killed prey to captive pythons, as live prey has the capacity to injure, mutilate or even kill captive snakes.
- Under captive conditions it is desirable to feed pythons on domestic animals, as these are less likely to transmit parasites and disease.
- Snakes feed most when young and growing. Hatchling pythons can be fed once per week during warm weather and less frequently throughout the winter, but only if adequate temperatures are provided (no wintering). Hatchling Children's pythons *Liasis childreni* and others can consume pink mice, while hatchlings of larger species (e.g. carpet python) can consume weaner or adult mice.
- Adult carpet pythons and similar sized species will usually readily accept freshly killed rats or pigeons. For a 200cm python, two to three adult rats or pigeons constitute a meal that will sustain the snake for 8-10 days.
- Under no circumstances must the feeding of live vertebrate animals be conducted as part of a public exhibition.
- All captive pythons must have access to water.

Aquatic and semi-aquatic snakes (Families Acrochordidae (file snakes), Colubridae (Homalopsids), Laticaudidae (sea kraits) and Hydrophidae (sea snakes))

General information:

- These snakes require special and costly accommodation for successful captive maintenance as well as the provision of live prey. The sea snakes are all regarded as dangerously venomous, while the venomous properties of some species of semi-aquatic colubrids are not well known.
- These snakes are unsuitable animals for the inexperienced reptile keeper. Suitably experienced people, with the appropriate licence may only keep sea snakes, as they are restricted wildlife.

Housing

General information:

- Reptile keepers involved in maintaining any species of sea snake need to be well aware of the technical aspects of marine tank maintenance (water replacement and quality monitoring), as well as the possibility of life-threatening bites from these species and the need for secure, escape-proof cages.
- It is possible that yellow-bellied sea snakes, *Pelamis platurus*, benefit from exposure to ultra-violet radiation and to fluctuating salinity, such as would be experienced by these snakes in the wild during heavy rain.

Minimum standards:

- Aquatic snakes from freshwater environments can be housed in tubs or glass aquaria, with water temperatures maintained in the range 24–29 deg.
- Cages of either design will require secure tight-fitting lids, as even apparently helpless file snakes, family Acrochordidae, can climb out of aquaria.
- Maintenance of water quality is important and aquaculture technology offers a range of filtering and water treatment options.
- Water replacement and supplementation will be periodically necessary depending upon the number of snakes kept and the volume of water available.
- Mangrove snakes, *Fordonia leucobalia*, will need the provision of some gently sloping land area, as these snakes forage in shallow water and on mud banks for prey.
- Arafura file snakes, *Acrochordus arafurae*, and Macleay's water snakes, *Enhydryis polylepis*, are entirely aquatic but will benefit from the provision of solid cover, either in the form of convex terracotta tiles or pots or live waterweed.
- Tropical marine tanks are required for the captive maintenance of sea snakes and those intended to house sea kraits (family Laticaudidae), need to be provided with some land area where they can leave the water.
- One adult sea snake (<1m total length) requires a marine aquarium at least 100cm by 40cm by 60cm high; 50 percent more area will be required for each additional adult of similar size. Individual sea snakes >1m will require proportionally larger cages at least 120cm long.
- Olive sea snakes, *Aipysurus laevis*, and other demersal (bottom-dwelling) reef species will benefit from the provision of shelter sites on the floor of the tank as these snakes behave remarkably like their terrestrial counterparts in seeking shelter beneath solid cover.
- Yellow-bellied sea snakes are pelagic, that is, snakes of the surface waters of the open ocean, and will probably fare best in a tank without solid structures.

Diet

General information:

- An account of the wide variation of diet and ecology of Australian sea snakes is available in *Toxic Plants and Animals*, a Queensland Museum publication (1988).
- Given the extreme difficulty in providing regular supplies of the more unusual dietary items preferred by some species of sea snakes, it is recommended that only those species which readily accept fish are kept.

- Similarly, unless live crabs are readily and regularly available, it will be easier to maintain those homalopsids that eat fish. Live fish can be purchased from the aquarium trade and thawed frozen fish can occasionally be offered.

Minimum standards:

- Frozen fish have high levels of an enzyme that destroys thiamine, so these should be used infrequently, or supplemented with 30mg of thiamine/kg of frozen fish.

Elapids and terrestrial colubrids (Families Elapidae and Colubridae)

General information:

- The following members of the Australian colubrids are snakes that can be housed and treated similarly to the elapids. These are:
 - green tree snakes, *Dendrelaphis spp.*;
 - brown tree snake, *Boiga irregularis*;
 - freshwater snake or keelback, *Tropidonophis mairii*; and
 - slaty-grey snake, *Stegonotus cucullatus*.
- Elapids are the largest family of snakes in Australia, and occur widely in a variety of natural and altered environments. Life histories in this family are diverse; however, all elapids are venomous and carnivorous and most are terrestrial.
- Most species are small snakes (to 50cm), which forage at night for sleeping skinks and, to a lesser extent, frogs; however, this family includes large, dangerously venomous snakes, including seven of the ten most toxic land snakes in the world. Even these formidable animals are usually extremely shy and flee readily from humans. However, those persons who are permitted to house dangerous members of this family are accepting a serious and enduring responsibility to ensure safe housing and proper conduct at all times.

Housing

General information:

- Non-dangerous species of elapids and the non-aquatic colubrids can be housed in glass terraria and glass-fronted wooden or metal cages, provided that ventilation and a secure lid are provided.
- While the freshwater snake often enters water to feed on fish, frogs and tadpoles, captive care of this snake is best accomplished in a terrestrial cage with a spacious water bowl.
- The tree snakes and slaty-grey snake are housed similarly to the elapids; however, cages for tree snakes need to be as high as they are long, and furnished with branches for climbing.
- As described for the pythons, cage furnishing can be either utilitarian (paper substrate, cardboard hide box and an appropriate weight to hold the hide box in place), or more natural with gravel or sand and leaf litter. The choice is made according to whether the species is likely to thrive on a particular substrate.
- The following litter-dwelling elapids are best maintained on a sandy soil/peat moss/leaf litter substrate:
 - burrowing snakes of the *Simoselaps* genus;
 - bandy-bandies, *Vermicella* genus;
 - members of the genera *Furina* and *Rhinoplocephalus*;

- the bardick, *Echiopsis*;
 - death adders, *Acanthophis*;
 - crowned snakes, *Cacophis*; and
 - the two members of the genus *Denisonia*.
- It is possible to keep some of the above species on paper substrates, but these snakes need the tactile sense of being buried in litter and will usually hide under the paper substrate, defeating the purpose of paper as a hygienic floor surface since the snake is then in contact with and defecating upon the actual cage floor.
 - While it is possible to maintain some of the following elapids on natural substrates, the high metabolic rate and frequency of defecation of the following species generally necessitate a more easily cleaned cage design. These include the:
 - black snakes, genus *Pseudechis*;
 - broad-headed snakes, genus *Hoplocephalus*;
 - brown snakes, genus *Pseudonaja*;
 - copperheads, genus *Austrelaps*;
 - rough-scaled snake, *Tropidechis carinatus*.
 - taipans, genus *Oxyuranus*; and
 - tiger snakes, genus *Notechis*.
 - In the case of dangerous species, it is safer for the keeper to manage the snake in a simple, relatively uncluttered cage.
 - Members of the remaining elapid genera *Demansia*, *Drysdalia*, *Hemiaspis* and *Suta* may be kept on either substrate type.
 - Care needs to be taken whenever two snakes are housed in a single cage. If one snake feeds more quickly than its cage mate, it may grasp and attempt to swallow the prey item already in the mouth of the slower one. This can result in the death or injury of one or both snakes and of injury to the keeper as they attempt to separate the two snakes. In practice, most elapids are best kept singly and placed together during the breeding season if reproduction is desired.

Minimum standards:

- Optimal cage sizes vary according to the species, i.e.:
 - active foragers like the whip snakes, genus *Demansia*, require larger cages than the more sedentary death adders, genus *Acanthophis*. Larger species require larger cages than do smaller species;
 - open space is not necessarily desirable for snakes, unless suitable cover is close nearby;
 - cages suitable for housing one adult of the smaller ‘ambush foragers’ (e.g. crowned snakes, or burrowing snakes, genus *Simoselaps*) need floor area at least 40cm by 30cm;
 - for an adult death adder, at least 70cm by 30cm;
 - for an adult tiger snake, copperhead or rough-scaled snake, at least 80cm by 50cm;

- for the largest elapids (black snakes, brown snakes and taipans), one adult snake (200cm total length) will require a cage with floor area at least 100cm by 100cm; and
- active foragers like the whip snakes and the green snake will require cages at least 90cm long by 50cm, and for tree snakes at least 100cm high for one to two adult snakes.
- If additional snakes are to be housed in the same cage, floor area needs to be 50 percent larger per additional specimen.
- Housing for the agile and extremely dangerous eastern taipan, *Oxyuranus scutellatus*, needs to address the safety of the keeper as much as the welfare of the snake. This species and certain other highly nervous dangerous species (e.g. some *Pseudonaja spp.*) are best kept in a cage with a secure system for dividing the cage into two. This can be achieved by providing a slot in the cage roof that permits the insertion of a panel of plywood, glass or other material that securely divides the cage into two areas. It is then possible to clean or service the half of the cage that does not contain the snake, without danger to the keeper. Subsequently, the snake can be induced to enter the serviced area and the divider replaced, so that both sections of the cage can be cleaned safely.
- Where dangerous fossorial (digging or burrowing) species (i.e. death adders) are kept on a substrate of litter, it may be safer to leave the snake undisturbed during cage cleaning, than to disturb the snake by removing it. In this situation, it is essential to cover the snake with some solid material and to use a long-handled spoon to remove faecal material, so as to reduce the risk of a bite to the keeper.
- It is recommended that in the case of dangerously venomous snakes, only one snake be kept in each cage.

Diet

General information:

- Common tree snakes, *Dendrelaphis punctuata*, eat lizards and frogs in the wild. Most specimens refuse to eat mice, but can be offered live fish in the water bowl. Juvenile common tree snakes eat only live lizards.
- Experienced keepers use a series of scent transference ploys to trick this species into taking small mice from forceps. First the snake is taught to accept food from blunt-ended forceps, using the favoured prey lizard or fish. Once the snake readily accepts food this way, a freshly killed small mouse, liberally smeared with lizard or fish, is offered when the snake is hungry. This process may take some time and repeated effort to achieve success, but some specimens can eventually be weaned on to a diet of small mice.
- Brown tree snakes are mammal and bird eaters, usually accepting mice, or chickens in captivity.
- Slaty-grey snakes eat reptile eggs in the wild but will accept mice and sometimes chickens in captivity.
- Freshwater snakes are frog and fish eaters and usually will not accept mice. The procedure described for common tree snakes may work with occasional specimens.
- The smaller elapid species are predominantly lizard eaters, especially favouring skinks, and most will not accept mice. Large numbers of skinks are regularly needed to maintain any number of small elapids and thought needs to be given to the potential impacts of this practice.
- Large individuals of the genera *Suta*, *Denisonia*, and *Demansia* may accept small mice.
- The larger elapids will usually accept mice and rats in captivity; however, juveniles are generally accustomed to a diet of skinks.

- Hatchling taipans are the only young elapids to readily accept mammals in captivity.

Minimum standards:

- Food provided to elapids and colubrids must be selected on the basis of the species, size and age of the snake(s) concerned.

17. Dangerous snakes

Security requirements for dangerous snakes

General information:

- Queensland's herpetofauna includes the most toxic and dangerous land snakes in the world. Some sea snake species are also highly venomous.
- The following species of land snakes found in Queensland are capable of delivering a fatal bite to an adult human:
 - death adders, *Acanthophis* spp.;
 - tiger snake, *Notechis scutatus*;
 - eastern taipan, *Oxyuranus scutellatus*;
 - western taipan, *Oxyuranus microlepidota*;
 - red-bellied black snake, *Pseudechis porphyriacus*;
 - blue-bellied or spotted black snake, *Pseudechis guttatus*;
 - Collett's snake, *Pseudechis colletti*;
 - mulga or king brown snake, *Pseudechis australis*;
 - Ingram's brown snake, *Pseudonaja ingrami*;
 - eastern brown snake, *Pseudonaja textilis*;
 - western brown snake, *Pseudonaja nuchalis*;
 - small-eyed snake, *Rhinoplocephalus nigrescens*; and
 - rough-scaled snake, *Tropidechis carinatus*.
- The copperhead, *Austrelaps superba*, is not found in Queensland, but is also capable of delivering a fatal bite.
- The following species are regarded as being capable of delivering bites that may cause severe symptoms. Bites from large specimens may require medical attention:
 - speckled brown snake, *Pseudonaja guttata*;
 - pale-headed snake, *Hoplocephalus bitorquatus*;
 - Stephen's banded snake, *Hoplocephalus stephensi*;
 - curl snake, *Suta suta*;
 - De Vis' snake, *Denisonia devisi*;
 - ornamental snake, *Denisonia maculata*; and
 - whip snakes, *Demansia* spp.

- While no deaths are recorded as the result of bites by these species, painful and severe symptoms can result. There is a record of a bite by an ornamental snake that produced loss of consciousness in an adult human. These species should be regarded as potentially dangerous.
- Persons keeping any of the above species in captivity are undertaking a serious responsibility. Failure to maintain strict security and safety practices in relation to the keeping of these dangerous animals cannot be tolerated. The consequences of escapes, or of bites, can be fatal or produce serious, sometimes long-lasting illness and monetary cost. Given that the herpetofauna of Australia includes numbers of non-dangerous species, the practice of keeping dangerous snakes should generally be avoided.

Minimum standards:

- Where dangerous snakes are kept the following standards apply:
 - dangerous snakes must not be handled with bare hands, unless this is absolutely necessary and unavoidable;
 - if a dangerous snake must be handled, a second person (preferably experienced) must be present;
 - never open the cage unless you know precisely where the snake is;
 - never clean the cage while the snake is in it, exceptions can be made in the case of fossorial species (burrowing species);
 - routine cleaning procedures must be carried out after removing the snake from the cage to a secure location (bin or cage) with appropriate equipment (hooks, tongs);
 - never put your hand in the cage while the snake is in it;
 - never clean cages, or handle dangerous snakes when tired or sick, or after consuming alcohol or other drugs;
 - always lock the cage, or room, immediately after finishing maintenance or feeding;
 - double check before leaving that all cages are secured;
 - snakes learn routines and anticipate being fed – food items for dangerous species must be offered with tongs, never with bare hands; and
 - snakes have powerful olfactory senses (sense of smell); always wash your hands after handling food if you intend to continue working with dangerous snakes.

Equipment required for handling venomous snakes

General information:

- The following equipment is recommended for use in handling venomous snakes:
 - hook – used to raise the body of the snake and possibly balance it for transfer;
 - container/bin – an easily secured container for the temporary holding of a snake during the cleaning process;
 - grasping tongs – used to grip and transfer snakes. Care is required to prevent reptile skin damage;
 - hoop bag – long, heavy calico bag, closed at one end and suspended open at the other end by a hoop. The ideal method is to secure the bag to the hoop using velcro. This enables the hoop to be removed from the bag once the reptile is inside and the bag securely tied off;

- jigger/head press – an appliance to securely pin the snake to the ground or padded surface before the head is secured by hand;
 - feeding tongs/forceps – used to hold prey items for feeding;
 - clear tubes – clear rubber or PVC tube used to restrain a snake. The snake is usually encouraged to enter the tube voluntarily; and
 - hide box – container designed with secure doors that can be closed with a hook. This enables a snake to be moved to and from an enclosure without handling.
- The length of all equipment required for the handling of venomous snakes should be an appropriate length for each procedure and the specimen being handled.

Standards for the captive maintenance of dangerous snakes

Minimum standards:

- Except during attempts to induce captive breeding, dangerous elapids must be housed individually.
- All cages and rooms in which cages are located must be snake-proof.
- If the room in which cages are located is not locked, then each individual cage housing a dangerous species must be kept locked.
- Hatchlings of dangerous species are at least as toxic as adults, and can escape through very small openings.
- Cages must be tightly screened and have no gaps greater than 1 millimetre. Rooms must likewise be secured so that snakes cannot escape. This can be accomplished by filling gaps with “Silastic”, by screening windows and by fitting sealing strips to doors.
- If you cannot snake-proof the room and cages in which dangerous snakes are to be held, then you cannot keep them.
- Label all cages housing dangerous snakes with the species, common name and number of occupants.
- Adequate supplies (at least two) of neatly rolled crepe bandages for first aid in the case of snakebite must be present in the room.

Disclaimer

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