NSW GOVERNMENT

Department of Planning and Environment

Initial treatment and care guidelines for rescued reptiles

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Cover photo: Lace monitor (*Varanus varius*). Dr Shane Simpson

All other photos have been provided by Dr Shane Simpson, unless stated otherwise.

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Dedicated to the late wildlife rehabilitator Julia McConnell, who gave her time and energy freely to help sick and injured reptiles both directly and through advocacy over many decades. And to all the volunteers who perform this invaluable role for our communities, thank you.

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Contents

List of tables

List of figures

1. Introduction

The purpose of this document is to standardise the initial treatment of reptiles (namely snakes, lizards and turtles) requiring rescue or rehabilitation, in line with the *Code of Practice for Injured, Sick and Orphaned Protected Fauna* (the 'Fauna Code') (OEH 2011).

Understanding that each case is different and should be assessed individually, this document aims to provide guidance for licensed wildlife rehabilitators in New South Wales on assessment and first aid treatment principles for rescued reptiles.

> The primary objective of rehabilitation is the successful reintegration of the individual into the wild. This determines decision-making about care and treatment of wild reptiles.

There are 4 orders of reptiles in the world of which 3 are found in Australia. Of these 3, only members of the Squamata (snakes and lizards) and Testudines (turtles and tortoises) are native to New South Wales, with approximately 240 species being found in the state.

This document provides guidance on the initial care and management of reptiles following rescue, from capture to physical examination, initial stabilisation and treatment before presentation to a veterinarian. It provides advice on managing the more common rescue encounters in reptiles, including trauma and entanglement.

Information specific to marine reptiles (sea turtles and sea snakes) can be found in the Code of Practice for Injured and Sick Sea Turtles and Sea Snakes (DPIE 2021a) and the Guidelines for Initial Treatment and Care of Rescued Sea Turtles (DPIE 2021b).

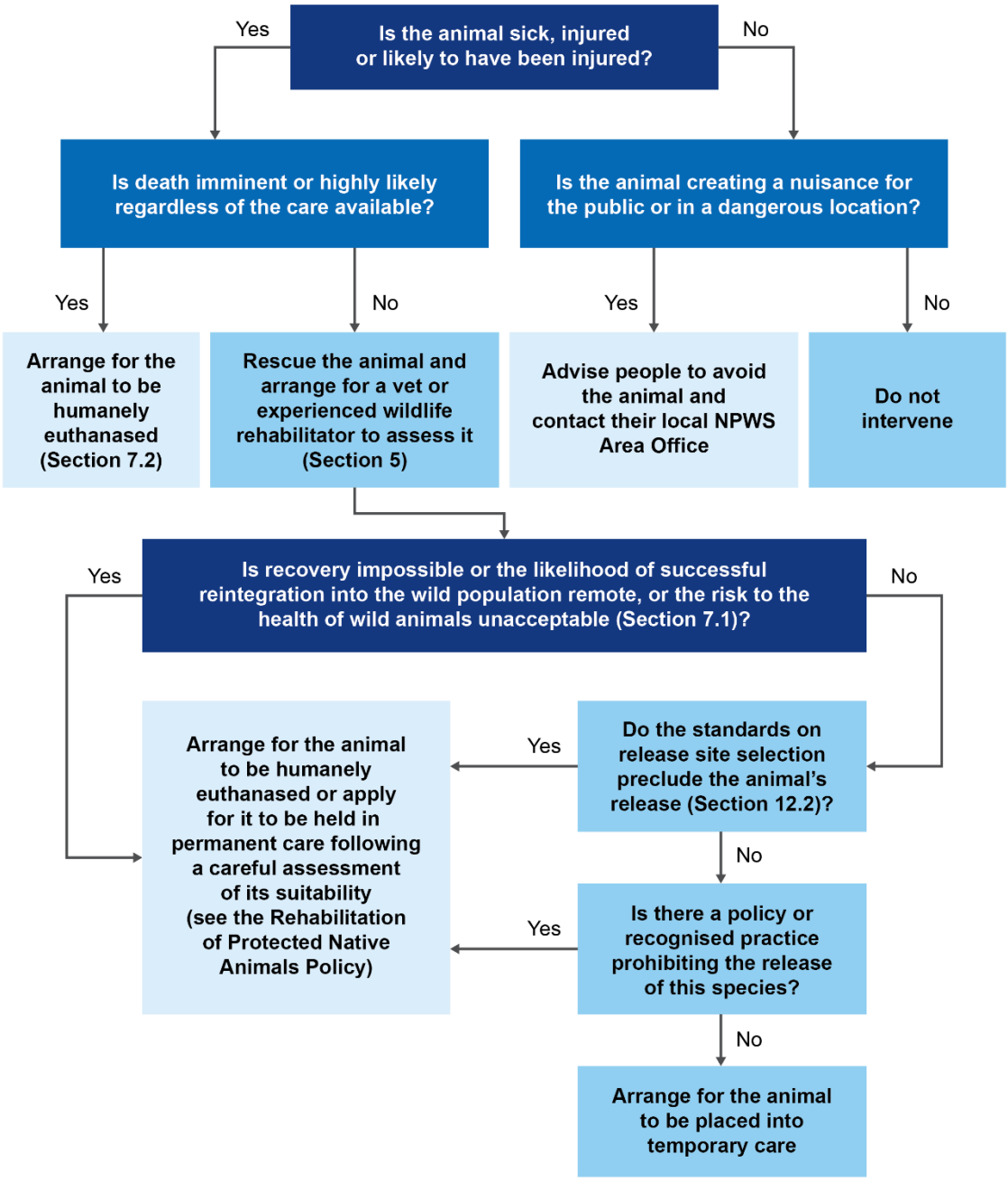

Figure 1 **Decision tree directing the course of action for reptile rescue encounters**

Source: Fauna Code (OEH 2011). Section numbers refer to numbering used in the Code.

2. Handling and examination

Personnel safety

Before handling reptiles, rescuers should be aware of possible safety risks to themselves, other people involved in the rescue and the individual animal. Some general points to consider are:

- Avoid handling reptiles if it is not necessary or you do not feel confident and capable to do so.
- Protect yourself and the animal by using appropriate personal protective equipment (PPE).
- Wear appropriate clothing – robust long sleeves, covered footwear, long pants.
- Wear a dust mask if warranted (e.g. rescuing an animal in a roof space).
- Wash your hands before and after handling animals and removing gloves (or use alcohol-based hand sanitiser).
- If bitten or scratched, clean the injury with warm water and soap (or disinfectant) and seek medical advice. Always tell medical staff you have been handling reptiles.
- Do not enter an area or location unless it is safe to do so. When rescuing animals from heights (e.g. roofs or trees) and working with hazards including barbed wire, care must be taken to prevent injury. Thoroughly clean any injuries and seek medical advice.
- When rescuing animals such as turtles from water sources (e.g. ponds and rivers), care must be taken to avoid accidental drowning. If entering the water, ensure it is safe to do so and additional personnel are present to assist.

Venomous snakes

It is likely while working with wild reptiles that a rescuer may be required to capture and handle a venomous snake.

It is highly recommended that wildlife rescue personnel who will have contact with snakes undertake a venomous snake handling course that includes venomous snake bite first aid.

Distance examination

Initial assessment begins before the animal is captured or handled. Where possible, observe the animal from a safe distance for behaviour, gait and posture and the presence of external wounds or injuries. If the animal is in immediate danger, for example, from oncoming traffic, immediate rescue is required.

- **Mobility, gait, posture and buoyancy:** Lameness or abnormal gait or posture in lizards and turtles can indicate musculoskeletal or neurological injures or disease. Snakes will often adopt an abnormal posture if suffering from similar injuries or disease. Buoyancy issues (i.e. an inability to dive, an inability to float or an uneven floating position) are not normal in turtles and can occur for several reasons.
- **Signs of pain and distress**: Reptiles, as a rule, are very good at showing no outward signs of pain. They do not vocalise (other than snakes hissing, which is normal) as many mammals do. They may act aggressively when handled, but this may be a normal trait for the species being assessed. The absence of obvious signs of pain and distress should not be assumed as an absence of pain.

- **Behaviour**: When approached, it is normal for reptiles to try and escape or at least show some sign of fear or aggression (e.g. threatening open-mouth display, hissing, tail whipping). It should be remembered that reptiles are ectothermic (i.e. rely on external sources of heat such as the sun to regulate and maintain body temperature) and, in times of cooler ambient temperatures, may enter a period of brumation. When a rescued reptile is unresponsive to handling, is cool to touch, and lethargic, the animal may be brumating, and this behaviour is not necessarily due to pain, injury or illness.
- **External injuries and wounds**: Observe the animal for any obvious external injuries or wounds, which can indicate trauma.

Capture and handling

Capture and handling of reptiles should only be carried out by appropriately trained people. Many species of reptiles, particularly larger specimens (e.g. lace monitor, carpet python), can inflict serious injury. In addition, several of the common species potentially encountered by rescuers are dangerously venomous (e.g. red-bellied black snake, eastern brown snake), and their bite can be fatal without appropriate treatment.

If there is any doubt about the species of snake, **do not** handle it under any circumstances.

Equipment required to capture and handle reptiles may include:

- **Snake hook:** Snake hooks are an essential tool when rescuing snakes. They are not only useful for handling snakes but also for moving items where snakes may be hiding while maintaining a safe distance between the animal and the rescuer. Snake hooks come in a range of lengths and hook types. The choice of a suitable hook is often a matter of personal choice.
- **Snake capture hoop and bag:** A snake capture bag removes much of the danger associated with transferring a dangerous snake into a transport carrier. The bag is held open on a frame that allows a snake to be placed into the bag and safely secured, all from a safe distance. If a snake envenomates any part of the bag, it must be rinsed thoroughly before it is touched and should be washed between rescues.
- **Capture net:** Many reptile species are very fast and will flee when approached. A net on a long pole may be required to capture such animals. Turtles may need to be retrieved from the water, and a net is an excellent way to secure these animals.
- **Towels and blankets.**
- **Protective gloves:** Heavy-duty leather gloves may be required to capture and restrain some animals. When using gloves, it is vital the handler is still able to adequately grip the animal to prevent escape.
- **Pillowcase or similar suitable bags:** Animals can be placed into pillowcases or cloth bags to secure them and reduce stress. The bags should be free from threads that may entangle the animal. Several bags of each type should be carried in case of multiple rescues.
- **Transport containers with securable lids of assorted sizes:** These are essential for the safe and secure transport of rescued reptiles. They must be constructed from a non-porous material that can be easily cleaned and disinfected. Plastic tubs available from hardware and storage outlets are ideal. Lids should be able to be easily secured. Holes should be placed in the lid to allow adequate ventilation. If the tub is to be used for transporting venomous snakes, it must be lockable and appropriately labelled that it contains a venomous snake.
- **Reptile identification guide.**
- **Torch:** A head-torch that allows hands to be free is best.

- **Snake bite kit:** Rescuers who handle venomous snakes should carry a fully stocked snake bite first-aid kit and know how to apply a proper compression bandage in the event of a bite.
- **Clear plastic tubes:** Rescuers who handle venomous snakes should carry clear plastic tubes of various lengths and diameters (see ‘Snake restraint’).

All equipment must be regularly checked and well maintained.

Figure 2 Snake hook and snake hoop bag
Photo: tongs.com

Methods of capture

It is important to have a plan in place when approaching a reptile for capture. Some species are fast and will evade even the most experienced handler. Others are strong and can be difficult to extricate from a location. Some are strong and can be difficult to extricate from a location, and some are dangerously venomous and so avoiding being bitten is vitally important. If there is any doubt about the species of snake, do not handle the snake and instead contact a wildlife rehabilitator experienced and trained in venomous snake handling.

Advise members of the public to maintain a safe distance from an injured or sick reptile. It is best to avoid involving members of the public in the capture or restraint of a reptile.

> Capture and handling of snakes and monitor lizards should only be undertaken by those who are trained and competent in the appropriate techniques.

The technique for capture and restraint varies depending on the species and size of the individual as well as on the type and severity of injury or illness and the rescue site.

- **Snake hook:** A snake hook can be used to manipulate and coax a snake to a position that will allow it to be captured safely. The handler can pick up the front section of a snake safely with the hook, supporting its weight while holding the tail, and guide it into a capture bag or other suitable enclosure with the hook.
- **Net:** A net on a long pole may be used to catch fast-moving or aquatic reptiles (excluding marine reptiles) until they can be safely hand captured.
- **Hand capture:** Towels and blankets can be used to cover the animal and allow it to be lifted safely and transferred to a transport container. This method is not appropriate for snakes or large monitors.

Initial examination before transport

If possible, it is beneficial to assess the individual before transporting it to a veterinarian or experienced wildlife rehabilitator. It is important to establish the following:

- Does the animal require immediate referral to a veterinarian for assessment and possible euthanasia due to extensive trauma, illness or compromised welfare? (See Section 3 'Euthanasia' for further information.)
- Does the animal require immediate stabilisation before transportation to minimise further pain and distress? Examples may include turtles with obviously mobile shell fractures (see 'Shell fractures in turtles') or animals with haemorrhaging wounds.

The initial examination should be done quietly and efficiently, always keeping the animal's stress level and welfare in mind, as well as those of the handler. The brief initial examination does not replace a more thorough physical examination performed after the animal has been transported from the rescue site.

Transport

Reptiles should be transported in secure carriers appropriate for their size, species and temperament. Transport boxes should reduce the risk of escape as well as provide ventilation and security during transport.

During transport avoid extremes of both heat and cold. Supplemental heat is generally not required for transport over short to medium distances or duration.

Snakes and small lizards should be placed in a pillowcase or similar bag appropriate for their size (Figure 3). Ensure there are no loose threads as this can result in entanglement injuries. The opening of the bag should be twisted closed, doubled over on itself and secured with a hair tie, zip tie or tape to prevent escape. This secured bag can then be placed in a plastic tub with a secured lid. If the container is to transport venomous snakes it must be lockable and appropriately labelled.

Figure 3 Snake contained in appropriately secured transport bag

Larger lizards can be placed directly into a suitable plastic tub with a secured lid.

Turtles can also be placed directly into a suitable plastic tub with a secured lid; however, a damp towel can be placed in the bottom to provide cushioning and prevent shell damage. Turtles should not be transported in water as they can tire quickly and drown. In addition, the movement of the water during transport will increase stress levels for the animal.

Restraint for physical examination

An initial examination can be performed on rescued reptiles with appropriate physical restraint. Sedation or anaesthesia, administered by a veterinarian, may be required in some cases to reduce stress associated with handling and to conduct a thorough physical examination.

When restraining a reptile, the aim is to perform a thorough examination with minimal stress to the animal. The restraint method used will be dependent on the species being examined and the temperament of the animal.

Lizard restraint

Lizards vary considerably in size, speed, strength and temperament, and so the methods used for restraint are variable. No matter the species, the handler should focus on controlling the lizard's natural serpentine movement.

A towel or blanket may need to be used to cover and pin the animal down first. A standard method of restraint utilises one hand placed around the neck and pectoral girdle (shoulder) area. The head can be controlled by firmly grasping just behind the base of the skull with the thumb and index finger. The remaining fingers can be wrapped around the shoulders and used to pin the forelimbs against the thorax. The other hand is used to support the body near the pelvis by grasping the rear legs up against the tail or just below the pelvis (Figure 4). To prevent tail whipping, the tail can be tucked between the handler's hip and elbow.

Figure 4 **Restraint of a monitor lizard**

It is preferable to wear long sleeves when handling mid-to-large sized lizards to protect forearms from scratches from the animal's claws.

Never grasp a lizard by the tail, and remember that many species, namely skinks and geckos, can undergo tail autotomy (voluntarily shed the tail). This ability is not seen in agamids (dragons) or monitors.

Never reach across or over a lizard unless the head is restrained. Be particularly cautious of carnivorous lizards such as monitors as they possess powerful jaws, sharp teeth, large claws and a long tail they can use very effectively to whip an unsuspecting handler.

Snake restraint

Slow, gentle movements and adequate support are the keys to proper snake restraint.

Non-venomous snakes, such as pythons, can be restrained by controlling the head initially. Never reach into a bag or under a towel without knowing where the head is. Locate the snake's head and gently pin it with one hand externally through the bag or towel. The other hand can be used to reach inside the bag and grasp the base of the head using the thumb and middle finger to support the sides of the head. The index finger can then be placed on top of the head (Figure 5). Restraining a snake's head will often cause it to struggle, and they will naturally try to wrap around the handler's arm and constrict. For small snakes, this will provide them with support without causing concern to the handler, but for larger snakes, a second handler may be required to support and restrain the body of the snake. Never allow the full weight of the snake to hang from a restrained head.

Figure 5 Appropriate restraint of a python's head

Venomous snakes should only be handled and restrained by experienced, trained personnel using appropriate equipment such as a snake hook and tube. A snake hook should be used to gently coax the snake into an appropriately sized clear plastic tube. The tube should be

snug-fitting to prevent the snake from turning (Figure 6). Once a significant portion of the body has entered the tube, both the body and tube can be grasped at the base to prevent escape. Should the head need to be examined, the tube can be gently retracted to a point where the head can be safely restrained as for non-venomous species. Many venomous snakes will bite the inside of the tube. Handlers should wear disposable gloves to avoid venom having direct contact with the skin and potentially causing envenomation through open skin and wounds.

Figure 6 **Venomous snakes can be restrained and examined in a clear plastic tube**

Turtle restraint

Though turtles are the slowest of the reptiles and therefore easiest to capture, they can be the most difficult to restrain as they can be very strong and can still inflict serious bites and scratches.

Small turtles can be held on either side of the shell using two hands positioned in such a way as to avoid the kicking of the legs.

Larger or more active turtles can be restrained using one hand around the front of the carapace, ensuring the hand is well away from the head. The other hand can be used around the back of the carapace (Figure 7). This way, the turtle can be held still or lifted safely for examination. Do not turn the turtle upside down, as this can be distressing for the animal. Ensure you have a firm hold of the animal when lifting to prevent inadvertently dropping the animal, resulting in injury.

Gaining control of the head to allow examination can be particularly difficult in turtles. In sick or debilitated turtles, the head may be simple to grasp from behind or underneath and allow the neck to be extended. In short neck species, care should be taken to avoid being bitten, but the head can be grasped in a similar fashion, and with gentle traction the animal's resistance can be overcome and the head extended. Take care not to grip around the neck as this can obstruct breathing. Long neck species are much less likely to bite, but they will retract their head and neck in under the shell making extraction difficult. A finger or blunt instrument can be used to gently pry the head out to allow the examination to be performed. It should be remembered that several species of turtle, particularly the eastern snake-necked turtle, possess musk glands located in the bridge of the shell that they will use to emit a foul-smelling liquid as a defence mechanism.

Figure 7 **Restraining a large Macquarie turtle**

Physical examination

Following initial assessment and stabilisation, the rehabilitator must aim to have the reptile assessed by a veterinarian or an experienced wildlife rehabilitator within 24 hours of rescue.

A physical examination should be conducted in a systematic manner to ensure it is done thoroughly. Only by doing this can an overall health assessment be made, which is necessary to determine treatment outcomes and prognosis. While progressing through the physical examination, ensure to make notes and keep records of findings.

Demeanour and behaviour

A wild reptile will usually try to escape or protect itself. Lizards and snakes should try and move away. Alternatively, snakes may adopt an S-position to protect themselves and be in readiness to strike. Turtles will also try to retract themselves into their shell. If an animal is quiet and allows itself to be easily picked up without struggling, it may indicate the animal is either severely distressed, injured or sick, or a combination of all 3. As previously mentioned, reptiles are ectothermic, and so in times of cold weather an animal that is minimally responsive to handling may simply be brumating or just too cold to respond.

Body weight and body condition score

The body weight and body condition of an animal are useful indicators of its health status.

Comparatively, reptiles have a much lower metabolic rate than mammals and birds. As such, it takes them considerably longer to lose significant body weight. Therefore, a reptile in poor body condition has likely taken many weeks or months to reach that point. This needs to be considered when assessing an animal's health and its likelihood of successful rehabilitation and release.

Reptiles can be placed in a bag or suitably secured in a container to be weighed. Body weight can then be calculated by subtracting the weight of the bag from the total weight of the animal and the bag or container.

Measuring the body weight regularly throughout the rehabilitation period is helpful to assess the animal's health and progress. An exact body weight is also important to allow the calculation of doses of medications and for calculating nutritional requirements.

Body condition scoring is a subjective appraisal system that estimates average body energy reserves. Since individuals can vary in size and shape, weight alone is not a good indicator of condition. Body condition scores (BCS) are based on evaluation of muscle mass and fat deposits in relation to skeletal features. There are no standardised BCS charts for reptile species that are most likely to be encountered, but a simple 1–5 system can be employed to document the BCS. Scores of 1–2 are considered thin, 2.5–3.5 are optimal, and 4–5 are overweight. Assessing the musculature of the head and body and the prominence of skeletal features while comparing these to known normal examples of the species can be used to determine the BCS.

Sex and age

Determining the sex of a reptile can be challenging as many species show no sexual dimorphism (i.e. males and females look the same). Some species, such as the eastern water dragon, display obvious differences between the sexes; however, this only really becomes obvious in adult animals. Other species, such as eastern bearded dragons may only show subtle changes such as hemipenal bulges and the presence of femoral pores in males. Snakes show no obvious physical differences between males and females. Many turtle species can be sexed based on the shape of the lower shell or plastron, with males having a more concave shape to the shell, the shape of the caudal plastron notch (females being U-shaped and males being V-shaped), and the length of the tail (males being longer).

Figure 8 Sex identification in eastern snake-necked turtles

Top: Female with a U-shaped notch. Bottom: Male with V-shaped notch.

There are several techniques that can be used by experienced rehabilitators and veterinarians to aid in the determination of the sex of a reptile. These include hemipenal probing, ultrasound and radiographs.

Identifying the gender of a rescued reptile can assist in determining the cause of any illness and helping with the rehabilitation plan; for example, a gravid female turtle may need to be induced to remove eggs for them to be incubated.

Accurately ageing a reptile is also challenging as there are no definitive ways to do this. Estimates can be made based on assessing body size, body condition, scars and other body damage. It should be remembered that some reptiles that come into care for apparent illness may, in fact, be old animals that are approaching the end of their lives.

Eyes and ears

The appearance of the eyes varies considerably amongst reptile species with differences in anatomy (e.g. snakes lacking eyelids) and appearance, particularly the pupil shape. The eyes should be checked for any discharge, changes in colour, obvious trauma and differences in pupil size between the eyes. Sunken eyes may indicate dehydration. Assessing vision in reptiles can be difficult, but watching the behaviour of the animal when placed in unfamiliar surroundings may be helpful.

Snakes and turtles do not possess any external ear openings. The ears of lizards should be checked for retained shed, external parasites such as ticks and any obvious trauma.

Oral cavity

If safe to do so the oral cavity can be examined. In venomous snakes this should only be done if deemed totally necessary, be performed by experienced personnel and done with extreme care. Opening the mouth of a reptile, particularly turtles, can be difficult. The corner of a credit card or similar plastic item, a guitar plectron, or specially designed oral speculums can be used to gently pry the mouth open and keep it open.

Animals with blood around the head and in the mouth may have injuries to the jaw (e.g. fractures), and care must be taken when opening the mouth for assessment. If concerned, it is best to avoid manipulating the jaws and refer the animal to a veterinarian for a thorough assessment.

The teeth, tongue and jaws should be checked for damage. Observe snakes for normal tongue-flicking, the absence of which requires further investigation. Any abnormal discharge or blood in the mouth should be noted. The mucous membrane colour should be noted while remembering that many species of reptiles have pigmented gums.

Figure 9 Examining the mouth of an eastern blue-tongue lizard with respiratory disease

Note abnormal discharge in the mouth (foamy mucus).

Skin

The skin of reptiles is one of their many unique features, and the variation between species is vast. In snakes and skinks, the skin is composed of overlapping scales. Some skinks such as shingleback lizards have bony plates inside the scales known as osteoderms. Other lizards such as monitors, dragons and geckos, have skin with smaller scales that do not overlap. Turtles have an obvious shell that is composed of both skin and bone.

Reptiles also regularly shed the outer layer of their skin. The rate at which this occurs is related to growth rate, age and season and is under hormonal control. Snakes that are about to shed will develop a cloudiness to their eyes and skin several days prior to shedding, 'going blue' or 'cloudy'. The skin will also become loose, wrinkly and 'tent' when pinched. This should not be confused with dehydration. In snakes, the shed skin should come off in one piece, and no skin should be retained. Lizards shed in patches and will often have pieces of skin stuck to their bodies while they undergo the process. Turtles shed skin on the neck and legs constantly. The individual sections of the shell or scutes will also be shed periodically.

Injured or sick reptiles in the process of shedding (e.g. 'cloudy' snakes) may have trouble completing a normal healthy shed and have specific husbandry requirements. They should be transferred to an experienced rehabilitator with the appropriate facilities.

The skin should be checked for retained shed (dysecdysis), especially around the digits and tail, external parasites and obvious trauma such as lacerations, puncture wounds and scars, as well as any signs of obvious infection. The shell of turtles should be checked for fractures and puncture wounds. It is normal for many turtles to have large amounts of algae growing on the shell, and there is no need for this to be removed.

Limbs and tail

The legs of lizards and turtles should be observed carefully and palpated for swelling, wounds and pain. Compare the appearance of one limb with the opposite to identify asymmetry or abnormalities. Limb function and locomotion should be assessed by watching the animal move, and any abnormalities such as lameness or paralysis noted.

Arboreal snakes such as carpet pythons use the tail to grasp branches to assist climbing. Tail function can be assessed in these species by observing them using the tail tip to coil around structures.

Many skink and gecko species can undergo tail autotomy. A skink that has been stressed in some way may have dropped its tail, and this is not a reason to consider euthanasia. These lizards will regrow their tails, though the size and colour will often be different to the original. This ability to regrow the tail is also seen in eastern water dragons that have lost parts of the tail due to trauma.

Placing a turtle in a shallow bath and observing it swimming can help assess for buoyancy issues as well as limb function.

Heart rate, respiration and body temperature

Obtaining the heart rate, respiratory rate, and body temperature in mammals is a key component of the physical examination. Collection of this data in reptiles, though, is not as easy, nor is it as important.

The heart rate of most reptiles cannot normally be heard with a stethoscope and can only really be seen in snakes and some lizards. The actual heart rate is also very variable between species and within individuals depending on body temperature, activity levels and nutritional state, so its value is often questionable.

The respiratory rate can be noted, but it should be remembered that reptiles can hold their breath for a considerable amount of time. What is more important to observe is for any open-mouth breathing, noises while breathing and the breathing effort, indicative of respiratory abnormalities. For example, snakes with breathing difficulties may raise their head in an abnormal position.

Reptiles are ectothermic and so rely on the external environmental temperature to maintain and adjust their body temperature. As such obtaining the body temperature of a reptile is of little value in the physical examination.

Management of exotic and introduced species

Australian biosecurity laws make it an offence to import and/or keep any exotic (i.e. not native to Australia) reptile without an appropriate permit. Such permits are normally only held by zoological facilities and are not available to the general public. In addition, an appropriate licence is required by private keepers to keep most species of Australian native reptiles. The species permitted to be kept in New South Wales can be found by referring to the *NSW Native Animal Keepers Species List* (OEH 2019).

If an exotic species or species that is not native to the area is rescued, it must be reported to the Department of Primary Industries (DPI) by calling 1800 680 244 or following the advice found on DPI's Report an unusual animal sighting webpage.

Personnel involved in reptile rescue should be familiar with the common exotic species and species kept as legal pets in New South Wales. If an animal comes into care that is unfamiliar, advice should be sought from someone experienced in reptile identification.

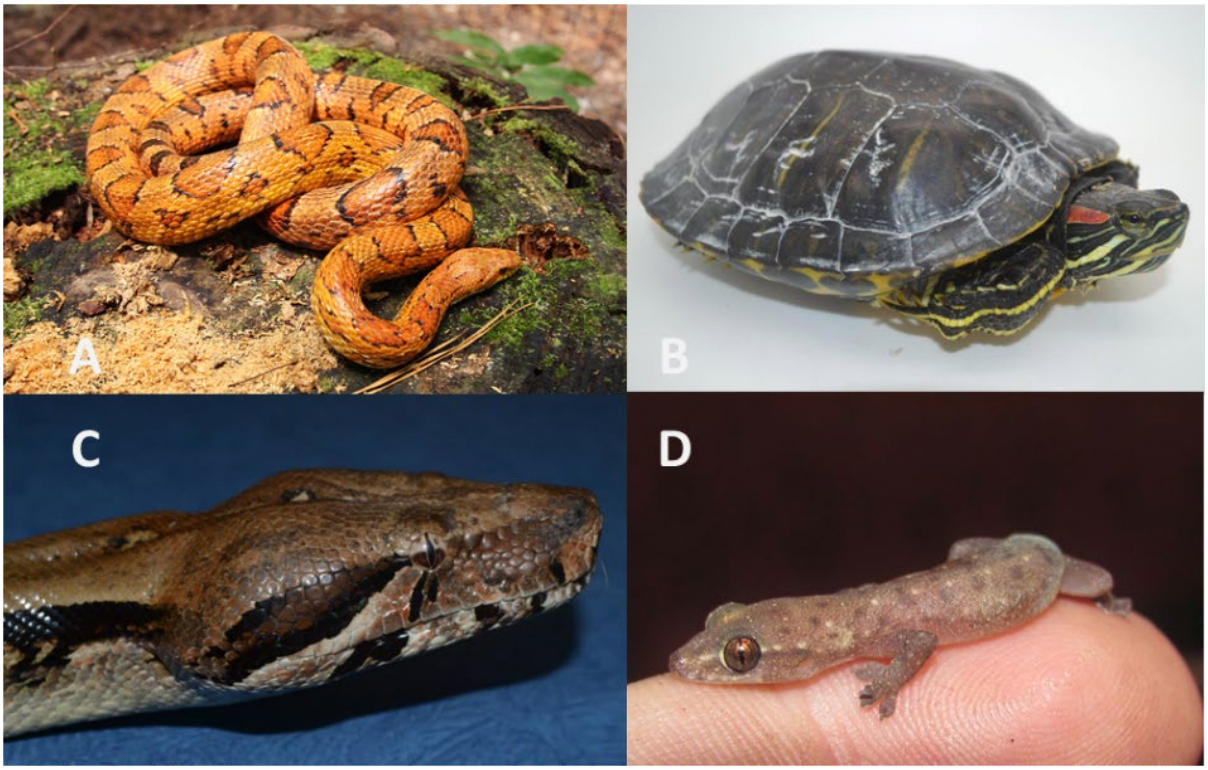

Figure 10 Common exotic reptile species

A: Corn snake (*Pantherophis guttatus*); B: Red-eared slider (*Trachemys scripta elegans*); C: Boa constrictor (*Boa constrictor*); D: Asian house gecko (*Hemidactylus frenatus*).

3. Euthanasia

A wild reptile must be euthanased where recovery is not possible, the animal is suffering from an incurable disease, death is imminent, the animal is suffering from chronic unrelievable pain or its ability to be released back into the wild is remote. Refer to the Fauna Code for further guidance (OEH 2011).

> Euthanasia should always be performed by a veterinarian where available and the use of a '2 stage' process is preferred.

The preferred method of euthanasia in a reptile is overdose with a barbiturate. Intravenous injection of the drug is the ideal route; however, this may not always be possible due to the size, anatomy or temperament of reptile species. If this is the case, the animal should be sedated first to either allow easier intravenous access or allow intracoelomic or intracardiac administration of barbiturate. Chilling a reptile should not be used as a method of sedation prior to euthanasia.

Actual death in reptiles can be difficult to ascertain, and doppler machine and ultrasound to detect heart beats may be required. Once an animal is deemed to be either unconscious or dead, a second method to ensure death should be performed. This may require decapitation using a sharp knife or heavy shears or pithing the brain with a sharp object to destroy the brain tissue.

Where a veterinarian is unavailable to perform the euthanasia, blunt force trauma can be used as an alternative. This should only ever be performed by an experienced person. The animal can be restrained in a pillowcase or other suitable bag with a corner. The head of the animal should be positioned in the corner of the bag and the animal well restrained. The head of the animal should be placed over a solid structure. The handler should use a heavy, hammer to deliver a single, sharp, solid blow to the animal's skull to cause instant death.

> Freezing a reptile is **not** an approved method of euthanasia and should never be done.

4. Initial treatment – stabilisation

Provision of warmth

The most important immediate treatment that should be given to a reptile that comes into care is the provision of warmth (see 'Temperature' in 'Husbandry'). Due to reptiles being ectothermic all their metabolic processes are intrinsically linked with body temperature. Until the animal is adequately heated, the administration of fluids, medications and food should be delayed as these treatments are likely to have minimal benefit.

Fluid rehydration

Commonly, wildlife cases coming into care are dehydrated to varying degrees. The primary routes of fluid supplementation for reptiles are oral (PO), subcutaneous (SC) and intraosseous (IO).

Assessment of dehydration and fluid deficit may be difficult in reptiles. The degree of skin tenting, sinking of the eyes and amount of thick mucus in the mouth can be used to assess the level of hydration.

Oral fluids are appropriate where the animal is mildly dehydrated and has no oral trauma. The fluid can be administered by syringe or stomach tube. Types of oral fluids that can be provided are warmed water, oral electrolyte solutions (e.g. Lectade, Spark Liquid), sodium chloride solution and lactated Ringer's solution. Fluid volumes can be given in the range of 5–10 millilitres per kilogram every 8–24 hours. Oral fluids should not be administered to animals with any injuries that may affect their ability to swallow as this increases the risk of aspiration (breathing in fluids) and resulting complications.

Subcutaneous fluids can be delivered using injection of warmed fluid under the skin, using sterile technique. The subcutaneous space in reptiles is limited and so giving large volumes in a single location should be avoided as it can cause trauma and discomfort. In lizards, SC fluids should be given under the skin over the dorsal (upper side) and lateral (sides) body walls. Insert the needle between scales rather than through a scale, and care should be taken not to inject too deeply to avoid entering the lungs. In snakes, SC fluids can be administered along the dorsal body adjacent to the spinal column (Figure 11). The loose skin of the axillary (armpit) and inguinal (groin) areas are ideal subcutaneous injection sites in turtles.

Only experienced rehabilitators trained and confident in the technique of administering oral fluids and subcutaneous injections should administer fluids using these techniques. If unsure, it is best to seek assistance and advice from experienced wildlife rehabilitators.

Figure 11 Subcutaneous fluids being given to a snake

IO fluids are reserved for severely dehydrated and debilitated lizards. It involves the placement of a sterile needle into the tibia or femur bone and must be performed by a veterinarian.

Pain relief (analgesia)

Like most wild animals, reptiles are very stoic and may not show any obvious signs of pain. Injuries such as open wounds, fractures, bites, infections and burns are all painful and will require pain relief. The choice of pain relief and the dose to be administered will depend on veterinary assessment of the injuries and the state of hydration of the animal. Analgesia must be prescribed by a veterinarian.

Wound care

Controlling bleeding (haemorrhage)

If a wound is bleeding, apply firm pressure to the wound with sterile gauze swabs and bandage the wound using a cohesive bandage material (e.g. Vet Wrap) to maintain even pressure. Ensure the bandage is applying pressure but is not constricting, as this can impede blood supply and damage tissue below the bandaged area.

For wounds in a location that cannot be bandaged, apply pressure with your fingers using gauze swabs. Holding them in place for 3–5 minutes may be adequate to stem the bleeding and allow a clot to form.

> If there is profuse blood loss from a wound, or the source of bleeding is from deeper tissues (e.g. muscle rather than superficial skin wounds), apply a bandage and contact a veterinarian as soon as possible for advice and care.

Flushing and cleaning wounds

Before veterinary assessment it may be possible to commence wound management by cleaning superficial wounds. Gross contaminants such as grass and leaves can be manually removed, and warmed saline can be used to flush wounds. Use a 10–20 millilitre syringe with an 18-gauge needle attached to create pressure and allow accurate direction when flushing.

Do not flush wounds where there is possible entry into the body cavity (e.g. shell fractures in turtles or deep puncture wounds around the body in lizards and snakes). Flushing these wounds can result in fluid and contaminants entering the body cavity and causing secondary complications.

Bandaging

Generally, superficial wounds in reptiles require no bandaging. Where there is haemorrhage or obvious entry to the body cavity, then a bandage can be applied to address bleeding and protect the wound. Low-adherent absorbent wound dressings (e.g. Melolin, Cutilin) can be applied and bandaged in place with cohesive bandage material (e.g. Vet Wrap). Bandaging can also prevent drying out of the wound, further contamination, further trauma and flystrike.

Bandages should be kept clean and dry and should be changed if there is ‘strike-through’ where fluid from the wound wicks through the external bandage layers. This does not often happen with reptile wounds as they do not tend to seep much fluid.

Bandaging reptiles can be a challenge due to their body shapes. Incorrect bandaging technique can also worsen injuries and therefore is best applied by a veterinarian following thorough assessment. Take care not to bandage and cover the cloaca in lizards and snakes.

Keeping bandages on snakes is particularly challenging as they will often 'roll' down the animal. The bandage can be secured in place using adhesive bandages (e.g. Elastoplast), but even then, snakes are very good at removing the bandage. When bandaging turtles, it may be necessary to bandage them in such a way as to allow them to get their heads out, but with their legs held in under the bandage. Bandaged animals must be dry docked to avoid the bandages becoming wet.

Shell fractures in turtles

Shell fractures in turtles are unfortunately very common and worth a special mention. Haemorrhage from shell fractures can be significant, and so it is important to apply bandages to minimise blood loss. Be careful flushing fractures as it can wash debris and flush solution into the body cavity. Shell fractures are equivalent to rib fractures in mammals and are very painful. If the shell fragments are obviously mobile, these should be stabilised using bandages prior to transporting the turtle. Take care when transporting the turtle and use towels to cushion the animal during transport. Never use glues or other sealants in the fractures. These can significantly delay healing and will trap debris in the wounds. All turtles presenting with shell fractures should be radiographed to assess for internal injuries such as fractured bones and the presence of eggs in gravid females.

> Never try and stabilise shell fractures without the guidance of a veterinarian as pain relief and anaesthesia or sedation is often required to perform these repairs without causing undue pain and suffering.

Husbandry

Reptiles that enter care may need to be housed for a long time (months) due to their slow healing rates, and as they should only be released back into the wild during the warmer months of the year. Following initial examination and stabilisation, arrange for the reptile to be transferred into the care of an experienced wildlife rehabilitator. Venomous snakes should be transferred to a suitably trained and experienced person as soon as possible.

Housing

The vast majority of reptiles are solitary animals, and each animal must be housed individually. The specifics of the housing provided will be dictated by the species and animal's condition, as requirements can vary greatly. To provide adequate housing for reptiles in care, the following factors need to be considered.

Enclosure design

Enclosures need to be safe and escape-proof. Many reptiles are good climbers, so enclosures must be secure or with walls at least high enough to prevent escape. Enclosures must be easily accessible and easy to clean and disinfect. Dimensions for intensive care enclosures for reptiles are listed in the appendix of the Fauna Code (OEH 2011).

Custom-built reptile enclosures are readily available, including heating that is thermostatically controlled, lighting and several other features. These are ideal for rehabilitators working with reptiles on a regular basis.

If having reptiles in care is only sporadic or temporary, suitable makeshift housing can be made from appropriately sized plastic tubs (Figure 12). The lids of these can be modified to provide an open mesh top for heat and lighting. These are cheap, easy to obtain, sturdy,

securable and easy to clean. They can also be stacked inside one another when not in use to save space. In addition, they can be used for both terrestrial and aquatic reptiles.

Figure 12 **Reptile enclosures**

Temperature

Reptiles are ectothermic and require environmental heat sources to be able to regulate their body temperature by behavioural means. Insufficient heating leads to immunosuppression and delays healing. Reptiles require a range of temperatures to be able to thermoregulate (known as the preferred optimal temperature zone or POTZ), which is specific to each species (Table 1).

Table 1 **Preferred optimal temperature zones (POTZ) and basking temperatures for commonly rescued reptile species**

Species	POTZ (°C)	Basking temperature (°C)
Eastern blue-tongue lizard	27 – 32	33 – 38
Eastern water dragon	27 – 33	32 – 40
Lace monitor	34 – 36	45 – 55
Coastal carpet python	28 – 30	32 – 34
Diamond python	26 – 29	30 – 33
Red-bellied black snake	28 – 31	32 – 34
Eastern brown snake	29 – 32	33 – 35
Common tree snake	30 – 33	36 – 38
Eastern long-necked turtle	22 – 26	29 – 31

In care, heat can be provided via heat lamps or emitters, heat mats and heat cables. The heating should be positioned to provide a background or ambient level of heat and an area that provides a higher temperature (up to the high point of the basking temperature for the species). In this way, a thermal gradient within the enclosure can be created that allows the animal to move around to regulate and adjust its own body temperature.

Heat lamps and emitters should be housed in appropriate reflectors and caged to avoid contact and burns to the reptile and the carer. Heat mats can be placed under caging to provide heat, but care should be taken to allow some airspace between the floor of the cage and the heat source to prevent overheating.

Temperatures in the enclosure should be monitored using thermometers. The use of a thermostat to control the temperature is highly recommended. Severely compromised reptiles may not be able to move away for a heat source, so careful monitoring and use of a thermostat is important to prevent hyperthermia and burn injuries. The various heat sources are available in different wattages, and an appropriate strength should be selected based on the animal's POTZ.

Figure 13 Reptile heat source options

Lighting

Wild reptiles that are going to be kept in short to medium-term care need no additional lighting other than the ambient lighting in a room unless they have been diagnosed with a medical condition that requires specific lighting.

Animals in longer-term care will benefit from being able to access suitable ultraviolet light, namely UVB. UVB light is extremely important for calcium metabolism. It can be provided by allowing the animal access to unfiltered natural sunlight for 30 minutes several times a week. Alternatively, UVB light can be provided using specially designed lights. These lights are available in a number of different designs (e.g. tube, compact) and strengths. An appropriate light should be chosen based on the species being housed and the enclosure it is being housed in. An appropriate photoperiod should be provided (e.g. 12–14 hours of light per day) using timers.

Advice should be sought from an experienced reptile rehabilitator or veterinarian on the lighting requirements for the individual animal in question.

Enclosure substrate and furnishings

The substrate is the material used to line the bottom of the enclosure. In situations where reptiles are being rehabilitated, this substrate does not need to be aesthetically pleasing but rather functional. It needs to be easy to clean, cheap and readily available and appropriate for the species.

Often the simplest substrate to use is newspaper, butcher's paper or paper towel. In some cases, such as when the animal being housed prefers to burrow, a particulate substrate like recycled newspaper pellets (e.g. Breeder's Choice Cat Litter) or vermiculite (e.g. All Natural Pet Litter) may be preferred. Particulate substrate should be avoided in animals with open wounds to prevent contamination of the wounds.

If appropriate to do so (i.e. they do not have injuries that preclude them from being allowed to swim) aquatic animals such as turtles should have access to water to swim and also access to dry areas in the enclosure to allow basking. Particular attention needs to be paid to water quality. Appropriate filtration is needed to keep the water clean and hygienic.

Arboreal species such as carpet pythons should be provided with branches or other climbing structures to allow them to demonstrate normal behaviours.

Appropriate hides should be provided in the enclosure to allow reptiles to seek shelter. This will reduce stress levels. Hides can be as simple as cardboard boxes with a hole cut in the side, or commercially available hides can be purchased.

Water

Clean water should be provided in a shallow bowl. The bowl should be heavy enough that it cannot be tipped over. Ceramic ramekins are ideal for this. Some animals may choose to soak in their water bowls. The bowl should not be so deep that the animal can drown, and stones can be placed in the water bowl to provide a means of escape if needed.

It should be noted that many species of reptile obtain most of their water requirements from their food and so may not be seen to drink regularly. Contact an experienced wildlife rehabilitator for advice on species-specific requirements.

Nutrition

Reptiles have evolved in such a way that there are large variations in their dietary requirements. As a rule, reptiles can be divided into 3 groups:

- **Herbivores:** The only exclusively herbivorous Australian native reptile is the adult green sea turtle.
- **Omnivores:** Many lizard and turtle species are omnivorous, including eastern blue-tongue lizards and eastern water dragons.
- **Carnivores:** All snakes and some lizards (e.g. monitors), and freshwater turtles are carnivorous. Carnivores can be further divided into those feeding predominantly on vertebrate prey (e.g. rodents, frogs) and those feeding on invertebrates (e.g. insects).

The appropriate food should be fed based on the medical history and natural ecology of the animal in care. Wildlife rehabilitators should understand the natural diet of the animals in their care and provide captive alternatives (Table 2).

Reptiles are ectothermic and do not convert food energy to heat. As such, they are very efficient at utilising ingested energy and can go without food for long periods of time. Fat stores in the body are used throughout these periods of non-feeding.

> Reptiles must be warmed to their preferred body temperature before any food is offered.

When nursing a reptile that has been possibly anorectic for a long time, initial focus should be placed on rehydration for the first 2–5 days. After this time, nutritional support can be gradually commenced. This is to reduce the risk of refeeding syndrome, a condition of metabolic disturbances that occur as a result of reintroduction of nutrition to patients who are starved, severely malnourished or metabolically stressed due to severe illness. When starting supplementary feeding, the intake should be limited to 10–25% of the calculated requirements and increased slowly over several days to weeks to reduce the risk of refeeding syndrome.

Table 2 Preferred diet of commonly rescued reptile species

Species	Diet
Eastern blue-tongue lizard	Omnivorous Mixed vegetables and fruit, insects and snails
Eastern water dragon	Omnivorous Mixed vegetables, insects
Lace monitor	Carnivorous Rodents, day old chickens, eggs
Coastal carpet python	Carnivorous Rodents, day old chickens
Diamond python	Carnivorous Rodents, day old chickens
Red-bellied black snake	Carnivorous Rodents, fish
Eastern brown snake	Carnivorous Rodents
Common tree snake	Carnivorous Fish
Eastern snake-necked turtle	Carnivorous Fish, mussels, prawns, yabbies, earthworms

Many wild reptiles are notorious for refusing to eat in captivity and may need assisted feeding if they are to recover. Debilitated animals may simply be too weak to eat. Animals can be assist fed using syringes or stomach tubing by trained and experienced personnel. Commercial supplement foods are available, and their use is encouraged as feeding volumes, and rates have been calculated and listed. Examples include Wombaroo Reptile Supplement and the EmerAid IC range (Figure 14).

Figure 14 Examples of commercially available reptile supplement foods

5. Common rescue encounters

Unsuitable environment

A common reason reptiles may come into care in New South Wales, particularly short-term care, is because they have been found in unsuitable locations. As the human population expands and encroaches further into wild reptile habitat, interactions between humans and reptiles will occur at increasing frequency.

Some species, such as eastern blue-tongue lizards, have adapted to living in close proximity to humans. Other reptiles, such as venomous snakes, need to be removed from situations where human life may be at risk.

> Animals that are removed from unsuitable environments should undergo a physical examination to assess their health.

If the animal is deemed healthy and fit for release it should be relocated and released in accordance with the Fauna Code (OEH 2011) and the licence conditions stated in the Licence to Catch and Release Reptiles (DPIE 2021c).

Trauma

Trauma is the second most frequent reason for a wild reptile to need rescue in New South Wales. There are several specific causes of trauma described in more detail below.

Dog and cat attacks

Predation by dogs and cats may result in life-threatening injuries, including internal organ damage and spinal trauma.

Important points to note specific to dog and cat-attack related injuries:

- Internal injuries are often more severe than they appear externally. Superficial injuries might appear minimal, however, injury to deeper structures such as muscle, bone or joints and internal organs may be severe.
- Dog and cat bite wounds are contaminated wounds and require antibiotic treatment and pain relief. Medications must be prescribed by a veterinarian, and the choice of medication and duration of treatment will depend on the severity and extent of injuries.
- In snakes that have been attacked, pay particular attention to the possibility of spinal trauma. Snakes with severe spinal damage may still be able to move their bodies relatively normally below the site of trauma. Look for abnormal alignment of the spine and weak movements of the body as the snake moves. Veterinary assessment and radiographs are required to fully assess the extent of the damage.
- In lizards that have been attacked, pay particular attention to the possibility of spinal and pelvic trauma. Lizards with spinal or pelvic trauma will not be able to move their back legs properly and, in severe cases, will drag them. Radiographs should be taken of any lizard that is attacked.

Figure 15 **Blue-tongue lizard with dog attack trauma. Internal organs have eviscerated through the abdominal wall**

Motor vehicle accident

Due to their small size, reptiles often do not survive motor vehicle accidents.

Important points to note specific to motor vehicle-related injuries:

- Head trauma is common. Animals with head trauma may display a variety of clinical signs. Look for blood from the nostrils, mouth and ears (if present) and a head tilt or lack of coordination.
- For lizards, particularly blue-tongues and shinglebacks, check the hard palate of the mouth for fractures. If present, it indicates a severe skull fracture, and the prognosis is guarded.
- For larger lizards such as lace monitors, check for limb and tail fractures.
- Before euthanasing a female reptile, where possible, it is recommended to check for viable unborn babies or eggs, as these may be salvageable depending on the stage of development. This requires veterinary assessment, and the animal should be transported to a veterinarian for assessment prior to euthanasia.
- Turtles that have been struck by a car will often suffer shell fractures of varying severity. Fractures that involve the midline of the upper shell (carapace) may involve the spine. Turtles with spinal fractures will not be able to withdraw their hind legs into the shell. Fractures of the bridge area, particularly when both sides are affected, carry a very poor prognosis as they are often associated with significant crush injuries to internal organs such as the liver. Radiographs should be taken of all turtles with evidence of trauma to check for fractured limbs, a fractured pelvis and the presence of eggs (Figure 16). Gravid turtles that require rehabilitation will likely need to be induced to allow the eggs to be removed and artificially incubated. Turtles with an open body cavity and evisceration should be euthanased as the prognosis is extremely grave.

Figure 16 Radiograph of gravid turtle with a severe shell and pelvic fracture

Gardening accidents

Lawnmowers, whipper snippers and shovels can cause significant injuries to reptiles. Reptiles hide in long grass and may not be easily visible to people operating such machinery and tools. Always check for head injuries as they are common with this type of trauma.

Fishhook ingestion

Turtles will often swallow bait on fishhooks and tackle (Figure 17). If the line needs to be cut at rescue, it is important to leave 20–30 centimetres hanging from the mouth, as this may aid in the removal of the hook. Never pull on the line to try and dislodge the hook. This will likely only drive the hook deeper and make it more difficult to remove. Never cut the line off at the level of the mouth and release the turtle hoping the hook with either dislodge itself or rust away over time. Turtles with ingested hooks need to be radiographed by a veterinarian to assess the location of the hook and determine the best way to remove it. Hooks caught in the oesophagus may be manipulated back out through the mouth. In some cases, the hook will need to be pushed through the skin to allow the barb to be cut off for the hook to then be extracted. Hooks that are in the stomach may require surgery to remove them.

Figure 17 Turtle with a swallowed fish hook. Note the line coming from the mouth

Entanglement and entrapment

Plastic garden and erosion control netting can be deadly for snakes and lizards. These products can cause fatal entanglements, with trapped animals often dying slow deaths due to their injuries, exposure to the elements and predator attacks (Figure 18).

Figure 18 Red-bellied black snake entangled in netting

Photo: Lynleigh Greig

When removing a snake from netting, always identify the species before assisting. Venomous snakes such as red-bellied black snakes are commonly entangled, and care

must be taken when handling these animals. Carefully snip the netting away while ensuring not to cause any further damage to the animal. Once removed from the netting, examine the animal for any wounds. Netting can cause wounds that completely encircle a snake's body. These wounds need to be carefully managed because as they heal and mature, the scars can cause severe constrictions of the body.

Just as netting can entangle a reptile, litter can also be a problem. Snakes and lizards can get their heads caught in all sorts of items such as aluminium cans. With patience and care, the animal can safely be extracted. It should be assessed for any injuries and released if no damage is evident.

External parasites

External parasites are a common problem for wild reptiles. In many cases, the parasite burden is not so severe as to cause clinical disease. As part of the rehabilitation process, any external parasites should be identified and removed so as to give the rescued reptile the greatest chance of recovery.

Ticks

There are several species of ticks that can infest wild reptiles. Australian native reptiles appear to be immune to the toxin produced by the Australian paralysis tick (*Ixodes holocyclus*). High tick burdens, however, can result in anaemia as the adult ticks feed on blood.

Blue-tongue lizards commonly have large numbers of ticks in the ear canals and around the front limbs (Figure 19). In severe cases, these can cause considerable irritation such that the lizard can be mistakenly diagnosed with symptoms of neurological disease. Removal of the ticks can result in an immediate alleviation of these signs.

Ticks can be manually removed using tweezers or forceps. Application of pyrethrin-based insecticides (e.g. Permoxin, Reptile Enclosure Spray) or fipronil (e.g. Frontline Spray for Dogs and Cats) can be used to kill ticks, but should be done in consultation with a veterinarian.

Figure 19 Tick on a blue-tongue lizard

Maggots

Wounds in reptiles should be closely examined for the presence of maggots (Figure 20). Wounds infested with maggots should be assessed by a veterinarian. Sedation or anaesthesia may be required to inspect and thoroughly clean the wound.

Figure 20 A maggot-infested wound in a common tree snake
Photo: Teresa Prunell/NATF

Mites

There are over 250 species of mites that can parasitise reptiles. In most cases of mite infestation, the exact species cannot and does not need to be identified.

Mites tend to congregate around the eyes and gular fold in snakes, but they can hide under any scale along the body. Larger scaled animals such as blue-tongue lizards and carpet pythons are more prone to mite infestation than smaller scaled species such as bearded dragons and monitors. Because of their aquatic lifestyle, mite infestation is very rare in turtles. Mite faeces may be seen scattered over the body of the infested reptile. This white dust-like material looks like talcum powder or icing sugar.

Mites feed on blood, and so when present in high numbers, they can cause anaemia. Other signs of infestation include restlessness, spending a lot of time in the water bowl and problems shedding (dysecdysis).

Mites are treated using pyrethrin-based sprays (e.g. Reptile Enclosure Spray) in the animal's enclosure and topical preparations (e.g. ivermectin diluted in water or fipronil sprays) on the animal. No mite treatment is guaranteed as 100% safe, and a veterinary assessment prior to any treatment is highly recommended.

6. Biosecurity

Biosecurity practices are vital in controlling and preventing infectious disease being transmitted between reptiles to reptiles in the wild, from reptiles to humans and from humans to reptiles.

Wildlife rehabilitators should implement good biosecurity practices, including hygiene, isolation and diagnosis and treatment of sick or diseased individuals (WHA 2018). The National Wildlife Biosecurity Guidelines provide detailed information on understanding biosecurity risks associated with wildlife, assessing the risk and applying appropriate risk management.

- House all animals separately. Rescued wild reptiles should be isolated from captive or pet reptiles.
- Do not share food and water bowls between animals.
- Thoroughly clean and disinfect all enclosures, food and water bowls and equipment between animals.
- Ensure hooks, tongs, catch bags and other equipment are thoroughly cleaned and disinfected before and after use.
- Ensure biological materials such as branches, logs and substrates are disposed of appropriately after use to prevent contamination between animals.
- Wash hands thoroughly before and after treating and handling individual reptiles.
- Use PPE as required: disposable gloves, covered clothing, alcohol-based hand sanitiser, eye protection (see ‘Personnel safety’ in Section 2).

A range of disinfectants (e.g. F10, Avicare) are available, with varying levels of efficacy against different pathogens. Follow the manufacturer’s instructions when using disinfectants as contact time, and dilution rates vary between products. Only surfaces that are impervious to water and completely free of organic material can be disinfected. Before disinfection, ensure surfaces are cleaned to remove organic debris.

If an unusual disease or mortality event is suspected, the wildlife rehabilitator must immediately contact their species coordinator to notify the DPI Emergency Animal Disease Watch Hotline (24 hours) on 1800 675 888 for immediate assessment of emerging health threats.

7. Zoonotic disease

Zoonotic diseases are diseases that can be transmitted from animals to humans. People who have regular contact with wildlife, such as veterinarians and wildlife rehabilitators, are considered to be more at risk of contracting zoonotic diseases. Knowledge of the disease, appropriate PPE and hygiene practices are vital in reducing the risk of disease transmission. Zoonotic diseases of specific importance to reptiles are listed below.

Salmonellosis

Salmonellosis is the most recognised reptilian zoonotic disease.

Transmission: Most, if not all, reptiles carry *Salmonella* bacteria in their intestinal tract and intermittently or continuously shed these bacteria in their faeces. Humans become infected by ingesting the bacteria.

Signs in reptiles: Salmonella rarely causes disease in reptiles. When it does, clinical signs can include anorexia, lethargy, paralysis, weight loss, bloody diarrhoea, shock and death. Disease can be acute through to chronic in nature.

Signs and symptoms in people: The infection is often self-limiting, and signs can include nausea, vomiting, diarrhoea, abdominal cramping and fever. Children and immunosuppressed people are particularly susceptible to disease, and in severe cases, hospitalisation may be required.

Prevention: Hygiene and PPE are vital in protecting against salmonellosis. This includes hand washing and regular disinfection of equipment. Testing or pre-emptively treating reptiles in care for salmonella is not considered useful and is therefore not recommended. It is safest to assume all reptiles may be shedding salmonella, and adopt appropriate hygiene practices on every occasion.

Mycobacterium

Several species of *Mycobacterium* known to cause infection in humans have been isolated from reptiles.

Transmission: Potential routes of transmission include direct contact through defects in the skin such as scratches and bites or with inhalation and contact with oral or respiratory mucosa.

Signs in reptiles: Infected reptiles will most often have granulomatous abscesses in the skin and organs. Treatment is not recommended due to the highly resistant nature of the organism to medications and the zoonotic potential.

Symptoms in people: The symptoms and severity can vary greatly from one person to another. The most common problem is chronic lung infection resulting in non-specific symptoms such as a cough, fatigue, shortness of breath, coughing up blood, fever, loss of appetite and weight loss.

Prevention: Hygiene and PPE are vital in protecting against mycobacterium. This includes hand washing and regular disinfection of equipment.

Other bacterial infections

There are many other bacteria found in reptiles that have the potential to cause disease in humans. These include *Campylobacter*, *Clostridium* and *Chlamydia*.

Transmission: Potential routes of transmission include ingestion, inhalation or direct contact with the organism and the specific route is dependent on the organism.

Signs in reptiles: Infected reptiles may not show any signs depending on the specific infection.

Symptoms in people: The symptoms and severity of disease in humans will be dependent on the organism involved.

Prevention: Hygiene and PPE are vital in protecting against assorted bacterial infections. This includes hand washing and regular disinfection of equipment.

Pentastomiasis

Pentastomids are a group of parasites of the respiratory tract commonly known as tongue worms. Pentastomids have zoonotic potential, although no human cases have been reported in Australia.

Transmission: Humans can potentially become infected by consuming water or foods contaminated with eggs eliminated in saliva or faeces of snakes, consuming raw or undercooked snake meat or by handling an infected reptile and ingesting pentastomid eggs.

Signs in reptiles: Infected reptiles classically show no signs of disease, and if they do, they are non-specific such as anorexia, lethargy, weight loss, oral and nasal discharge and laboured breathing.

Symptoms in people: Most infected people have no symptoms. If symptoms do develop, they vary depending on the organ or location in the body that is infected.

Prevention: Hygiene and PPE are vital in protecting against pentastomiasis. This includes hand washing and regular disinfection of equipment.

8. Record keeping

Accurate records must be maintained to track the progress and outcomes of reptiles in care. If the animal is referred for treatment at a wildlife hospital, these records provide vital clinical information for determining continued treatment and outcomes. They are also a useful resource for research and government organisations.

Records to be maintained include:

- encounter details – date, circumstances, location, name and details of people involved
- individual identification of reptile – species, approximate age if possible, sex if possible
- initial physical examination findings
- daily clinical notes – including treatments provided, progression or development of clinical signs, weight, food intake, faecal output, shedding occurrences. Maintain daily record sheets while the reptile is in care
- outcome – record the outcome for each individual coming into care; for example, whether the animal was transferred to a carer or veterinarian, if the animal was euthanased or if the animal died while in care.

These records are required to be submitted to the NSW National Parks and Wildlife Service (NPWS) as part of annual reporting requirements.

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10. More information

Report an unusual animal sighting

Licence to Catch and Release Reptiles

National Wildlife Biosecurity Guidelines (PDF 2.3MB)

Emergency Animal Disease Watch Hotline