



Australian Freshwater Turtles

www.turtles.net.au

A Non-Profit Animal Welfare Charity Promoting Conservation & Pet Turtle Health & Care



CARING FOR AUSTRALIAN FRESHWATER TURTLES IN CAPTIVITY

INTRODUCTION

Turtles are one of the most appealing animals of the reptile world. There are no 'effort free' animals to keep as pets, and turtles are no exception. Along with the pleasure of owning a turtle comes the responsibility to provide the best possible care for it that you can. Their survival is in your hands! If basic guidelines are followed, then your turtle should thrive in captivity and may even breed whilst in your care. Turtles are renowned for their longevity and provided your pet remains healthy, may live from fifty to over hundred years. This point should be taken into consideration before purchasing your turtle to begin with. You are choosing a friend for life! Most Australian freshwater turtles are very timid and shy, but within time will lose their fear and become accustomed to you and will recognise where their food comes from. There are many stories of keepers being amused while watching a turtles' antics in their aquatic enclosures, and many keepers agree that they each have their own recognisable personalities.

There is NO such thing as a 'Penny turtle'. This was merely a name given to at least four species of **baby** turtles that were sold in pet shops in the 60's and 70's at the size of a penny, including the Mary River turtle, the Saw-shelled turtle and the Southern snapping turtle. The poor husbandry advice given most often led to the turtle being improperly housed **without** heating, filtration, adequate UVB lighting and fed an improper low calcium diet causing the turtle to become 'stunted' or dying in its fishbowl, or aviary due to being improperly labelled a tortoise. There are no 'penny' sized turtles in Australia that stay that small as adults.

I believe that if more people keep Australian freshwater turtles as pets, the more knowledge we will gain from the experience and we will be better equipped to help them in the future. This will assist with the conservation & preservation of freshwater turtle species by creating a 'safety net' or 'assurance colony' of animals being bred in captivity. As pollution increases and wetlands are filled in for development, or rivers are dammed all in the name of progress, then we must make a concerted effort to monitor the effects that these impacts are having on our wild turtle populations. Australia's most endangered reptile is the Western Swamp turtle, with wild population numbers falling below thirty in the 1980's. This species is currently engaged in a careful breeding program under the watchful eye of turtle expert Gerald Kuchling and the Perth Zoo. Imagine how helpful it would have been if amateur herpetologists were already successfully breeding Western swamp turtles in captivity and could contribute to the depleted gene pool of the species.

Australia has some thirty five+ described species and sub-species of freshwater turtles and four monotypic genera. They naturally occur in all states and territories excluding Tasmania. There are possibly many more freshwater turtle species that remain undiscovered due to their elusive and secretive nature.

The correct taxonomic nomenclature that applies to Australian freshwater turtles is:

Kingdom - Animalia

Phylum - Chordata

Class - Reptilia

Order - Testudines

Suborder – Pleurodira - (Advanced side-necked turtles & Primitive side-necked turtles); EXCLUDING the Pig-nosed turtle (*Carettochelys insculpta*) which belongs to the **Suborder- Cryptodira - (hidden-neck turtles)** that evolved approximately 260 million years ago.

Members of the Suborder – **Pleurodira**, did not evolve until the Cretaceous Period - some 135 million years ago. Reptiles in this Suborder are closely linked together by the fact that their bodies are encased in a hard shell, they curl their necks back into the shell by horizontal movement and their pelvic girdle (Ref. Fig 1) is joined to the shell. Turtles are sometimes described as 'living fossils' and in many respects this term is correct. Members of the Suborder Pleurodira (**Advanced side-necked turtles ONLY**) occur in Australia, South America and New Guinea. Primitive side-necked turtles however also occur in South America as well as parts of Africa. The difference between Advanced and Primitive side-necked turtles has to do with the bone structure and the arrangement of the scutes on the shell.

TURTLE, TORTOISE OR TERRAPIN

The main difference is based on physiology.

Tortoises are terrestrial (land dwelling) and possess thick legs and toes and require water for drinking only. There are **no true** Tortoises native to Australia.

A Freshwater Turtle is aquatic and is not capable of swallowing food or mating unless submerged in water. They possess webbed feet or paddle-shaped, flipper-like limbs (as in the case of the Pig-nosed / Pitted-shelled turtle). Pig-nosed turtles will only leave the water to lay eggs. Australian web-footed turtles travel over land to nest, bask in the sun or seek more favourable conditions in circumstances including food shortage or drought. Freshwater turtles kept on dry land will dehydrate, starve and die slowly and painfully.

‘Terrapin’ is merely a synonym for Turtle and was derived from the North American Indian word ‘Terrapene’.



Tortoise limb

Freshwater Turtle
-webbed feet

Pig-nosed turtle flipper
-like limbs

TEMPERATURE CONTROL (THERMO-REGULATION)

Turtles are sometimes incorrectly regarded as ‘cold-blooded’ and cannot produce their own body heat, but instead regulate their body temperature by behavioural means like basking - (They are Ectothermic). Surprisingly, their body temperature can be higher than that of their environment. On warm or hot days, turtles may leave the water and bask, usually stretching their hind legs out behind them to attain maximum surface area or maximum contact with a warm surface, and will retreat into the water to cool down. Turtles have also been observed floating near the surface in warm water currents with outstretched limbs. Here they are able to capture valuable UV and warmth, but with the added security of being submerged. One interesting personal observation has been a turtle’s reluctance to sometimes dive back into the water after it has obviously reached its preferred temperature, and occasionally submerges its head and neck in an attempt to drink and cool down. Other turtles sometimes appear to be ‘crying’ and are releasing fluids via the eyes as part of a cooling mechanism. Basking also aids in the control of skin infections, assists in shedding scutes and helps inhibit the growth of algae on the shell. Freshwater turtles are able to gain heat much quicker than they lose it. They can also control the blood flow in their circulatory system to retain heat for as long as possible whilst submerged. The colour of the carapace of a turtle also plays a role in thermo-regulation. A darker carapace will heat up more quickly than a tan or other light coloured turtle and will be able to reach a higher temperature. Heat gained through basking and ambient temperature allows a turtles’ metabolism to increase.

Ultra-violet rays in sunlight trigger the synthesis of vitamin D3, so in spring and summer your turtles should be taken outside three to four times a week, for about ten to twenty minutes at a time of dry basking. Place your turtles in an escape proof container without water and find a quiet spot outside, making sure that you provide some shade for them to retreat to if they get too hot. Cover the container with netting or aviary mesh to prevent dogs, cats and birds from devouring them. Do not leave your turtles outside by themselves as they are very vulnerable to overheating, attacks by ants as well as much larger predators and pets. **Monitor their temperature at all times as overheating may result in their death.**



Female Mary River turtle basking

BRUMATION AND AESTIVATION

In the winter months, turtles kept in outdoor enclosures will reduce their activity, lose interest in eating and enter a state of dormancy termed brumation. The amount of time spent brumating is governed by environmental factors and some turtles can be seen on warm winter days swimming around or sunning themselves.

In the colder regions of Australia such as Victoria, turtles will brumate for longer periods than more northern species. Turtles living in warmer climates such as the Northern Territory will not brumate and will remain active right throughout the year. Turtles brumate either on land or in water, burying themselves in dirt and foliage, or mud and sediment respectively. Those that remain beneath the water are able to absorb oxygen by means of gaseous exchange. Gaseous exchange can be performed through three different processes:

- 1) Pharyngeal respiration - where an extremely vascularised area at the back of the mouth will take oxygen out of the water.
- 2) Cloacal respiration- is achieved through thin walled sacs in the cloaca, also absorbing oxygen from the water.
- 3) Oxygen absorption through the skin.



Fitzroy River Turtle juvenile demonstrating Cloacal Respiration through two highly vascularised Bursa located inside the Cloaca

It is important to note that **most** species cannot survive under the water for more than 2-3 hours without air when not in a state of dormancy.

Aestivation is when a turtle buries itself in the mud at the bottom of its waterhole, or drinks as much water as it can, then leaves the water and buries itself elsewhere to escape drought conditions, or dangerously low levels of water. During this time a turtle also enters a state of dormancy and slows its body processes down. Here it will remain until the water levels are restored or will perish in the event of an extended drought.

DIGESTION IN TURTLES

All modern turtles lack teeth. Short-necked turtles use the tough edges of their 'beak-like' mouths to tear and dismember food. Their clawed feet are also used here to shred large food items whilst they are firmly clamped by the jaws. Long necked turtles are essentially 'ambush feeders'. They strike with their mouths open, drawing in large quantities of water containing their prey. They will however eat dead fish, prawns, yabbies and insects. Food intake of all turtles is subject to availability, and the size and the age of each individual. Turtles are opportunistic feeders and may instinctively gorge themselves on food in preparation for food shortages. Food intake is also temperature dependent, with most turtles ceasing to feed below 16°C. Temperature also plays an important role in the time food takes to pass through the digestive system. For this reason it is not recommended to offer food to your turtles for several weeks prior to brumation or hibernation, as the food may slowly rot in the gut and cause death. Food normally takes between 2 to 6 weeks to be completely digested and this is due to a turtles' slow metabolism, which is dependent on many factors including body temperature and ambient temperature. Feeding them red meat is extremely hazardous as slowly digested red meat can cause toxins to build up within your turtles digestive tract. This is one of many reasons why **red meat and frozen "Turtle Dinners" etc. should not be included in a turtle's diet**. Apart from it being a completely unnatural food source, red meat and products containing red meat are also not recommended as it is not nutritionally beneficial to turtles. Turtles will live longer and benefit more from fish, prawn, aquatic plant and insect protein. Too much protein causes rapid growth (which is dangerous without increased calcium and essential vitamins and minerals), obesity, calculi / stones forming in the bladder and kidneys, Metabolic Bone Disease (MBD) and shell deformities including scalloping, tenting and pyramiding.

At the end of the intestinal tract is the Cloaca (Ref. Fig 2) which is where faecal and urinary waste collects and is passed. Both the male and female genital openings are also located in the cloaca.

THE SHELL

A turtle's shell is divided into two sections. The lower section is the Plastron and the upper section is the Carapace (Ref. Fig. 1). The two sections are joined together by the Bridges that are located both side of the body, between the fore and hind limbs. The strength of the shell comes from the fused plates (Ref. Fig 1), which are covered by shields called scutes, lamina or scales (Ref. Figures 1+3). These shields are made from Keratin that is produced by the Malpighian cells, located just under the scutes.

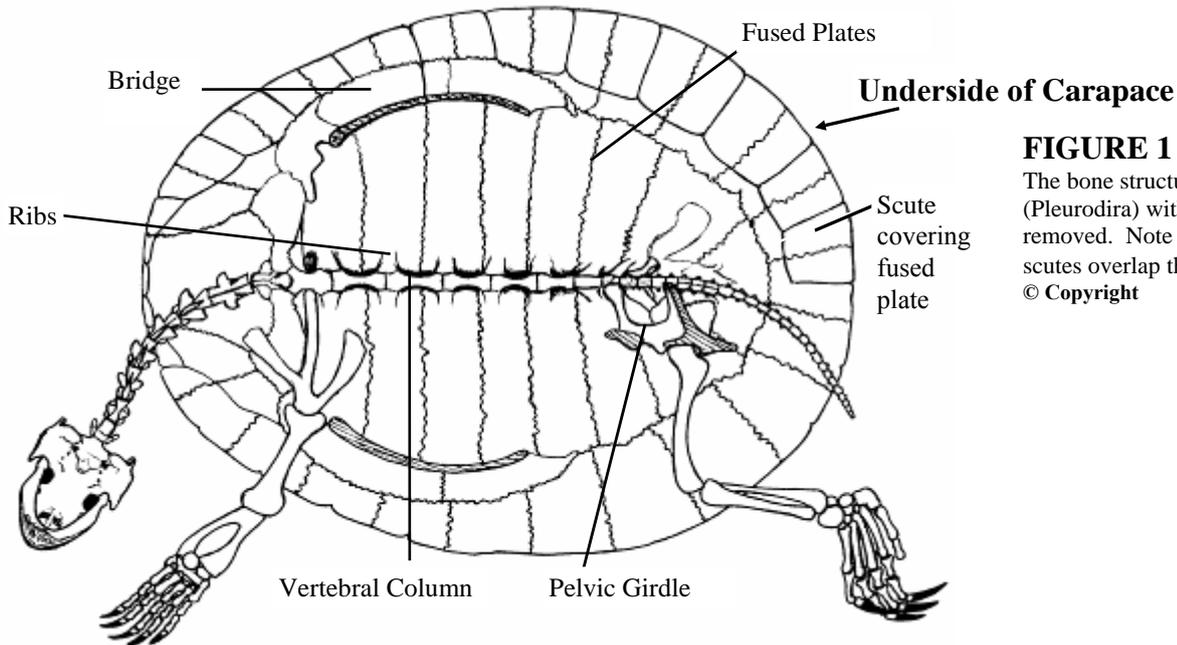


FIGURE 1

The bone structure of a Turtle (Pleurodira) with Plastron removed. Note the marginal fused plates. © Copyright

CIRCULATORY SYSTEM

A turtle's heart (Ref. Fig 2) has only three chambers. Many things including increased activity, temperature and increased water pressure during diving affect their heart rate. An increase in ambient temperature will cause an increase in heart rate, thus increasing a turtle's metabolism. As a turtle dives, pulmonary resistance increases and the heart rate decreases. The scientific name for this is '*Bradycardia*'. When a turtle dives, the level of oxygen in the blood decreases as the body uses it. Anaerobic metabolism takes over causing an increase in carbon dioxide. Most aquatic turtles can tolerate extremely high levels of carbon dioxide in the blood. After about 15 minutes of being submerged and the oxygen supply is depleted, the brain will divert (as previously mentioned) to anaerobic metabolism. Here the brain can continue to function effectively for around 2- 3 hours depending on the species and size of the individual.

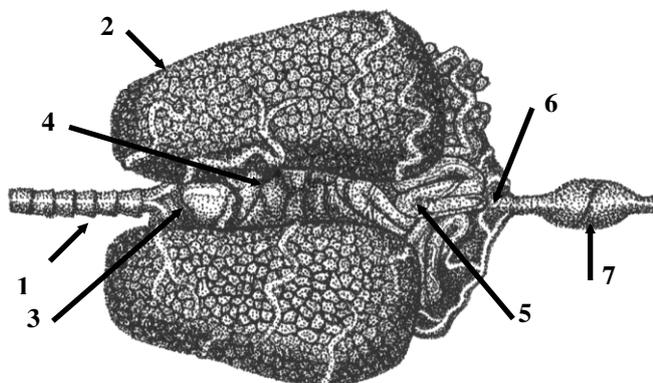


FIGURE 2

Internal Organs
 (1) Trachea
 (2) Lungs
 (3) Heart
 (4) Liver
 (5) Small Intestine
 (6) Bladder
 (7) Cloaca
 © Copyright

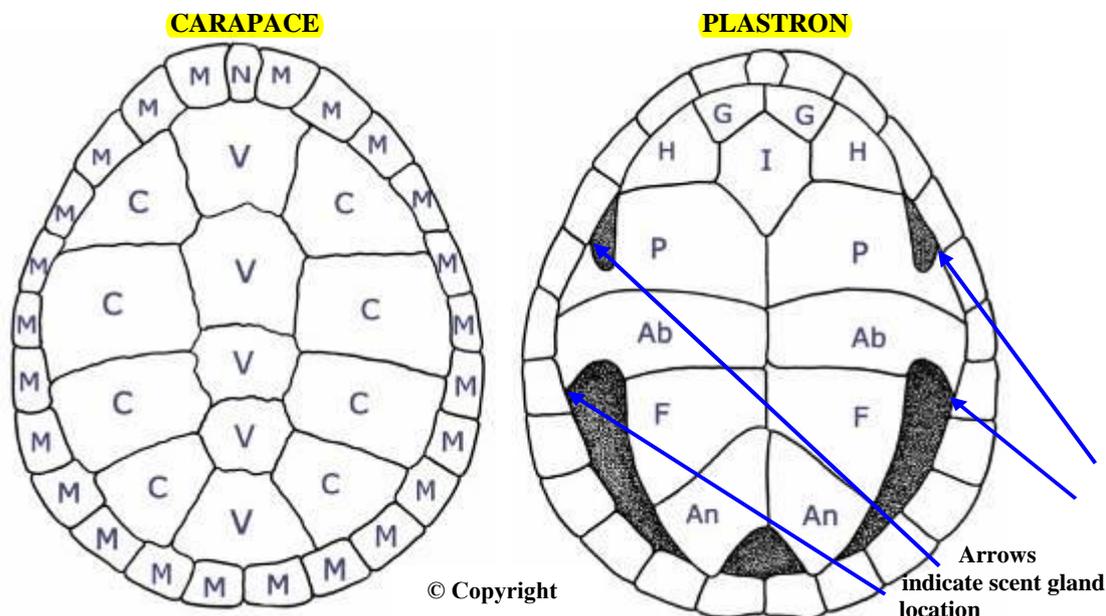
RESPIRATION

Unlike the lungs of mammals, a turtle's lungs (Ref. Fig 2) are not sustained at positive pressure. The ribs of a turtle are joined to the shell (Ref. Fig.1) and cannot expand like ours so breathing has to be performed with the help of muscles that are located near the limbs at the four corners of the shell. These muscles create negative pressure in the lungs and respiration (breathing) takes place. Inspiration (inhaling) occurs due to the difference in pressure created and air flows in. Expiration (breathing out) however does take quite some effort.

When a turtle enters the water and is at the surface breathing, this situation is completely reversed due to the water pressure acting on the body. Inspiration (inhaling) now requires muscular activity, and expiration (exhaling) is aided by the water pressure acting on the body forcing carbon dioxide out of the lungs, and takes hardly any effort. The amount of air in the lungs and the shifting of fluids within the bladder and cloaca control a turtle's buoyancy. Proof that the lungs help control a turtle's buoyancy is clear when watching a turtle with a respiratory infection. **Turtles suffering from respiratory infection cannot dive and have been observed floating at unusual angles** (pers. obs) in the water.

FIGURE 3

Nomenclature of a Turtle's Scutes



N=Nuchal M= Marginal C= Costal V= Vertebral G= Gular
H= Humeral I= Intergular P= Pectoral Ab= Abdominal F= Femoral An= Anal

SIGHT, SMELL, HEARING AND VOCALISATION

A turtles senses of vision, smell and hearing are extremely well developed which is necessary for locating food, avoiding predators and important in finding suitable partners during the breeding season. It has been suggested that they possibly have colour vision and this may be why some turtles show colour preferences when feeding. All freshwater turtles have a thin, transparent third eye-lid called a nictitating membrane that covers their eye whilst they are submerged to allow them to see effectively under water. Their sense of smell is highly developed and is achieved through the nostrils and also through a specialised structure called Jacobsen's organ. Jacobsen's organ is located in the roof of the turtle's mouth. Its function is to detect and identify tiny scent particles that are floating around in the air and water. The scent particles are moved around the mouth and throat by 'gular pumping' (throat movements similar to that of frogs). I have observed many species of freshwater turtles gular pumping whilst they are submerged.

Turtles do not have an external ear opening, instead they have a Tympanum (eardrum) that is covered with skin. The inner ear is surrounded by a bony box-like structure known as the otic capsule. Turtles' hearing is at its best detecting low-frequency vibrations under water and to a lesser extent, on land. Their ability to hear medium to high frequency sounds is difficult to determine.

All Australian turtles have four scent glands, one on either side of the two bridges of the shell near the limb pockets (Refer to arrows on Fig.3). The odour produced is used as a defence mechanism against predators, and possibly with other males when they feel threatened while competing for the same female during the breeding season. I often hear of stories where turtles are rescued from roads and are quickly released due to the pungent odour.

Recent studies have shown that Australian freshwater turtles can communicate with each other via a wide range of vocalisations that are too soft for humans to hear. This complex form of communication may be essential in turbid water conditions. There is also some evidence that 'head bobbing' echolocation may be utilised for finding prey items and to get a three-dimensional image of their pond, aquarium or prey.

KEEPING TURTLES INDOORS

It is recommended to keep small turtles up to fifteen centimetres SCL (Straight Carapace Length) indoors where they can be easily monitored. A 120cm-180cm (4ft -8ft) length aquarium is recommended, depending on the species. The width of the aquarium is very important for freshwater turtles and should be a minimum of 2ft (front to back).

Glass aquariums should be placed on Polystyrene foam (available from your local aquarium shop) to prevent the glass from cracking due to imperfections in your aquarium stand. Large turtles should be kept in outdoor ponds, but if this is not possible, a minimum 6ft X 2ft X 2ft tank will be sufficient for two or three individuals, depending on the species. A guide to how many turtles you can keep in your aquarium is to work out your aquarium water volume. For every 100 litres of water your tank holds, you can accommodate 1 kilogram of turtles. Therefore, a 180 cm (6ft) X 60 cm (2ft width) X 50 cm (water depth) aquarium can hold approximately 5 kilograms of turtles as adults. Use the link to the AFT Water Volume Calculator below to work out your aquarium water volume. The aquarium substrate should be made up of 2-3 centimetres of Calgrit & (1-3mm graded river sand mix). Do not use beach sand as it has sharp, angular edges. Ask AFT for more information at www.turtles.net.au/ If your aquarium's substrate is any deeper than this then anaerobic bacteria can cause unstable water chemistry, including high levels of ammonia, fluctuating pH and can also produce toxic gas (hydrogen sulphide).

The water depth should vary according to the size of your turtle. Very small turtles should start with a water depth of 15-25 centimetres. Larger turtles can have a full aquarium providing they cannot escape. It is not recommended to have an enclosed hood on your turtle aquarium as constant humidity can cause respiratory infections. Dangerous black mould can also be an issue in humid conditions. A commercially available mesh lid is a more suitable choice.

Calgrit (composed mainly of the mineral 'calcite'- calcium carbonate & trace elements) if accidentally swallowed is readily digested and is a good source of calcium. Calgrit prevents soft-shell, buffers pH, increases Carbonate and General Hardness and makes ammonia and nitrites less toxic than they are in soft water. To work out exactly how much Calgrit, river sand and turtle salts you need, use the free online 'AFT Water Volume Calculator'. Simply insert the length, width and water depth into the [AFT Water Volume Calculator](#) at AFT for the results. Calgrit does not need to be replaced, just top up the Calgrit in your tank as it dissolves.

The addition of 0.4% to 0.5% (4-5 grams per litre) of turtle salts to your aquarium water helps to prevent skin infections. Do not add salt when replacing evaporated water. Only add additional salt when physically removing water during partial water changes or substrate vacuuming. **Do not add Turtle Salts when topping up an aquarium due to evaporation!** Once again, the Water Volume Calculator will calculate how much salt is initially required. Dissolved salts in your water detoxify ammonia and nitrites which are the first two nitrogenous compounds of the nitrogen cycle.

Include some driftwood in your tank for a more natural look and for behavioural enrichment. If tannin from the log discolours the water, simply add a Purigen pillow (by *Seachem*) to the final stage/compartments of your filter.

LIGHTING

The aquarium should also contain a basking platform so that your turtle may leave the water to bask and dry out at will. Basking assists with the skin and scute shedding process. There are a wide variety of floating turtle basking platforms available on the market that are far more suitable than pebble covered, fixed glass platforms which can cause damage to your turtles' plastron, causing infection.

The 'basking areas' should be situated directly below the sides of the aquarium where the glass lids can be removed (glass and Perspex blocks all beneficial UVB light). Here, your turtles can receive direct light from special UVB & UVA producing Reptile fluorescent tubes or UVA/ UVB producing spotlights, which are available from specialist reptile and aquarium shops. A fluorescent tube 'reflector housing', available from any good aquarium supply store, is recommended and more beneficial than a standard fitting. Turtles kept indoors should receive ten to twelve hours of artificial light each day. Fluorescent tubes

that can simulate sunlight are beneficial to their growth and survival but are **not** a substitute for natural sunlight. T8 and T10 tubes need replacing **every** 6 months. High output T5's do not need to be replaced until 12 months and should not be closer than 30cm from the top of your turtle's shell when on the basking platform.

Remove all glass and perspex lids from under the fluorescent tubes as glass and perspex 'filters out' UVB rays and this would be defeating the purpose of using an expensive UVB light. Connect the power supply to the light with an electrical timer so that it turns on and off at the same time each day. This will remove the tedious task of turning your lights on and off and allow the turtles to become accustomed to a normal day/night cycle.

An Exo-Terra Swamp Glo basking spotlight situated above the basking area will add warmth and coax your turtle out of the water, helping it to achieve its preferred body temperature which aids all of their body processes, including digestion. Swamp Glo lights are splash proof and well suited for turtle aquariums as they do not shatter when water is directly splashed onto a hot bulb. It is recommended to use a non-contact infrared thermometer to monitor the temperature of the basking area.

Ultra-violet rays in sunlight trigger the synthesis of vitamin D3, so in spring and summer your turtles should be taken outside three to four times a week, for about ten to twenty minutes at a time of **dry basking**. Place your turtles in an escape proof container and find a quiet spot outside making sure that you provide some shade for them to retreat to if they get too hot. Cover the container with netting or aviary mesh to prevent dogs, cats and birds from devouring them. Do not leave your turtles outside by themselves as they are very vulnerable to overheating, attacks by ants as well as much larger predators and pets. **Monitor their temperature at all times as overheating may result in their death.**

FILTRATION

Turtles excrete much more waste than fish, so a good filtration system should be included. A wet/dry trickle filter system is highly effective and recommended for use in a turtle aquarium. A good reptile or aquarium shop should be able to recommend some of the latest filtration systems that will best suit your needs. Canister filters that turn over your aquarium's volume of water a minimum of 7 times per hour are recommended as the minimum requirement for all turtles as they produce a large amount of waste. Clean the substrate weekly by gently running your fingers through the Turtle Grit/river sand mix to loosen and stir up any detritus for your filter to pick up, or by using a gravel vacuum, available from most pet & aquarium stores. The frequency that you vacuum your aquarium depends on many factors including how many turtles you have and whether you feed your turtles in a separate container out of the aquarium.

HEATING

A thermostatically controlled submersible water heater with heater guard should also be included to maintain a constant water temperature. 22° - 24°C is recommended for Eastern snake-necked turtles (*Chelodina longicollis*) and 25°-27°C is recommended for all other temperate climate species. Tropical species like Painted turtles (*Emydura subglobosa subglobosa*) require temperatures ranging between 27° and 29°C, whereas Pig-nosed turtles (*Carettochelys insculpta*) are best kept between 27° and 30°C. Please check the [AFT website](#) for specific water temperatures of other species.

WATER QUALITY

Water quality in a pond or aquarium situation is very important as it can mean the difference between owning healthy or constantly sick turtles. Dirty water can promote many diseases and skin conditions that would not normally occur in their natural environment. Whilst in captivity, a turtle's illness can be worse than if it had the same problem in the wild. This can be due to many factors including the increased stress associated with being kept in unnatural conditions.

If you are experiencing a continual problem with your turtle's health you will need to investigate the water parameters in your aquarium more closely. Sparkling clear water is not always an indication of its purity. Many 'invisible factors' that can have detrimental effects on your turtles' health include increased water acidity or excessive alkalinity (pH), excessive salinity, incorrect temperature, hardness and levels of chlorine, chloramines, nitrate, nitrite and ammonia. Wherever possible, you should try to replicate your turtle's natural environment.

WATER CHEMISTRY

pH

The pH value is the measurement of hydrogen ion (H⁺) concentration in relation to the hydroxyl ion (OH⁻) concentration in water. The more hydrogen ions found in a body of water, then the more acidic the water will be and the lower the pH. The more hydroxyl ions present then the higher the alkalinity and pH. A pH test kit is used to check the degree of alkalinity or acidity of water. pH ranges from 0 to 14 with 0 being extremely acid and 14 being extremely alkaline. Most basic test kits range from 6.0 to 8.0 with neutral being 7.0. Sudden fluctuations and values outside these measurements can be harmful to plants, fish and other animal life. It is important to understand that pH is a logarithmic scale meaning that each step is ten times greater than the step before. A reading of pH 8.0 is ten times more alkaline than pH 7.0 and also pH 6.0 is ten times more acidic than pH 7.0. The scale represents a ten-fold change in levels of acidity and alkalinity. Therefore a reading of pH 5.0 is 100 times more acidic than pH 7.0 (neutral) and pH 9.0 is 100 times more alkaline than pH 7.0 (neutral).

There are many factors that can cause the pH of your water to fluctuate. Biological filtration can become an acidifying process when there is a reduced oxygen level from the breaking down of waste and decaying organic matter. This reaction is amplified when there is decreased water flow. The addition of calcium and trace elements in the form of Turtle Grit will increase water alkalinity. Commercial pH adjusters can temporarily change the pH levels of your pond or aquarium water. pH up (**Sodium Bicarbonate**) will reduce acidity and increase alkalinity. pH down (**Sodium Biphosphate**) will reduce alkalinity and increase acidity. When altering the pH level within an aquarium it should be done gradually, following the manufacturer's instructions.

Once the aquarium is established the water should be checked frequently for pH levels using a pH test kit. An alkaline reading of 7.4 to 7.8 is recommended for healthy turtles. Increasing the pH to an alkaline reading at the higher end of the scale of around 8.0 for very short periods can be used as a preventative and cure for some skin infections but ammonia in your water becomes very toxic at this pH level.

Carbonate Hardness

Carbonate hardness can best be described as the levels of carbonate and bicarbonate found within water. Carbon dioxide dissolved in water reacts with calcium and magnesium to form carbonates. Heated water in tropical aquariums could cause the carbon dioxide to be released and a white, crusty deposit (calcium and magnesium) may form on the glass.

The Carbonate hardness of water and pH go hand in hand. Carbonate hardness helps to control and stabilise the pH. Acids produced in anaerobic (lacking oxygen) pond and aquarium biological filtration systems will reduce the carbonate hardness value found in water, and will therefore make it difficult to keep the pH stable. Raising carbonate hardness levels can be done by adding Turtle Grit. Carbonate hardness test kits are available from most good aquarium outlets or pet shops. The ideal level of carbonate hardness in a turtle tank is **80ppm**.

General Hardness

Water can contain many dissolved substances from organic and inorganic compounds, which are described as 'trace elements'. Many of these trace elements are important in sustaining life within all ecosystems. They include calcium, magnesium, potassium, sodium, sulphates and chlorides. General Hardness is the levels of calcium and magnesium concentrations found within a body of water. General hardness is caused by acids reacting with magnesium and calcium to form calcium sulphate, calcium chloride and magnesium sulphate and magnesium chloride. The desired range for general hardness is between **180ppm and 200ppm**. General Hardness can also be raised by adding Turtle Grit to your aquarium substrate.

Salinity

Adding between 4-5 grams of pure evaporated sea salt (pool salt with no additives) to every litre of water

(0.4% - 0.5%) will help reduce the chances of your turtle getting skin infections. Salt also inhibits diseases and helps to destroy infectious micro-organisms. **Never use iodised salt or salt with added caking agents.**

OUTDOOR ENCLOSURES

Turtles over fifteen centimetres shell length can be kept in larger ponds outdoors. A fibreglass pond or pond liner, which can be purchased from most large garden nurseries, are both perfect for beginners. Make sure to choose a fibreglass pond without pebbles or stones covering the inside, or scarring and infections in your turtle's shell may result. For the serious enthusiast, a pond can be constructed of concrete. A builder should be consulted to determine the thickness of the walls, the amount of steel reinforcing to use and the best product to seal the concrete with.

Water depth should be a minimum sixty centimetres to allow turtles to mate successfully and help prevent the water overheating during summer. The pond should be situated where it will receive as much sunlight as possible, especially the morning sun, as turtles like to bring themselves to their optimum temperature so they can begin their daily activities. Shade an area of the pond so they can escape from the harsh midday sun and hide when they feel threatened. Build a wall at least eighty centimetres high around your enclosure to prevent escape. Turtles are extremely good climbers. A large Saw-shelled turtle has been observed escaping from its enclosure by climbing over a two-metre barrier made of kopper logs. An island or land area filled with sand or a mixture of sand and soil should be provided to allow turtles to leave the water to dig a nest and lay eggs, bask in the sunlight and hibernate. A large log should be included to serve as a ramp for your turtles so they can leave the water at will. Grass and grass roots should be removed from the enclosure.

Small native fish and freshwater prawns can be added once the water chemistry in the pond has stabilised. Aquatic plants (Val/Ribbon Weed, Elodea, Azolla, Duckweed etc.) are favoured by most short-necked turtle species. They will make your pond more attractive, provide hiding spots for your turtles and supplement their diet.

POND FILTRATION

A filtration system should be incorporated into the design of the pond. At the heart of any good filtration system is a pump. There are two types of pumps available. These are the submersible and external models. The volume of water your pond holds and the recommended filtration flow rate should be taken into consideration. A good rule of thumb is to select a pump that will turn over the entire volume of water 4 to 7 times an hour. The submersible pump and the inlet pipe of the external type should have a pre-filter / filter strainer or screen fitted to prevent the loss of fish and the limbs of small turtles. If you decide to use the submersible pump type, then one with a built in, low level cut out switch is preferable. I have had success with the combination of a 70 Watt ultra-violet light steriliser unit, a system 2000 Biological / mechanical pond filter and a 2000 litre biological matting filter. The ultra violet-C rays that the UV-C steriliser unit emits prevents algal blooms by damaging the microscopic algal cells internally, thus killing them. The ultra violet unit also helps to reduce the levels of infectious micro-organisms in the pond. If you include a UV-C steriliser unit into your pond filtration, it is important to connect it as the final stage of filtration before the water returns to the pond. The purpose of a biological filtration is to provide a large surface area of filter 'medium' to provide a home for vast quantities of nitrifying bacteria that break down toxic waste into less harmful substances. Scoria rock is an excellent biological filter 'medium' and is highly recommended in larger pond filtration systems. Each individual scoria rock has many tiny holes on its surface which provides a home for microscopic nitrifying bacteria. 'Bog' filters are also recommended as they include densely vegetated areas that naturally filter water through plant root systems, and remove nitrates from your pond by providing the plants with nitrogen. Plants require nitrogen for protein synthesis.

For more information on setting up 'Bog' filters go to [AFT](#) and search the DIY forum as well as the Keeping Turtles Outdoors forum.



Ideal outdoor concrete turtle pond with viewing windows



Three types of filtration- Mechanical (Grey pond filter), Biological (black tub with dense matting) and UV Clarification/Sterilisation (Stainless steel tube)

DIET

A natural, well balanced diet with plenty of variety should keep your turtles in a very healthy condition. Feed your baby turtle a **portion the size of its head** every day up until approximately 7 cm Straight Carapace Length (SCL). Larger juvenile turtles (7cm SCL to 12cm SCL) only require feeding every second or third day and larger turtles (12+ cm SCL) only require feeding only every fourth or fifth day.

However having live aquatic plants (for short-necked turtles) and feeder fish and freshwater prawns available at all times is recommended. Overfeeding can be detrimental to their health. A turtle's diet should include small whole fish and silkworms (both are high in calcium), pesticide free garden worms, insect larvae, freshwater prawns, raw salt water prawns (soaked in freshwater) with their sharp rostrum and tail spike removed, freshwater mussels, non-brightly coloured moths, woodies and small yabbies. Good quality turtle pellets or plant based fish pellets, including Hikari Cichlid Gold and Exo Terra Aquatic Turtle pellets should also be included in your short-necked turtle's diet. Long-necked turtles rarely eat 'turtle pellets' and need a diet that includes live feeder fish, freshwater prawns, yabbies and a variety of insects including woodies, flies, non-brightly coloured moths, silkworms (very high in calcium) and garden worms. Do not feed your turtles mincemeat as it is too fatty, and can contain chemical dyes and preservatives. Also avoid feeding your turtles red meat of any kind as it lacks the vitamins and minerals necessary for their growth and survival. Apart from that, red meat cannot be fully digested by turtles.

A short-necked turtles' diet should also include a wide variety of aquatic plants. Ribbonweed/Vallisneria, Duckweed, Azolla and Elodea are all readily eaten in the wild. Dandelion, Clover, Cat's ears and Plantain are all common terrestrial weeds that are high in Calcium, LOW in Phosphorous and highly recommended if you wish to add easily sourced plant matter to your turtle's diet. Aquatic snails carry trematode parasites, protozoa and flukes, and shouldn't be fed to pet turtles.

For turtles all sizes we recommend the following 'Turtle Pudding': Mix 'Wombaroo Insectivore Rearing Mix' (available from all veterinary clinics & some specialist Pet Stores) with gelatine and warm water to a sticky paste, and add whole feeder fish, prawn meat and/or yabby tail meat. You may need to blend this mix in an electric blender. If you are feeding short-necked turtles you can add duckweed as well. Adding Calcium Carbonate to the mix will help with bone and shell development. Spoon into ice-cube trays and allow to 'set' in the refrigerator. Turtle Pudding cubes can then be placed in a bag and frozen for use at a later date. Various insects could also be added to the mixture for a more natural source of food.

All of my short-necked and long-necked turtles, hatchlings and adults alike, find this mixture irresistible.

Native floating water plants like Duckweed (high in calcium), Ribbonweed (Val), Elodea and Azolla are readily eaten in the wild and can be added to your pond or aquarium as a supplemental food source. In an aquarium situation you will need to install a special plant light as they require different light wavelengths from the ones reptile lights produce. In an outdoor pond, food should be offered mid-morning or mid to late afternoon, as turtles tend to hide when the sun is at its highest. Remove any uneaten food as this will soon become rancid and pollute your water.

Frozen, commercially available "Turtle Dinners" are **not** recommended for freshwater turtles as they contain red meat which cannot be fully digested by turtles. Diets high in red meats are also customarily high in phosphorous and low in calcium.

It is best to provide a diet high in calcium and low in phosphorous with the recommended ratio being at least 2 : 1 of Calcium to Phosphorous.

Peas and Corn are two of the worst vegetables that can be fed to turtles as they contain multiple anti-nutritive properties. Peas are extremely high in Phytic acid which binds with minerals like calcium and magnesium, preventing the body from metabolising these minerals and utilising them. Even adding additional calcium and magnesium to the diet will NOT overcome this problem, but will actually create a greater deficiency. Peas are also very high in protein which is a 'double blow' to a turtle's system if they are fed in combination with red meats of any kind. Corn is high in Phytic acid and oxalic acid. Phytic acid, as mentioned previously, binds with calcium and magnesium, which are two very important minerals to turtles, and prevents the body from processing them for their own use. Oxalic acids in corn also binds with calcium and magnesium (as well as other minerals) to form oxalates (salts) which further diminishes these minerals from being metabolised and used by the body.

I do not recommend ANY 'human' vegetables of any kind being fed to your turtles, but especially **NOT** peas, corn, lettuce, beans and spinach. **For further information see DIGESTION above.**

DISEASES AND TREATMENTS

It is important to realise that most diseases and ailments do not just happen; they are the result of stress, incorrect diet or poor husbandry. Newly acquired turtles should be quarantined (in water that has been treated with a multipurpose wide spectrum medication) at the recommended ratio for a minimum of 3 weeks. Watch closely for any signs of sickness, disease or parasite infestation and treat accordingly.

It is highly recommended that you consult your reptile specialist veterinarian before initiating any treatments.

ACCIDENTAL DROWNING

As turtles are air breathing animals there is always the possibility for drowning to occur in certain circumstances. Sometimes when hatchlings and juveniles are kept in water that is too deep or is too turbulent to allow them to surface, the turtle may accidentally drown. Their feet may also become trapped in the **intake of uncovered filtration** pipes or under and between rocks, logs or other aquarium furnishings, especially in aquariums with no substrate, which is not recommended!

If this happens, a turtle may appear to be dead but in fact its heart may continue to beat for several hours after the event. Treatment for this involves holding the turtle between both of your hands with the neck supported (by your fingers) and tail pointing towards your wrist. While holding the turtle with its head facing towards the ground (so water will drain from the mouth) gently swing it between your legs to force any remaining water out of the lungs. Gently blowing into the mouth and nose, may also be necessary for resuscitation.

Open the turtle's mouth with your fingers and gently blow until you see the limb pockets expand, and then stop to allow air to escape. Repeat the breathing until you get a response from the turtle.

If the turtle recovers, it should be taken to a reptile veterinarian immediately! In order for the turtle to completely recover, it will require close observation, special care and medication to prevent respiratory infection!

EXTERNAL PARASITES

Leeches and oligochaetes can sometimes be found on turtles housed in outdoor ponds and can be easily removed by dabbing a paste made from Copper sulphate and water on them. Rinse the copper sulphate off your turtle before returning it to your pond. Copper sulphate is commonly used on horses hooves and can be purchased from produce and rural stock feed stores.

INTERNAL PARASITES (WORMS)

The most common types of worms found in turtles are the red Nematode worm and the white Roundworm. They are usually detected when your newly acquired turtles are quarantined and found wriggling at the bottom of the container. Your veterinarian can treat this infestation by orally administering *Panacur*® (Fenbendazole) at 25 mg/kg once every second week for 8 weeks.

NOTE: Ivermectin, often used to treat worms in other reptiles, should under no circumstances be used due to its toxicity to turtles.

CUTS AND SCRATCHES

Betadine® antiseptic ointment may be used to treat all superficial wounds including scratches, bites, cuts and abrasions. Betadine is a very good antiseptic and is recommended by veterinarians. After treatment, keep the turtle out of the water for 1 hour. Be careful not to accidentally apply any to your turtles eyes. **Thoroughly rinse the turtle under running water before returning to the aquarium as residual antiseptic will destroy important nitrifying bacteria in your filtration system.**

SEPTICAEMIA

Septicaemia is a blood infection or 'blood poisoning' that is usually indicated by bleeding into the skin or skin redness. Minor infections caused by wounds can sometimes allow bacteria to enter the bloodstream and travel to other vital organs where other infections may develop. We recommend *Fortum* (ceftazidime) antibiotic at a dose rate for turtles of 20 mg/kg SQ/IM q 72h* (injected subcutaneously or intramuscularly every 72 hours with a minimum of 5 injections.)

SHELL INFECTION

A rough or sharp object in your turtle's enclosure usually causes this problem. Remove **any sharp or abrasive rocks** from the area and replace them with logs. Ensure that all exits are non-abrasive. Treat the shell by covering the damaged area with *Betadine*® ointment and keep the turtle out of the water for 24 hours to help prevent infection. Thoroughly rinse the turtle under running water before returning to the aquarium as residual antiseptic will destroy important nitrifying bacteria in your filtration system. **Your veterinarian may need to be consulted.**

SHELL ROT

This condition can be caused by even a small scratch or bite which allows bacteria or pathogens entry to soft tissue under the scutes. The bacteria most responsible for this are anaerobic and rapidly spread in the absence of oxygen. Carefully remove all dead tissue and clean affected area with *Betadine* solution and a stiff brush, thoroughly rinse with water, then allow the area to "dry out" and fresh air to circulate around the wound. Isolation is recommended as shell rot is highly aggressive and contagious and can be passed on to other turtles. Thoroughly rinse the turtle under running water before returning to the aquarium as residual antiseptic will destroy important nitrifying bacteria in your filtration system.

Some of the symptoms of shell rot include: 1. Pitting in the shell on or just below the surface. 2. Soft areas on the shell (especially on the plastron) that are yellow or cream in colour and often have a pungent odour. 3. Areas where scutes have lifted or fallen off exposing bony plates that have live or necrotic tissue underneath. 4. A build-up of reddish fluid visible under the scutes. **Consult your reptile veterinarian as a course of *Fortum* antibiotic injections may be required.**

SOFT SHELL

This condition is unfortunately common amongst young turtles kept indoors, and will usually lead to their death. All young turtles have soft shells upon hatching which will usually begin to harden within two weeks. If calcium and proper UVB light are not available then the hardening of the shell may not eventuate. The solution is to offer a natural diet of insects, fish, worms, mosquito wrigglers, silkworms and garden worms etc. and sufficient artificial UVB producing light and lamps, as well as natural sunlight. Adding Turtle Grit to your aquarium substrate will help prevent soft shell disease.

SWOLLEN EYES

This complaint is predominantly caused by dirty or contaminated water, and is distinguished by the swelling of the area around the eyes. Treat the infected eyes with *Chloropt-P* or *Chlorsig* ointments and keep the turtle out of the water for an hour after treatment. Change the water and clean the aquarium or pond regularly to prevent recurrence. Swollen eyelids or eyelids that are stuck together indicate an even more serious problem. A **vitamin A** deficiency, as seen in many hatchlings that are fed exclusively on red meat, causes the Harderian and Lacrymal glands to enlarge and force the eyelids across the eyes causing blindness. **An injection of vitamin A by your veterinarian and a natural diet should lead to a speedy recovery.**

BACTERIAL SKIN INFECTIONS

This complaint mainly affects turtles that are housed indoors and three predisposing factors can be lack of sunlight, incorrect water pH and dirty water. The first indication of skin infection will be the appearance of grey, white, or yellow patches on the skin. If the infection is not treated quickly, it will eventually spread over the entire body and may cause death as rapidly as within five to seven days. Treat the infected areas with **10% Povidone-Iodine** solution, **Betadine®** ointment or **Panalog** (**avoid contact with eyes with ALL products**) and keep the turtle out of the water during treatment by 'dry-docking' it. There is a dry-docking guide available at [AFT](#) that should be consulted for further information as dry-docking times vary for turtles of different sizes.

Thoroughly rinse the turtle under running water before returning to the aquarium as residual antiseptic will destroy important nitrifying bacteria in your filtration system.

Repeat this procedure 3 times a day for two to three days. If symptoms show no sign of improving, a vet will need to be consulted to obtain **Silvazine** ointment which has been used successfully with difficult and persisting cases. Immediately do a 30%-50% water change in your aquarium and add aquarium salt at a rate up to 5 grams per litre (**ONLY if you do not already have salt added to your aquarium water**). If symptoms persist, I would also recommend making a small bath of water and broad-spectrum aquarium remedy such as **Multi-Purpose Medication** by Aquarium Science, in a separate container to the manufacturer's recommended dosage. Place the infected turtle in the solution for one hour, remove and allow your turtle to dry out, and then return it to the aquarium. As previously mentioned, most skin diseases require **urgent** attention and treatment as they can cause death within as little as five days and are often associated with another underlying problem. **A veterinarian may need to be consulted to remedy this condition.**

SALMONELLOSIS

Salmonella bacteria are a normal part of a turtle's digestive system. When the animal is sick or stressed, a bacterial imbalance may occur, causing infection and disease. It is of vital importance that animal and personal hygiene is maintained at all times. **After handling your turtle, please ensure your hands are washed thoroughly with an anti-bacterial soap as a precaution before eating.** Recommended Veterinary treatment is 2.5 mg/kg **Neomycin** every 24 hours orally for 3 days.

RESPIRATORY INFECTION AND PNEUMONIA

Turtles kept in continuously cold or draughty conditions may develop a respiratory infection. Some indications of this condition are loss of appetite, discharge from the nose in the form of bubbles, drooping of the head, and wheezing. This condition can be fatal if not detected in its early stages. Outdoor ponds should receive morning and afternoon sun to allow turtles to bask and achieve a preferred body temperature. Indoor aquariums should be heated and have a constant temperature of between 24°C and 27°C (varies for different species). Do not place aquariums in front of open windows. **Fortum (ceftazidime) antibiotic dose rate for turtles is 20 mg/kg SQ/IM q 72h* (Meaning 20mg/kg sub-cutaneous injection or intra muscular injection every 72 hours). A course of five injections (one given every 72 hours) is optimal (just over 2 weeks) in total.** A vitamin A deficiency can be a predisposing factor.

GASTROENTERITIS (DIARRHOEA)

This is a common complaint amongst freshwater turtles. This condition usually occurs when it is stressed or housed in unclean conditions. **Fortum (ceftazidime) antibiotic dose rate for turtles is 20 mg/kg SQ/IM q 72h* (Meaning 20mg/kg sub-cutaneous injection or intra muscular injection every 72 hours). A course of five injections (one given every 72 hours) is optimal (just over 2 weeks) in total.** Fluid and vitamin supplements may also be given. '**Kaolin-pectin®**' or other anti-diarrhoeal preparations may be used.

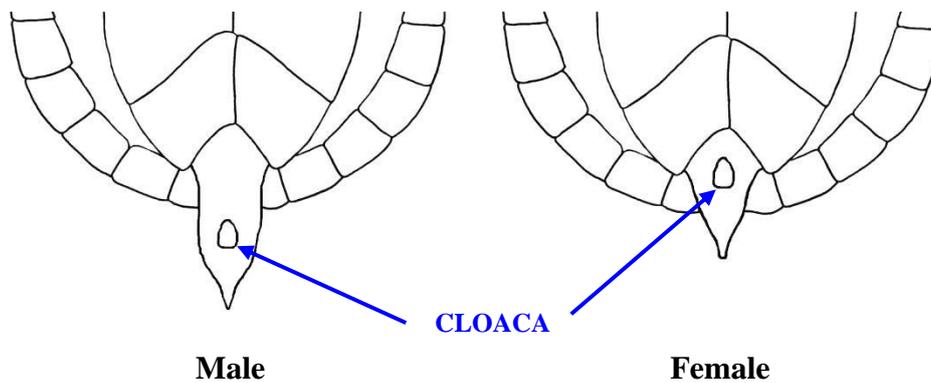
NECROTIC DERMATITIS AND SEPTICAEMIC CUTANEOUS ULCERATIVE DISEASE

These conditions can occur when a turtle's skin is scratched by another turtle or object within its enclosure. This allows bacteria that are naturally found in untreated freshwater to enter the body, and if your animal is stressed or has a low immunity then a serious infection may eventuate. The symptoms are greenish-yellow decaying skin slowly rotting away until the area starts weeping and bleeding. **Fortum (ceftazidime) antibiotic dose rate for turtles is 20 mg/kg SQ/IM q 72h* (Meaning 20mg/kg sub-cutaneous injection or intra muscular injection every 72 hours). A course of five injections (one given every 72 hours) is optimal (just over 2 weeks) in total.** The skin should also be debrided and treated topically with **Betadine** or **Iodine** diluted to 1:10. During the course of this treatment the turtle should be kept dry, allowing it to rehydrate for 30-60 minutes in a clean tub of straight tap water every 24 hours.

SEXING TURTLES

There are two main categories of Australian freshwater turtles. They are the short necked and the long necked species. Short-necked turtles are relatively easy to sex as females have a much shorter tail than their male counterparts. Long necked turtles however are much more difficult to assess. One method of telling them apart is to observe them while swimming around with their tails relaxed. A male long-necked turtles' tail is slightly longer and also thinner at the tip. Another method is to observe interaction during courtship and mating. In some species like the Saw-shelled turtle (*Myuchelys latisternum*), Steindachner's turtle (*Chelodina steindachneri*) and 'Snapping turtles' (*Elseya sp.*), they are sexually dimorphic with males being significantly smaller than females. In most turtles, the cloaca of the male is situated further away from the anal scute of the plastron than in females (fig.4).

Figure 4 © Copyright



Male

Female

BREEDING

Most turtles mate in early to late Spring and late Summer to Autumn depending on the species and the geographic location. Female turtles are capable of storing sperm inside their bodies over Winter and even multiple seasons to take advantage of good laying conditions. This can help establish populations in new locations even in the absence of a male.

Freshwater turtles can only successfully mate whilst submerged in water.

When approaching a female, a male will sniff closely around the Cloacal region. This behaviour is for gender recognition and to help determine if the female is producing pheromones. Before copulation, the male may exhibit aggressive behaviour, frequently biting her on the limbs and back of the neck until she responds.

Males have also been observed swimming backwards, fanning with their forelimbs for hours at a time around the face of prospective mates. Some species discharge a milky fluid from their nostrils over their prospective mate's head during courtship, as witnessed in Broad-shelled turtles (pers. obs.)

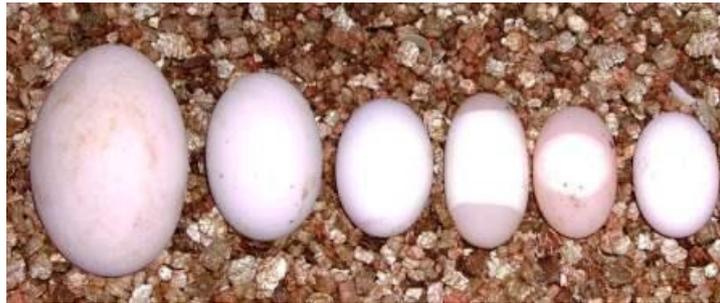
After adopting the mating position, the claws are used to hold the female around the edges of the carapace. A male Eastern snake-necked turtle in my pond has been observed inserting his hind feet into the gap between the carapace and plastron, either side of the females' tail, and 'locking them' into position by twisting them vertically. He then proceeded to gently caress the female's carapace with his front limbs. After acceptance, he then released his front legs and floated vertically while still assuming the mating position for approximately 20 minutes. Eastern snake-necked turtles commonly adopt this position. One reason for this is that a male Eastern snake-necked turtle's tail is relatively short and this position may be necessary for successful mating.

In the wild, turtles lay one to three clutches of eggs in sandbanks or riverbanks well above the water level. In 2008 I had a Painted turtle (*Emydra subglobosa subglobosa*) produce a World record 15 clutches of viable eggs between 4 and 5 weeks apart, of which all hatched successfully. Clutches may consist of between 4 to 37 eggs depending on the species. It is impossible to ascertain the incubation periods due to fluctuations in climatic conditions. Saw-shelled turtle eggs artificially incubated at 28°C have hatched between 54 and 62 days. Eastern snake-necked turtle eggs also artificially incubated at 28°C have hatched between 46 and 123 days. Mary River turtle and Painted turtle eggs incubated at 28° Celsius hatched at 55 days.

We strongly advise against keeping different species and sub-species of turtles together in the same pond or aquarium as they may cross breed, producing mongrel turtles with tainted genetics.

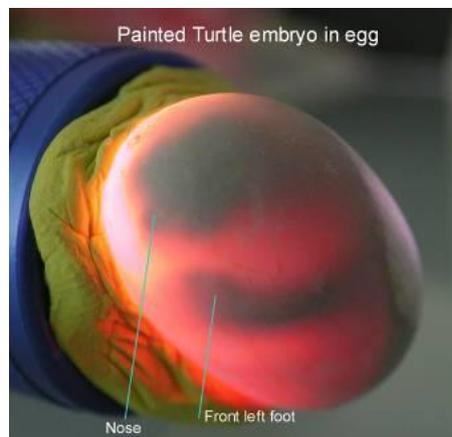
ARTIFICIALLY INCUBATING TURTLE EGGS

One of the most rewarding aspects of successful husbandry is captive breeding. It is a good indication that your turtles are healthy and completely happy with your efforts in creating a suitable environment. From early September onwards, female turtles should be examined for eggs weekly by gently feeling the abdomen area in front of the hind legs (Palpating). When it is apparent that she is gravid, you should keep an eye on the ground surrounding your pond for obviously disturbed areas. Turtles usually lay their eggs on overcast or rainy afternoons. After they have commenced laying, turtles lose their natural caution and become oblivious to their surroundings. Eggs are channelled into the nesting chamber by the careful positioning of the hind legs which prevents them from falling onto each other and breaking. The nest is then covered and compacted by the repeated lifting and dropping of her body over the site. The eggs should be gently uncovered and marked with a felt pen on the uppermost point of the egg before they are removed, and then placed in the incubation container. Don't be too concerned if the eggs are turned within 1/2 an hour of being laid. They must sit for the duration of the incubation with the mark facing upwards.



Viable turtle eggs at various stages of 'Banding up'

Vermiculite is the preferred incubation medium (purchased from most garden nurseries) which is mixed with water at a ratio of 1:1 (preferred) by weight. The mixture should feel moist, but not wet, as the eggs may rot. Not enough moisture and the eggs will soon dry up. A level of around 90% humidity is recommended for eggs in incubator surroundings. The mixture can then be placed in an ice cream container with a lid, or my choice is to use a decor 1.8 litre see through container with lid to keep an eye on the moisture content and progress of your eggs. Half fill your container with the vermiculite mixture and place the eggs in it, either slightly buried or just slightly showing above the surface, allowing you to monitor the eggs more easily. **NOTE:** It is wise to have the vermiculite and incubator already pre-heated to the correct temperature before adding the eggs. Every 3rd day test the moisture content of the mixture with your fingers and spray 2-3 light mist sprays over the eggs if the mixture appears to be drying out. Do not turn the eggs, and try to be as careful as possible when removing the lid of the container. The eggs will start 'banding up' or calcifying within 24 hours, usually starting from the centre and working outwards. Do not be alarmed if you notice 'windows' or uncalcified patches on the shells, as they may be present in viable or non-viable eggs. If an egg takes on a slimy or mouldy appearance it is best to remove it as mould or fungus may spread to viable eggs. Eggs that are accidentally cracked in the beginning stages of incubation can be repaired by wiping a thin smear of silicone sealant (aquarium sealant) over the crack to prevent fluid leakage and the egg from desiccating during the remaining incubation period. The most important lesson though is to not to expect all eggs to hatch on time and then make the sometimes fatal mistake of cracking them open yourself! Candling the egg with a candling light will show if the egg is still viable and developing properly.



'Candling' shows the developing embryo inside the turtle egg

THE INCUBATOR

The recommended incubating temperature for freshwater turtle eggs is 28°C. Pig-nosed turtles, *Carettochelys insculpta*, are the ONLY Australian freshwater turtle's eggs that are temperature dependent sex determined. Some species, including Broad-shelled turtles and White-throated snapping turtles require a diapause or 'over-wintering', where there is a period of suspended development within the eggs.

The incubator I have had most success with is made from an large insulated plastic moulded Esky that has a hinged or lock down lid, an electronic thermostat with digital temperature readout, and a small rotary fan to force air evenly throughout the incubator. A cheaper thermostat may be used but they are usually not as accurate or have a limited life expectancy. A second mechanical thermostat with a probe should be included as a back-up system set at two degrees above the other one just in case of malfunction. The backup thermostat should supply the power to the digital thermostat and cut off the power if the first one fails and jumps above the set temperature. Arrange an electrician to wire them all up using two 40-watt globes (placed well above your egg containers) as your heat source. It is best that the fan works only when the globes are on as the fan will generate its own heat thus effecting the inside temperature. If the ambient (outside) temperature is higher than your pre-set temperature then you must find a cooler position for the incubator or introduce a cooling source e.g. air-conditioner to the room. Place a second thermometer, positioned inside the incubator to monitor the accuracy of the thermostat.



HATCHLINGS

If you have an expected hatching date then commence daily inspections ten days before they are due, just in case they arrive early. The young hatchlings or 'Neonates' will usually take up to 24 - 48 hours to escape from the egg after the initial tear is apparent. The hatchlings can then be removed to a **food grade** plastic container **or** custom made, shallow glass aquarium, that has approximately 5 -10cm of aged, treated or filtered water in it (should be changed daily) up until they are approx. 4-6 weeks of age, at which stage they can be moved to larger quarters. A suitable container is available from "Reflex®" (**Nally No. 5 bin**) and measures 52.5 cm L x 37.5 cm W x 14 cm H.

Increase the water level as your turtles grow. Surprisingly, many juvenile turtles have drowned due to inexperienced keepers housing them in aquariums that are too deep without plants to hang onto at or near the surface. **A 'basking area' or 'dock' must be provided so that they can leave and enter the water at will.** Nourishment is provided through the remnants of the yolk sac that will continue to sustain them for the next few days, although they should begin to show some interest in solid food within 3-5 days. It is best to offer live food including mosquito wrigglers, daphnia (water fleas), or live blackworms at this stage, until your neonates become accustomed to you feeding them. Food should be offered daily for the first year of your turtle's life and **varied** as much as possible. Frozen foods such as Bloodworms (should ONLY be fed occasionally), white Mosquito larvae, Shrimp and Daphnia can be offered after defrosting and rinsing.

Live natural foods including small whole feeder fish, small Mosquito larvae, Worms, Dragonfly larvae, freshwater Shrimp, Maggots, Moths (non-colourful moths only- brightly coloured moths can be poisonous), Grasshoppers and Flies should also be offered. *Hikari* Cichlid Gold 'baby' or 'mini' pellets are also recommended as they contain vitamin D3, the correct ratio of calcium to phosphorous, and other important vitamins and minerals. Place the special reptile fluorescent light tube (as previously mentioned) over the container and have it on for 6-10 hours per day. Whenever possible 'sun' your turtles outside providing it is not too hot, for approximately 10-20 minutes, 2-3 times per week. Monitor them at all times while they are outside or they may fall prey to the local wildlife, or may die of heat exhaustion if the water temperature rises too high.

TRANSPORTING TURTLES

Turtles should never be transported in water filled containers as they are at risk of breathing water into their lungs which could lead to pneumonia and death. Instead, large turtles should be lightly wrapped in slightly damp (not saturated) open weave calico bags, towels or Hessian bags. Small turtles should be transported in small take-away containers or Ice-cream containers with holes in the lid. They should have a damp paper towel placed under them. Never use moistened pillowcases, as the tight weave does not allow for easy breathing when wet. Place the turtle in a container in a cool area away from drafts and **never** leave them in direct sunlight.

For further information and help with your freshwater turtle husbandry join the **Australian Freshwater Turtle forum (AFT)** online at www.australianfreshwaterturtles.com.au

© COPYRIGHT 1996-2017 CRAIG LATTA

No part may be reproduced by any process without written permission. This document is protected by International Copyright Laws. Not to be uploaded to any website or Social Media site without written consent. For personal download ONLY.