



CARING FOR AUSTRALIAN FRESHWATER TURTLES IN CAPTIVITY

INTRODUCTION

Turtles are one of the most appealing animals of the reptile kingdom. 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 for you. Turtles are renowned for their longevity and provided your pet remains healthy, may live for thirty to seventy-five years in your care. This point should be taken into consideration before purchasing your pet to begin with. You may be 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 some go as far to say that they each have their own recognisable personalities.

I believe that if more people keep our Australian freshwater turtles' in captivity, then we can learn more from them and the better equipped we will be to help them. As pollution increases and swamplands 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 this is having on our turtle populations. The world's most endangered turtle is the Western Swamp turtle whose numbers fell to around thirty in the 1980's. This species is currently undergoing a careful breeding program under 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.

Australia has some thirty described species and sub-species of freshwater turtle and four monotypic genera. They naturally occur in all states excluding Tasmania! There are possibly many undiscovered species of turtle that have eluded the watchful eye of herpetologists due to the elusiveness and subtlety of these fascinating creatures.

The correct zoological classifications that apply to Australian freshwater turtles are Class -Reptilia, Order - Testudines, Sub-order - Pleurodire (all except the Pig-nosed turtle which is Cryptodire). Members of the sub-order - Pleurodire, or side-necked turtles, did not evolve until the Cretaceous Period -some 135 million years ago. Reptiles in this sub-order are closely linked by the fact that their bodies are encased in a hard shell, they curl their heads 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.

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 Tortoises indigenous 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 or Pitted-shelled turtle) and will only leave the water to lay eggs, bask in the sun or seek more favourable conditions in circumstances such as 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'.

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- (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 U.V 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 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 complaints such as fungal 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. 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 turtle's metabolism to increase.

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. Turtle's 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.

It is important to note that **most** species cannot survive under the water for more than 2-3 hours 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 under dirt and foliage 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 jaws to tear and dismember food. Here the clawed forelimbs also serve a useful purpose by tearing excess food away while it is firmly clamped by the mouth. Long necked turtles are essentially ambush feeders. They strike with their mouths open, drawing in large quantities of water containing their prey. Food intake of all turtles is subject to availability, and the size and the age of each individual. Food intake is also temperature dependent, with most turtles ceasing to feed below 15 deg. 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, as the food may rot in the gut and cause death. Food normally takes around 1 to 2 weeks to be completely digested. 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. Food digested that is considered excess to the turtles growth and energy requirements is turned into fat and stored in the abdomen, rather than beneath the skin as in the case of mammals. This may be because fat stored beneath the skin could act as insulation and effect thermo-regulation.

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 either 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.

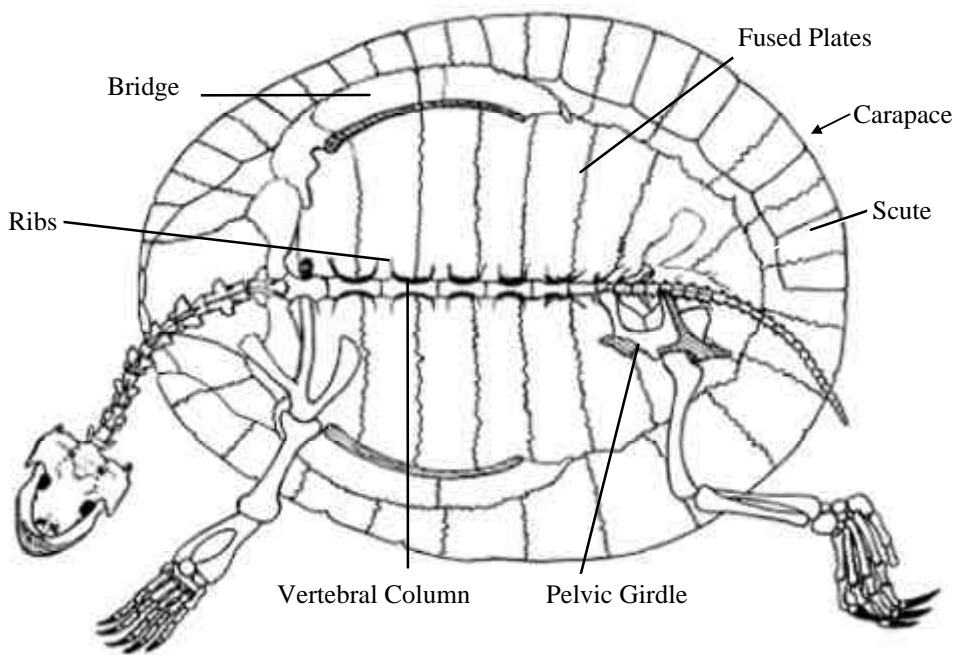


FIGURE 1
The bone structure of a Turtle (Pleurodire) with Plastron removed. Note the marginal scutes overlap the fused plates.
Drawing by Gabrielle Latta

CIRCULATORY SYSTEM

A turtle's heart (Ref. Fig 2) has only three chambers. Many things including increased activity, temperature and increased 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 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.

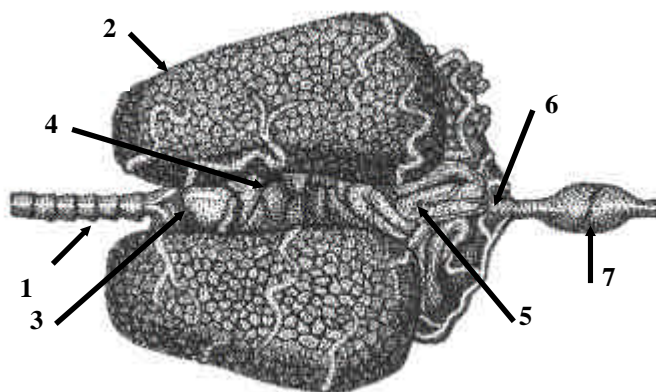


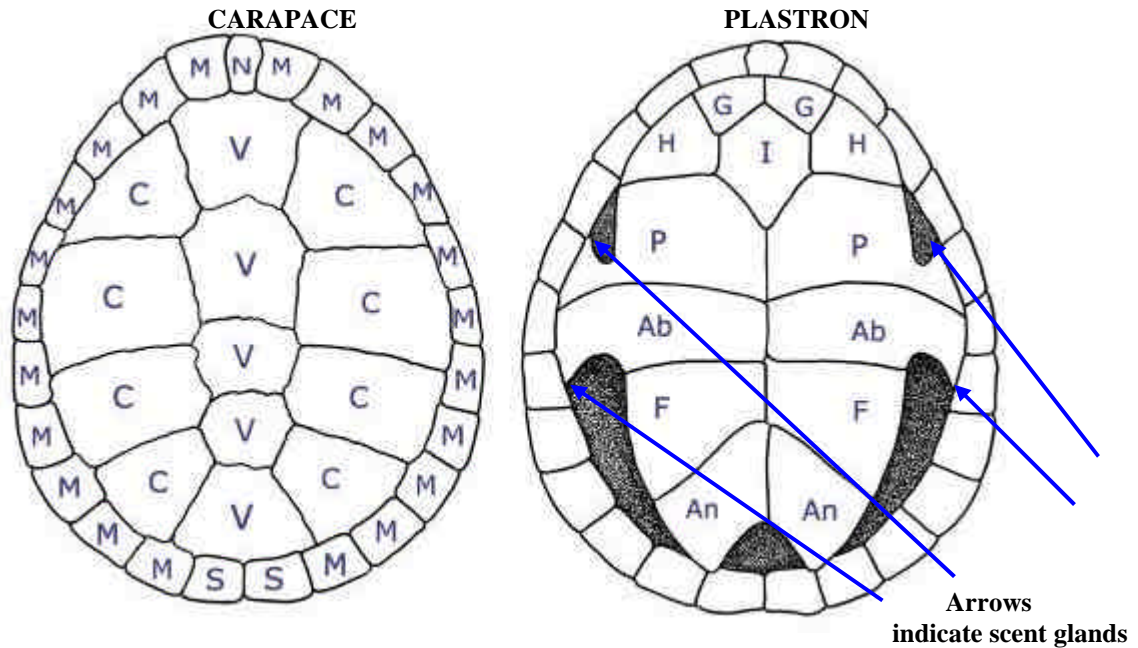
FIGURE 2
Internal Organs
(1) Trachea
(2) Lungs
(3) Heart
(4) Liver
(5) Small Intestine
(6) Bladder
(7) Cloaca
Drawing by Gabrielle Latta

RESPIRATION

Unlike the lungs of mammals, a turtle's lungs (Ref. Fig 2) are not maintained at positive pressure. The ribs of a turtle are joined to the shell (Ref. Fig.1). Breathing is performed with the help of muscles that are located near the limbs at the four corners of the shell. These muscles create a negative pressure in the lungs and respiration takes place. Inspiration occurs due to the difference in pressure. Expiration, however, does take some degree of effort. When a turtle enters the water this situation is completely reversed due to the increase in water pressure. Inspiration now requires muscular activity, and expiration is aided by the water pressure and takes little or no effort. The amount of air in the lungs and the transferral 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).

FIGURE 3

Nomenclature of a Turtles Scutes



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

SIGHT, SMELL AND HEARING

A turtles senses of vision, smell and hearing are highly developed which is necessary for locating food, avoiding predators and important in finding suitable mates during the breeding season. It has been suggested that they possess colour vision and this may be why some turtles show colour preferences when feeding. All freshwater turtles have a thin, transparent third eyelid, called a nictitating membrane that covers their eye while they are submerged to allow them to see proficiently under water. Their sense of smell is achieved through the nose and also through a specialised structure called Jacobsen's organ. Jacobsen's organ is located in the roof of the mouth. Its function is to detect and identify tiny chemical, 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). We have observed many species of freshwater turtles gular pumping while 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 each bridge, near the limb pockets (Refer 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.

KEEPING TURTLES INDOORS

It is recommended to keep small turtles up to seven centimetres shell length indoors where they can be easily monitored. A three-foot or four-foot long aquarium is recommended. The aquarium should have 3-4 centimetres of river gravel and be a half to two thirds full of water. The aquarium should also contain a log that protrudes above the surface of the water, or an artificial platform, so the turtles may leave the water to bask and dry out. Choose a log that has been collected from a creek or stream as dry timber will float and discolour the water. There are some commercially available floating islands like the *Zoo-Med* "Turtle dock" or the *Herp craft* "Floating Land" products that are inexpensive and highly recommended. The "basking areas" should be situated directly below the sides of the aquarium where the glass lids can be removed. Here, your

turtles can receive direct light from special “Reptile” fluorescent tubes, UVB producing blacklight fluorescent tubes or UVA/ UVB producing spotlights, which are available from most good lighting, reptile and aquarium shops. Turtles kept indoors should receive six to ten 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. We have had a great deal of success with the relatively inexpensive NEC T10 Blacklight fluorescent tube.

Remove all glass and plastic lids from under the fluorescent tubes as glass and plastic “filters out” some ultra-violet rays and this would be defeating the purpose. If possible, 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 take the tedious task of turning it on and off away from you, and allow the turtles to become accustomed to a normal day and night cycle.

A forty to sixty watt lightglobe situated fifteen centimetres above the log or platform will add warmth and help them to achieve their preferred body temperature. Turtles excrete much more waste than fish, so one or two good filtration systems should be included. A wet/dry trickle filter system is highly effective and recommended for use in a turtle aquarium. A good aquarium shop should be able to recommend some of the latest filtration systems that will best suit your needs. Power heads are not recommended for small turtles as they have difficulty swimming against strong currents and may drown. Clean the aquarium gravel regularly by using a gravel vacuum, available from most pet stores. The frequency that you “vacuum” the gravel depends on many factors including how many turtles you have and whether you feed your turtles in a separate container (recommended).

A thermostatically controlled submersible heater should also be added to maintain a constant water temperature of between twenty-four degrees Celsius and twenty-six degrees Celsius. The addition of a few water plants (*Vallisneria sp.* or ribbonweed is eaten by most species) will make your aquarium more attractive and supplement your turtles diet. Once the aquarium is established the water should be checked frequently for pH levels using a pH test kit. A neutral reading of 7.0 to an alkaline reading of 8.0 is recommended for healthy turtles, increasing the pH to an alkaline reading at the higher end of the scale of around 8.0 - 8.4 as a preventative and cure for some fungal skin infections. For additional information refer to “Water Chemistry” below.

Ultra-violet rays in sunlight trigger the synthesis of vitamin D3, so in spring and summer your turtles should be placed outside two to three times a week, for about ten to twenty minutes at a time. **Monitor the temperature of the water at all times as overheating may result in their death.** Place a plastic container that contains about six to ten centimetres of water in a safe, quiet spot outside and shade about one third of it. Add a small log to the container to allow the turtles to bask and then cover the container with netting or aviary mesh to help prevent dogs, cats and birds from devouring them.

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 ailment 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 chronic problem with your turtle’s health, you will need to investigate their enclosure 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 water acidity or alkalinity (pH), salinity, temperature, hardness and levels of chlorine, chloramines, nitrate, nitrite and ammonia. Wherever possible, you should try to replicate the 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 “water conditioning blocks”, coral sand, shells or shell grit will increase water alkalinity. Using commercial pH adjusters can 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.

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 pH stable. Raising carbonate hardness levels can be done by adding a carbonate hardness generator, without fear of raising general hardness. Carbonate hardness test kits are available from most good aquarium 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.

Salinity

Adding one teaspoon of aquarium salt to every ten litres of water will help reduce the chances of your turtle getting fungus and other skin complaints. Aquarium salt also inhibits diseases and helps destroy infectious bacteria. Salt should not be added to aquariums containing turtles that predominantly cloaca-breathe such as *Rheodytes leukops*.

OUTDOOR ENCLOSURES

Turtles over seven-centimetre shell length should 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 to 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 at least sixty centimetres to allow turtles to mate successfully (particularly *Chelodina longicollis*) 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 come ashore to 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. Floating water plants should be included; as these will provide some shade, serve as an additional food source and help keep the water cool.

Small native fish and freshwater prawns can be added once the water chemistry in the pond has stabilised. 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. They 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 in one to two hours. The submersible pump and the inlet pipe of the external type should have a pre-filter or screen fitted to prevent the loss of fish and the limbs of small turtles. If you decide to use the submersible 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 clarifier/disinfection unit, a system 2000 Biological / mechanical pond filter and a 1000 litre biological matting filter. The ultra violet "C" rays that the unit emits prevent algal blooms by damaging the microscopic algal cells internally, thus killing them. The ultra violet unit also helps to reduce the levels of infectious bacteria in the pond. If you include a UVC clarifier 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 filter is to provide a large surface area of filter medium to harbour vast quantities of nitrifying bacteria. These bacteria break down toxic waste into less harmful substances.

DIET

A natural, well balanced diet with plenty of variety should keep your turtles in a very healthy condition. Large turtles require feeding only every third to fifth day. Overfeeding can be detrimental to their health.

A turtle's diet should include small whole fish, worms, insect larvae, liver (high in vitamin A), water snails, freshwater prawns, raw saltwater prawns (soaked in fresh water) with their heads removed, freshwater mussels, crickets and small yabbies. *Go-Cat* cat pellets and *Whiskas* casserole variety cat food may also be offered (after the chunks have been rinsed to remove excess gravy) as they contain added vitamins and minerals. Avoid feeding your turtles mincemeat as it is too fatty, and contains chemical dyes and preservatives. Also avoid feeding your turtles on plain raw meat as it lacks the vitamins and minerals necessary for their growth and survival. If another pet food is to be offered, make sure to choose one that is preservative and additive free, is low in salt and fat, and contains added vitamins and minerals. A turtles diet should also include a wide variety of vegetation. Most short-necked species regularly eat some form of vegetation. Long necked turtles will sometimes include it in their diet. I regularly feed my turtles on a blended mixture of one kilogram topside steak (or kangaroo meat), broccoli leaves, parsley, banana, and one kilogram of seafood marinara (prawns, mussels, fish meat, calamari). After chopping all the ingredients in a food processor I add one tablespoon of calcium supplement for reptiles and one of vitamin supplement for reptiles and thoroughly mix it in. Portions can then be placed in a bag and frozen for use at a later date. All of my short-necked and long-necked turtles alike find this mixture irresistible. Native floating water plants like Duckweed, Azolla and Nardoo are readily eaten in the wild and can be added to your pond as a supplemental food source. 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.

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 *Bactonex* made by Aquasonic® at a ratio of 10ml to every 40litres of water) for a minimum of 3 weeks. Watch closely for any signs of sickness, disease or parasite infestation and treat accordingly. The water should be changed and treated daily. **DO NOT OVERDOSE WITH BACTONEX.**

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

Maintaining a water pH of 7.6 to 8.4 can help in preventing and controlling some skin conditions

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 units or under and between rocks, logs or other aquarium furnishings.

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!

EXTERNAL PARASITES

Leeches and Mites, often found on turtles collected from the wild, can be removed by placing them in a strong solution of salt water until they drop off. **(Treatment not recommended for *Rheodytes leukops*, *Elusor macrurus* and *Elseya dentata*)**

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 in turtles.**

CUTS AND SCRATCHES

Betadine® antiseptic ointment or *Iodine* may be used to treat all superficial wounds including scratches, bites, cuts and abrasions. They are very good antiseptics and are recommended by veterinarians. After treatment, keep the turtle out of the water for 1 hour.

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. Aggressive antibiotic treatment by your reptile veterinarian is required!

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. 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 iodine 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. 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 can 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 antibiotics may be required.

SOFT SHELL

This condition is unfortunately common amongst young turtles kept indoors, and will usually lead to their death. All neonates have soft shells upon hatching and will usually begin to harden within two weeks. If calcium and sunlight are not available then the hardening of the shell may not eventuate. The solution is to offer a natural diet of insects, fish, worms and water snails etc. and sufficient sunlight. The addition of a calcium water-conditioning block (turtle block) in your aquarium will have some benefit.

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 *Terramycin ointment* 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.

FUNGUS

This complaint also mainly affects turtles that are housed indoors and a predisposing factor is a lack of sunlight. The first indication of fungus will be the appearance of grey or yellow patches on the skin. If the fungus is not treated quickly, it will spread over its entire body and may cause death. Treat the infected areas with *Betadine*® ointment or *Iodine* and keep it out of the water for about two hours before returning it to the water. Repeat this procedure 3 times a day until the problem clears

up. Fungus *Adeä*, by Wardley®, is an excellent fungicide and should be added to your aquarium water at the specified ratios. Some skin diseases require urgent attention and treatment as they can cause death within as little as 5 days.

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. Do not place aquariums in front of open windows. A course of *Enrofloxacin* (Injectable Antibiotic Solution) given at a dose rate of 2.5 mg/kg every 5 days by your veterinarian should improve the situation. Vitamin and fluid therapy may also be necessary. 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. Suggested veterinary treatment is 2.5 - 5 mg/kg *Enrofloxacin* (Antibiotic) administered IM every 5 days. A veterinarian should determine the length and course of treatment. Fluid and vitamin supplements may also be given. '*Kaolin-pectin*@' or other anti diarrhoeal preparations may be used.

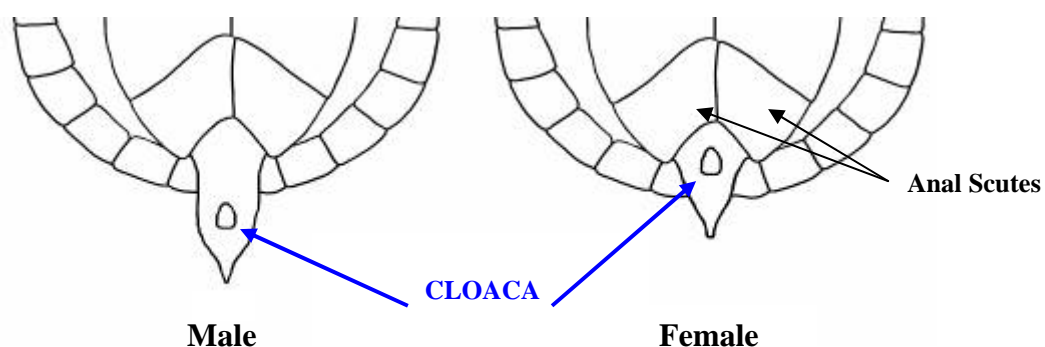
NECROTIC DERMATITIS AND SEPTICAEMIC CUTANEOUS ULCERATIVE DISEASE

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. **A veterinarian will need to be consulted to remedy this condition.** Chloramphenicol Antibiotic will need to be injected daily IM or SC at a dose rate of 40mg / kg until the condition improves. The skin should also be debrided and treated topically with *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 (*Elseya latisternum*), Steindachner's turtle (*Chelodina steindachneri*) and the 'Northern snapping turtles' (*Elseya dentata*), 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



BREEDING

Turtles usually mate in early to late spring, and also late summer to early autumn, depending on the species and the geographic location. Female turtles are capable of storing sperm inside their bodies over winter or sometimes longer to take advantage of good laying conditions. This can help establish populations in new locations even in the absence of a male. When approaching a female, a male will sniff closely around the cloacal region. This behaviour is for gender recognition. 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 head and 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 river turtles (pers. obs.) and also in some short-necked species (Cann, J. 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 mins. 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 or two clutches of eggs in riverbanks, well above the water level. Clutches may consist of between 6 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 deg. C have hatched between 54 and 62 days. Eastern snake-necked turtle eggs also artificially incubated at 28 deg. C have hatched between 46 and 123 days.

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. 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. They must sit for the duration of the incubation with the mark facing upwards.

Another method is to inject 0.1ml/kg of 10 IU/ml synthetic oxytocin and a 0.5ml injection of calcium at the same time into the muscle of the hind leg or the muscle between the hind leg and the tail; 7 to 14 days after the eggs feel sufficiently hard.

The gravid turtle is then placed into a large container 2/3 full of heated water (26 deg. C- 28 deg. C) and laying should commence within 5-15 mins if she is undisturbed. Don't be too concerned if the eggs are turned within 1/2 an hour of being laid. The eggs can then be removed, marked, and placed in suitable preheated containers inside your incubator. The more experienced keeper should only attempt this method. 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 icecream 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. N.B 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!

THE INCUBATOR

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. Have an electrician 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 your 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 eg. Air-conditioner to the room. Always have a second thermometer positioned inside the incubator to check 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 hours to escape from the egg after the initial tear is apparent. Eggs that fail to hatch 2-3 days after the rest of the clutch can be assisted with the use of a razor blade, delicately etching a slit in the egg.

The neonates can then be removed to a food grade plastic container or custom made, shallow glass aquarium, that has approx. 5 cm of aged, treated or filtered water in it (should be changed daily) up until they are approx. 4-6 months 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, as a result of inexperienced keepers housing them in aquariums that are too deep. A 'land area' or island 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 bloodworms 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 Plankton, Blood worms, white Mosquito larvae, Brine Shrimp and Daphnia can be offered after de-frosting and rinsing. Live foods including small Crickets, Worms, Dragonfly larvae, freshwater Shrimp, Maggots and Flies should also be offered. *Nutrafin* tropical fish flakes are also recommended as they contain vitamin D3 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 approx. 10-20 mins 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 even cook 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, turtles should be lightly wrapped in slightly damp, not saturated, rags or towels. 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 draughts and never leave them in direct sunlight.

LICENSING

Before obtaining a turtle from a licensed breeder you will need to contact your local wildlife authority to arrange the appropriate licence.

Reference: CANN, J (1978). *Tortoises of Australia*, Angus and Robertson, Sydney

For further information and help with Reptile and Amphibian husbandry join your local Herpetological Society.

NSW

The Australian Herpetological Society - PO Box R79 Royal Exchange Sydney NSW 2000

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Society of Frogs and Reptiles Inc. (SOFAR)- PO Box 30 Jesmond NSW 2299

Frog & Tadpole Study Group of NSW Inc.- PO Box 296 Rockdale NSW 2216 email:fatsgroupnsw@hotmail.com

Riverina Frog & Reptile Society- PO Box 712 Wagga Wagga NSW 2650 email:secretary@riverinafrogandreptilessociety.org

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Central Coast Reptile & Frog Group- PO Box 922 Gosford NSW 2250

Hawkesbury Herpetological Society- PO Box 30 Emerton 2770 email: hawkesburyherps@bigpond.com

New England herpetological society email: information@herps.org.au

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Reptile & Amphibian Interest Group- PO Box 5013 East Lismore 2480

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