Tropical Topics

An interpretive newsletter for the tourism industry

Wetlands in the Dry

No.68 June/July 2001

Notes from the Editor

Welcome to the second 'orange' issue of *Tropical Topics*, funded by the Tropical Savannas CRC and focussing on the area of tropical savanna which stretches from Queensland, through the Northern Territory to Western Australia.

This issue, coming in the dry season, is devoted to the impacts of dry times on the wetlands of the savanna. The tropical savanna of Australia is subjected to climatic extremes which see torrential rain in the Wet and next to none in the Dry. This makes life difficult for not only human inhabitants, particularly farmers, but also for wildlife. However, as happens in nature, those organisms which have managed to adapt to such extreme conditions not only thrive but often rely on them. Close study has shown that ecosystems benefit from both dry conditions (see page 1) and from flooding (see page 7).

Although they are mere dots in the vast savanna lands, wetlands are extremely important. Harbouring large numbers of species, their biodiversity values are out of all proportion to their size.

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The importance of drying out

How does the drying out of a wetland lead to an increase in ducks? It doesn't seem very logical, but a chain of related events creates a connection.

As the area dries, it is colonised by grasses and other terrestrial plants. However, when water returns, these plants drown. The dead grasses, along with the remains of aquatic plants, fish and invertebrates which perished during the dry period, form a rich organic layer. This, in turn, leads to a population explosion of invertebrates which feed on this nutritious detritus. Notable among these are rice midge larvae, which have been recorded in densities as high as 15 000 per square metre. This ready food source encourages the adult ducks to breed. Then, by the time the ducklings hatch, the adult midges have emerged to form dancing clouds on the water surface, just at duckling bill height – an easy catch for these hungry learners.

The extreme variations in rainfall patterns in Australia mean that many wetlands dry out on a regular basis. This benefits not only ducks. Studies have shown that these ephemeral wetlands are, biologically, among the most productive and most diverse.

A variety of water levels suits a variety of plants. As one type of vegetation is succeeded by another it leaves behind tubers and seeds. Many of these can withstand long dry periods, ready to sprout as water levels rise. On the other hand, others may respond to increased light, available when water levels drop.

High water levels, which never drop, are detrimental to many plants. River red gums, which grow close to water and can withstand flooding, will nonetheless die if high water levels do not fall. Seedlings of paperbarks and other waterside trees need a period of low water levels to become established while the seeds of cumbungi (*Typha* spp), produced in thousands from the bull-rush-like flower heads, can only germinate in moist mud which has become exposed. Similarly, the female flowers of ribbonweed (*Vallisneria gigantea*) must be able to protrude above the water surface, when levels are low, for pollination to take place.

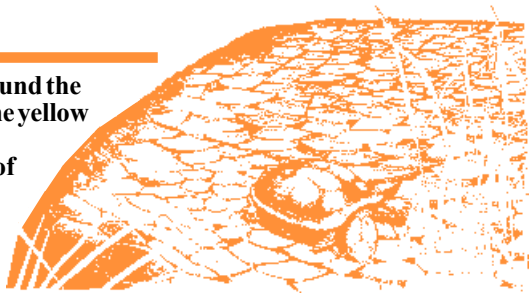
A number of wetland animals also require dry periods as part of their lifecycle. (See *Surviving the Dry*, page 2.) Various small freshwater crustaceans lay eggs which are not only resistant to drought but, in some cases, actually require a period of desiccation before the eggs will develop. Some of these eggs are so small they are dispersed by wind during dry periods. Some long-necked turtles lay eggs below the water, development only beginning when falling water levels expose the eggs (see page 4.)

It is a mistake to think that a wetland must always be wet. Studies have shown that the cycle of flooding (see page 7) and drying is probably the single most important factor in maintaining wetland health. If water levels are held constant (or if a wetland is drained) the natural diversity and productivity suffer.

TROPICAL SAVANNAS CRC
Cooperative Research Centre for the Sustainable Development of Tropical Savannas

Queensland Government
Environmental Protection Agency
Queensland Parks and Wildlife Service

Surviving the dry

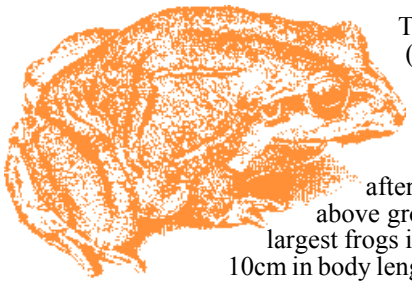


As the Dry progresses, life contracts with the water and becomes concentrated around the swamps and lagoons which retain moisture. Floodplains dry out and grasses become yellow and desiccated, inviting fire. Rock-hard black soils, once slushy mud, crack into geometrical patterns. Life is hard for many creatures. Some birds take the option of leaving the savanna lands for the wetter coastal areas. Other animals are not so mobile, but have developed strategies to deal with this time of hardship. Indeed, alternating periods of wet and dry may be vital to their lifecycle. For yet others, the Dry is a time of plenty when fish and other aquatic creatures, concentrated in diminishing pools of water, become easy prey.

Many of the reptiles which inhabit seasonally dry wetlands are adapted to withstanding periods of low food supplies. Crocodiles eat less when the temperature is lower, a time which coincides with the lean dry season. Arafura file snakes grow extremely slowly and have a metabolic rate which is lower than most reptiles.

Many frogs of the savanna lands survive dry periods by burrowing – usually backwards – into moist mud, using hard shovel-shaped structures on their feet. They then shed the outer layers of dead skin to form a cocoon around themselves. This hardens, functioning like a plastic bag to reduce evaporation, allowing the frog to remain underground until rain softens the earth around it. Since these frogs may be entombed half a metre or more beneath mud which has hardened to the consistency of a brick, it stands to reason that only very heavy rainfall – producing suitable conditions for breeding – will rouse the frog.

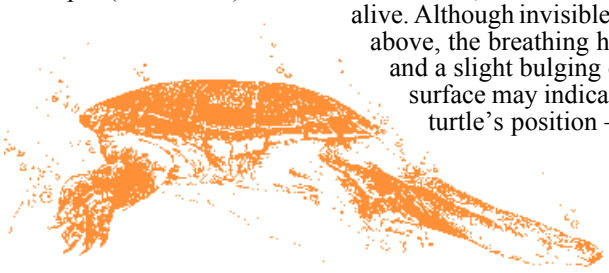
Breeding is an urgent affair which must be completed before the water dries up again so it more rapid than in other frog types. Males immediately start calling for mates, eggs hatch into tadpoles within hours and fully-formed frogs may appear within a week.



The northern bullfrog (left), which lives across the Top End, the Kimberleys and northwest Queensland, is normally seen only after rain induces it to go above ground. It is one of the largest frogs in Australia, growing to 10cm in body length.

Pig-nosed turtles live in the river systems of the Northern Territory. They are unusual turtles in that they have soft shells and paddle-shaped flippers rather like those of marine turtles. The females lay their eggs in sand banks during the dry season. The embryos inside develop within about 70 days but stay put, biding their time in a dormant state, until the first rains or rising floodwaters penetrate the nest. Then the hatchlings burst out of their eggs, all at once.

Some adult turtles, notably long-necked turtles (below), survive the dry season by burying themselves in the soft mud of a drying lagoon. Usually they burrow to a depth of 12cm, some even lying head-down, with a 3-5mm diameter hole acting as a breathing hole. The mud eventually becomes baked hard but the turtle, by going into a state of torpor (aestivation) similar to hibernation, is able to remain alive. Although invisible from above, the breathing hole and a slight bulging of the surface may indicate the turtle's position – clues used by indigenous people for whom these animals are an important food source. They use long sticks to locate the turtles. Where mud is not available, some turtles aestivate among the roots of overhanging trees.



Crustaceans of various types are important wetland inhabitants. Although they breathe through gills and, unlike insects, have no waterproof 'skins', a large number of species are able to survive dry periods. Many of the small shrimps produce eggs which are drought-resistant. Some yabbies, on the other hand, are able to burrow into mud and encase themselves in a drought resistant egg-like case until wet conditions eventually soften the walls and allow the inhabitant to emerge.

Freshwater 'sidewalker'crabs dig burrows about a metre long, plugging the entrance with mud. Inside they go into a state of suspended animation, taking up water from the trapped humid air. Unlike marine crabs, the young have no free-swimming larval stage. They hatch as juveniles – but can be carried around under the mother's body in an arrested state of development for months waiting for good rains. There is only one common species, *Holthuisana transversa*, which is widely distributed in central and northern Australia.

Deep cracks in parched clay and mud provide shelter for a number of animals, notably planigales (right) and rodents. Planigales are ferocious dasyurids – carnivorous marsupials – some of which are small enough to fit in a standard matchbox. Their flattened heads and sinuous movements allow them to fit into the tiniest cracks until flushed out by the first rains.

Dusky rats, found in the Top End, inhabit these cracks in huge numbers. They have been found at Fogg Dam, a wetland east of Darwin, in densities of 150 per hectare, which has been calculated as one tonne per square kilometre. They are preyed on heavily by water pythons which occur at levels of 700 per square kilometre. These two animals together create one of the greatest mass of animals (biomass) per square kilometre ever recorded anywhere in Australia, and perhaps the world.

Crocodiles can also dig themselves into mud to survive times of drought. The only alternative for a croc whose billabong dries up may be to attempt a hazardous overland journey in search of a wetter place – but then may find it already full of other crocs ready to fight to defend their patch.

Many plants, such as water lilies, survive the dry by going into a 'resting' phase, allowing their leaves to die but staying alive as roots, tubers or rhizomes. Many also set seed, some of which are extremely long-lasting – one lotus seed is recorded as having germinated after 237 years.

Threats to the wetlands

Many introduced plants and animals find savanna conditions ideal and are doing considerable damage to the wetlands.

Buffaloes

A small number of domesticated water buffaloes were brought to the Top End from Indonesia over 150 years ago. By the 1980s there were an estimated 350 000 feral buffaloes. The hard hooves of these animals cause considerable environmental degradation around wetlands where they congregate to wallow. Their trails become deeply eroded, sometimes allowing saltwater to invade freshwater habitats. Reeds and other aquatic plants have been destroyed, young trees of many species eaten away and waterholes fouled.

Buffalo numbers have dropped considerably since the Brucellosis and Tuberculosis Eradication Campaign led to intensive removal. Unfortunately, however, the disappearance of the buffaloes has facilitated the spread of weeds, such as para grass, in the eroded environment.

Pigs

Pigs cause enormous environmental damage but are much harder to control than buffaloes. They are smaller, shelter out of sight by day and are very mobile and very intelligent. They also reproduce prolifically. Pigs eat almost anything, excavating the earth for roots and soil fauna such as earthworms, and consuming the eggs of ground-nesting birds and turtles. They trample saplings, ringbark trees, erode wetland edges, contaminate water, feast on crops and compete with native animals for food. Weeds thrive in their wake and they can carry many diseases, including forest dieback (phytophora). They also have the potential to spread foot and mouth disease far and wide, should it ever reach Australia.

Feral pig illustration reproduced with permission of the Department of Natural Resources and Mines, Queensland

The importance of floods

Recently The Australian Geographic magazine published a letter from a reader who suggested damming the large rivers of northern Queensland and diverting the water into Murray-Darling system. This, he argued, would serve to increase the flow of the Murray and also help control flooding in the northern States.

Television news coverage of flooding emphasises only the ill-effects on humans. It overlooks the fact that the natural systems of the Australian tropical savannas have evolved with weather extremes which constitute the climatic norm. Plants and animals are adapted to cope with, and even flourish, with annual inundations and droughts.

Each year, at the end of the dry season, floods bring life to the savanna lands. Rivers break their banks, linking up to create great sheets of water which spread out across the flood plains. Water pours into drying swamps and waterholes, reconnecting billabongs to their parent rivers, filling lagoons and travelling on to provide water to areas which have had no direct rainfall. Water tables are replenished, providing a reservoir of underground water.

The first floods serve to cleanse the waterways. They scour sediments out of river channels, maintaining the depth of waterholes and keeping rivers navigable for boats. The rushing water also flushes organic matter out of billabongs and lagoons where a build up of nutrients might otherwise provide ideal conditions for potentially toxic algal blooms. Sediments and organic matter are carried downstream and deposited over the flood plain, replenishing nutrient levels and revitalising these areas for another growing season.

The arrival of water triggers breeding among many animals. Crustaceans, frogs and insects breed quickly, in turn attracting predators and fuelling a surge of growth right up the food chain. Floods not only stimulate spawning in fish of the savanna waterways, but also provide them with the means to migrate as they link up the rivers and lagoons. The bigger the flood the further they go, resulting in better genetic mixing and colonisation of new areas.

Although sometimes destructive to human endeavours, floods bring immense benefits. Floodplains, replenished by nutrients and water, provide feed for cattle, while temporary and permanent floodplain water allows the pastoral industry to make full use of grazing lands. Underground water is drawn on by farmers and urban dwellers throughout the Dry. Good floods, with large numbers of fish spawning, mean good catches in subsequent years.

Even the marine environment benefits. Estuaries are kept healthy, nutrients introduced by the floods providing food for many young marine fish and prawns; breeding for many species is timed accordingly. There is a direct correlation between big floods and large catches of banana prawns. Sediments washed to the coast also go on to nourish our beaches.

We need our floodwaters in northern tropical Australia. They can cause major disruption at times, but they are part of the natural system which, without them, would be in trouble.

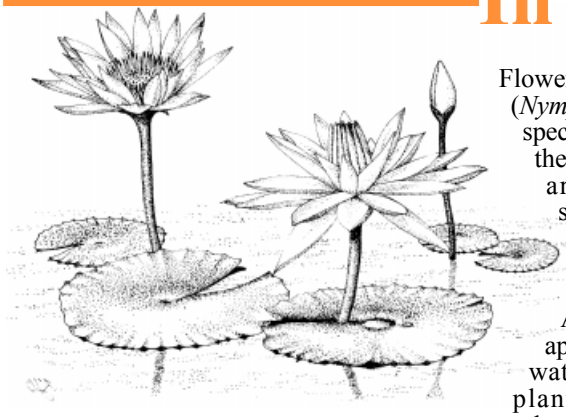
Weeds

Two notable weeds (below) are water tolerant grasses, introduced to increase the grazing potential of wetlands. Unfortunately they spread rapidly, clogging irrigation and drainage channels, infesting lagoons and creeks, displacing native vegetation, reducing access to waterways for wildlife and recreation and lowering oxygen levels with detrimental effects on fish and other aquatic animals.

Para grass (*Urochloa/Brachiaria mutica*) was introduced from tropical Africa to Queensland about 1880. It can grow in water up to a metre deep from which it excludes all other species, establishing itself as a dense monoculture which completely obliterates open water. Para grass spreads rapidly, even into rainforest next to flood plains, carrying fire into these areas in dry times.

Olive hymenachne (*Hymenachne amplexicaulis*) (above) was introduced to Australia in the 1970s from South America. A 'ponded pasture' grass, it can grow comfortably in water as deep as 2 m. It is a severe threat to open wetlands, replacing water lilies, reeds and all other plants, wherever it spreads, with a dense green mass. It is important to look out for infestations of this grass in natural areas. The illustration shows the distinctive clasping manner in which leaf base grows around the stem of the plant.

In and around the waterholes

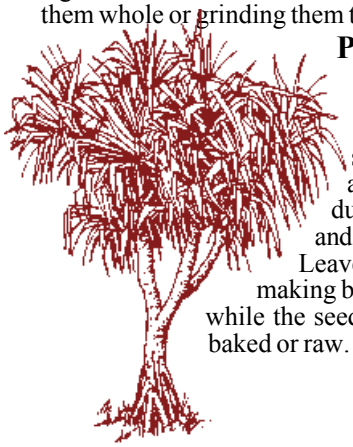


Flowering **water lilies** (*Nymphaea* spp) make a spectacular sight during the dry season. There are a number of species, with flowers ranging from white to pale blue and pink. Although they appear to float on the water surface, these plants are actually anchored to the bottom, up to 3 metres below. Seeds are contained within spongy berries. As they develop, the stalk forms a coil which pulls the fruit below the water, a strategy which may protect them from being eaten. Aboriginal people eat the fruits and stems raw and bake the tubers, which are considered a good medicine for diarrhoea. They also bake the oily seeds, eating them whole or grinding them to make damper.

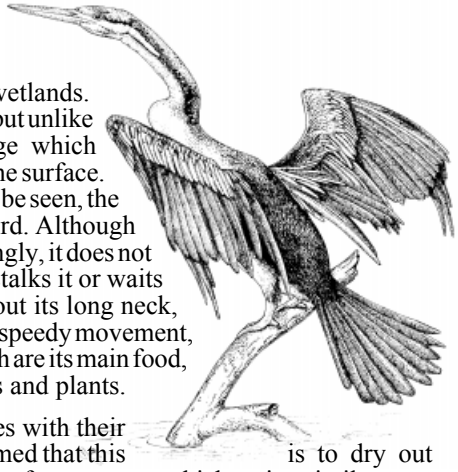
Lotus lilies (*Nelumbo nucifera*), although they are very similar to water lilies, belong to a different family. Their leaves can grow from 50cm to nearly one metre in diameter, floating on the surface or held above the water. The short-lived flowers, which are also held high above the water, open at first light but drop their petals by midday. They are a spectacular dark pink with dense yellow stamens. Curiously, it seems that the plants can regulate the temperature of their flowers, keeping it within the range of 30-35C even when surrounding temperatures drop as low as 10C. This may serve to attract pollinating insects. Fruits are embedded in distinctive conical woody receptacles. These plants are an important source of food for Aboriginal people, who use them in a similar way to water lilies. They are also grown and eaten widely across Asia.

The lotus effect

Revered as a symbol of purity in Hinduism and Buddhism, the lotus has leaves which never seem to get dirty. The trick to this has recently been discovered by German scientists and adapted to create self-cleaning paint for building exteriors and roof tiles. It seems that the secret is a combination of chemical repulsion and the bumpy, waxy surface of the leaf. This provides no flat surface for water to cling to so each drop rolls off. Dirt is more strongly attracted to the surface tension of the water than to the leaf so it is 'captured' by the water and carried away with it.

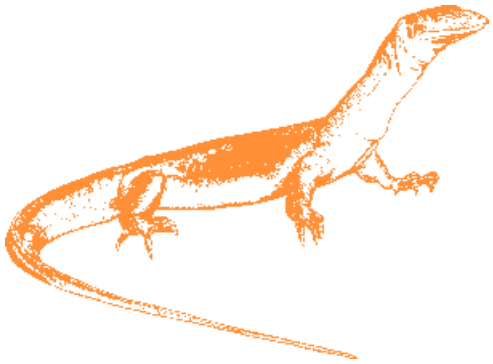


Pandanus of various species line wetlands, many of them fruiting during the dry season. These plants are important for Aboriginal people. They serve as seasonal indicators – the appearance of the fruit signals the dugong-hunting season in some areas – and are used for food, medicine and materials. Leaves, with thorns removed, are useful for making baskets, mats, ropes, dilly bags and so on while the seed kernels within the fruit can be eaten, baked or raw.



Darters can be seen in and around most wetlands. In common with closely related cormorants, but unlike most other waterbirds, they have plumage which absorbs water allowing them to sink below the surface. Often only the bird's long S-shaped neck can be seen, the reason for its other common name, snake bird. Although large webbed feet allow a darter to swim strongly, it does not chase its prey under the water, but instead stalks it or waits until it comes within reach. It then shoots out its long neck, specially equipped with hinged vertebrae for speedy movement, and spears it with its long dagger-like bill. Fish are its main food, but it also eats small turtles, aquatic insects and plants.

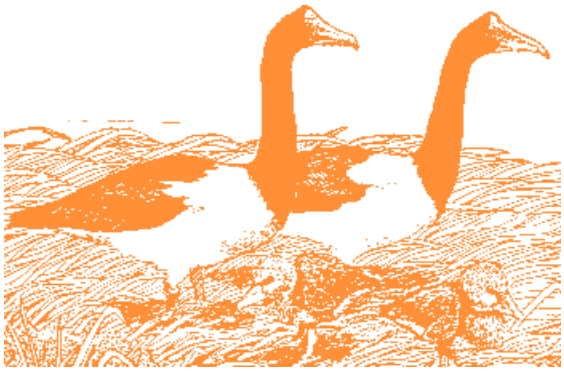
Darters have a habit of standing on branches with their wings outstretched. It has always been assumed that this is to dry out their waterlogged plumage. However, studies of cormorants, which act in a similar way, suggest that it also aids digestion. Experiments, in which some cormorants were given cold fish and some were given warm fish showed that the former spread and flapped their wings more. The theory is that the flapping wing muscles produce heat which in turn, warms the fish in the bird's stomach. In other parts of the world female darters are dark, like the males. Australian female darters, however, have a pale front with a grey-brown back.



Merten's water monitor is at home in the water, feeding mainly on fish, freshwater crabs, frogs and carrion. Growing to about one metre in length it is usually seen basking on rocks, logs and branches overhanging creeks or swamps, but quickly drops into the water when disturbed. It is a good swimmer, its long vertically flattened tail providing propulsion. Nostrils placed high on its snout mean that, like a crocodile, it can remain submerged with just the tip of its nose above the water. Underwater, it uses its long body and tail to herd fish into the shallows where they can be easily snapped up.

File snakes are remarkably loose-skinned snakes with a flabby appearance. Their common name comes from the pointed scales which give their skin a very rough texture. These snakes live in water, where they are very agile, but they are really quite helpless on land. They can remain submerged for long periods with their nostrils closed by a flap of skin on the roof of the mouth. Non-venomous, file snakes are an important food for Aboriginal people. There are two species. The little file snake lives mainly in estuaries and mangroves, while the larger Arafura file snake (above) ventures further inland and is most commonly found in freshwater streams and lagoons. These snakes have a habit of wrapping their tails around underwater logs or roots to use them as an anchor while striking at passing fish, the chief item on their menu.

Water snowflake (*Nymphoides indica*) is one of the most commonly seen aquatic plants, easily recognised by the delicately fringed petals of its white flowers. The related wavy marshwort, (*Nymphoides crenata*) has similar flowers which are yellow.



Magpie geese rely on two main habitat types and two main food plants. During the breeding season, from March to June, the adults frequent patchy grass and sedgelands where they, and their young, feast on the seeds of wild rice (*Oryza meridionalis*). As these areas begin to dry out, the geese move to swamps where bulkuru (*Eleocharis dulcis*) grows. Also known as water chestnuts, these plants produce starchy tubers in large numbers; one site studied averaged five million bulbs per hectare. From July to September the geese shuffle through the sticky mud, digging up the tubers with their hooked bills and gorging themselves on this high-energy food. As the wetlands continue to dry out the geese congregate in ever-increasing numbers on the remaining swamps. The late dry season is a lean period, when food supplies run low, but when the rains come the birds are able to feed on young shoots of grass until the next crop of wild rice seeds is ready.

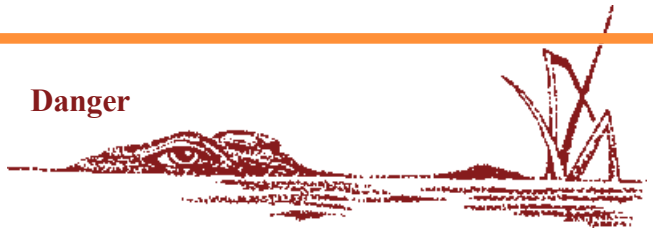
Magpie geese were once widespread across Australia but alterations to wetlands, poisoning and shooting have led to their disappearance in southern, temperate areas and they are now found only in the tropics. However, their wetlands are under threat in the north, with introduced plants such as para grass and olive hymenachne rapidly filling up many magpie geese feeding sites, rendering them useless to the birds. Although the geese do sometimes eat grass, it does not provide the necessary nutrients in the long term. They need seeds and tubers.

Underwater nests

Normally, inundation would be expected to destroy any turtle or crocodile eggs but some northern long-necked turtle mothers deliberately deposit theirs under the water. Development does not begin until the water evaporates in the dry season, leaving them high and dry (but buried under sediments). Experiments with the eggs have shown that they can develop quite normally even after they have been immersed in water for up to 12 weeks.

This strategy, which may have developed in low-lying situations where there is little land above water outside the dry season, may help to protect the eggs from terrestrial predators. Researchers, keen to investigate the rumour, finally proved it by catching a pregnant female, inserting an egg-shaped radio transmitter into her ovaries and, a few days later, found the nest which was buried in sediments in 15cm of water. When the water evaporated, the eggs developed.

Danger



Although wetlands in the dry season, with their tranquil waters, delicate water lilies and dabbling waterbirds are the epitome of peace, this can be deceptive. Wherever there is high productivity, there are large appetites and most animals need to be wary. Both freshwater and estuarine crocodiles are liable to turn up wherever there is water in northern tropical Australia. Young ones feed on insects, crustaceans and frogs, the type of prey changing as they grow. Adult freshwater crocs eat large amounts of fish but food from terrestrial origins, such as invertebrates, birds, and small reptiles and mammals make up as much as 40% of their diet.

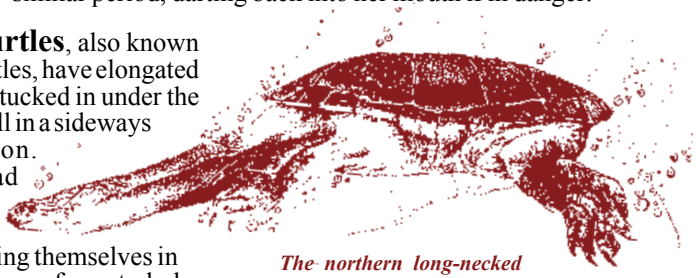
Saratoga are fish found in clear, slow-flowing or still waters around Cape York, the Gulf of Carpentaria and as far west as the Adelaide River, east of Darwin. They are able to tolerate low oxygen levels and are suspected of using their swim bladders as 'lungs' for an extra supply. They can grow to almost a metre in length and to over 10kg in weight.

Saratoga have an interesting and ancient history, belonging to a once numerous group of fish with a fossil history dating back 55 million years. There are now only eight species of saratoga left in the world, two of them in Australia. Since the others are found in Africa, South America and Southeast Asia, saratoga are seen as evidence that these continents were once joined in the supercontinent, Gondwana.

While most freshwater fishes evolved from marine ancestors, saratoga and lungfish are among the very few species, still in existence, which evolved in freshwater.

Saratoga have bony mouths and are the only fish known to have bony tongues. It is surprising, therefore, that they are mouth brooders. The female lays between 30 and 130 eggs, each the size of a marble, which she carries in her mouth for five to six weeks until they hatch. (She doesn't feed during this period.) Afterwards, the young fry stay close to her head for a similar period, darting back into her mouth if in danger.

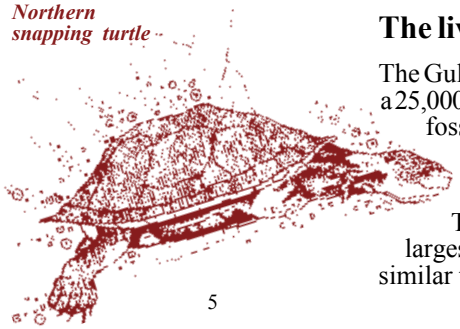
Long-necked turtles, also known as snake-necked turtles, have elongated necks which can be tucked in under the front edge of the shell in a sideways folding motion. Together, the head and neck can be as long as the shell. Sometimes concealing themselves in sediment at the bottom of a waterhole, these turtles ambush prey, using their long necks to strike out, with speed and accuracy, and sucking fish, crustaceans and molluscs into their large mouths.



The northern long-necked turtle is found across tropical northern Australia, where it lives in lagoons and other quiet waters.

Shorter-necked turtles include aquatic plants and fruits, such as pandanus in their diet. Indeed, adults of the northern snapping turtle, which is found in rivers throughout northern tropical Australia and the east coast of Queensland, are almost entirely vegetarian although they prefer meat in captivity.

Northern snapping turtle



The living fossil

The Gulf snapping turtle was known only from a 25,000-year-old fossil, found at the Riversleigh fossil site—until a live one was discovered in 1995 in one of the rivers draining into the Gulf of Carpentaria.

This 'living fossil', which is one of the largest freshwater turtles in Australia, is very similar to the northern snapping turtle.

Questions & Answers

Q I have been told that there are no koalas on the lowlands around Cairns because they were all killed by people.

A There is no evidence that there were ever any healthy or thriving populations of koalas in the Wet Tropics lowlands. There would probably be enough food in pockets of sclerophyll forest, so the reason for their absence may be primarily climatic. Since there are no leaf-eating possums there either, it may simply be too hot and wet. There are historical records from Cooktown and they are definitely found from Ravenshoe west. There have been sightings around Irvinebank, Herberton, Mt Surprise and so on – they seem to be found just west of the Great Dividing Range. These populations are very sparse but there may actually be quite a large number of animals, spread out over a large area. It is doubtful whether their range in north Queensland will ever be properly known.

Koalas on Magnetic Island are believed to have been brought there from Hervey's Range, west of Townsville – so they are fairly local.

If you do see koalas, Dr Andrew Krockenberger at James Cook University would be very interested to hear about your sighting. You can contact him on e-mail: Andrew.Krockenberger@jcu.edu.au or by phone on (07) 4042 1238.

Q Could you give me some information on the lifecycles and predators of ticks?

A Ticks are essentially large mites. The lifecycle takes about a year, depending on species and climate.

After hatching from the **egg**, the tick passes through two juvenile stages, as a six-legged **larva** (the 'seed-tick')and then an eight-legged **nymph**. This is a miniature version of the adult, about the size of a pin head. At the final **adult** stage an unfed tick is about the size of a match head. At each stage of her life, the female must attach herself to a warm-blooded animal for a meal of blood, but the male does not need a blood meal at the final stage. After each feed the tick drops off, choosing a new victim when it is time for the next meal. When unfed, the tick's relatively long legs, in four pairs, make its close relationship to the spider group obvious (both are Arachnids). However, during a feed, the body increases in size by up to 400 times, the bloated abdomen dwarfing the tiny legs. The female lays 2000-6000 eggs in moist leaf litter before dying. A small proportion of these hatch out after 40-110 days.

Wasps apparently prey on ticks and it is thought that other insects and arachnids as well as insectivorous birds would also do so. However, their biggest enemy is low humidity. Indeed, most ticks die waiting for an opportunity to feed, expiring from thirst rather than hunger. Male ticks, in the third stage, parasitise the females. Latching on to her body (sometimes along with two or three other males), he pierces her skin and feeds on the blood stored in her engorged abdomen.

For more information, have a look at the University of Sydney's Medical Entomology Department website: http://medent.usyd.edu.au/fact/ticks.htm#introd and follow links.

Tourist talk

ENGLISH	GERMAN	JAPANESE	
flood	Überflutung	kouzui	洪水
drought	Dürre	kanbatsu	旱魃
season	Jahreszeit	kisetsu	季節
to become dry	austrocknen	hiagaru	干上がる
mud	Schlamm	doro	泥
water lily	Wasserlilie	suiren	睡蓮
turtle	Schildkröte	kame	亀
frog	Frosch	kaeru	蛙
to burrow	sich eingraben	ana o horu	穴を掘る
to hibernate	überwintern	toumin suru	冬眠する

Facts and stats

About 70 percent of all Western Australia's rain falls in the Kimberley region.

In the Wet, 2700 sq km of Kakadu may be inundated with flood waters.

There is a greater number of river systems in Queensland than in any other Australian State – run-off from these rivers accounts for more than 45 percent of the total discharge from all Australian rivers.

Officially, the Mitchell River, flowing into the Gulf of Carpentaria is Australia's second largest river. Its drainage basin of 72 000 sq km discharges an average of 21 230 ML a year – twice that of the Burdekin and four times the Johnstone River. However, if flood flows could be adequately measured, it might actually be Australia's largest river in terms of annual discharge.

The word billabong is of Aboriginal origin. It refers to permanent or semi-permanent areas of open water, often ox-bow lakes which have become cut off from the main river but are reconnected during times of flooding.

One hundred and eighty-three freshwater fish species have been recognised in Australia.

Approximately 35 percent of Australian frogs can burrow – a consequence of living in a land prone to droughts.

Magpie geese hatchlings which weigh about 70 grams when they emerge from the egg, increase their weight by more than 20 times in the first seven weeks or so. At this rate, a human baby would weigh more than its mother in less than two months.

Water buffaloes were recorded in the Top End by explorer Ludwig Leichhardt in 1835.

Get to know your waterplants

It is a good idea to familiarise yourself with waterplants so if you encounter an introduced one, which could become a threat, you can report it to your local authorities. A good water plant guide is listed in *Bookshelf*, page 8. Information on weeds of national significance is available on www.weeds.org.au/

Some plants which have not yet been introduced, but have the potential to become pests are water chestnut (*Trapa natans*), Eurasian watermilfoil (*Myriophyllum spicatum*) and water soldier (*Stratiotes aloides*).

Out and about

Winter is mating time for **brush-tailed phascogales**. These acrobatic climbers, with extraordinary bushy ends to their tails, live mainly in wet sclerophyll forests on Cape York, and across the Top End into the Kimberleys. Brush-tailed phascogales are dasyurids – carnivorous marsupials. They eat mainly insects but may occasionally take a small vertebrate.

Courtship for these animals is brief, but mating lasts for several hours, during which the female dozes off from time to time. However, this marks the end for the short-lived males. Like many dasyurids, they wear themselves out at mating time and succumb to stress-related diseases soon afterwards. (The brush-tailed phascogale is the largest mammal in which the male is known to die at the end of its first breeding season.) This ensures that the males do not compete with the females and young for food resources later – but is a risky strategy. Densities of phascogales are low, so if predation on mother and young is heavy or the weather bad, a local population could disappear. The female gives birth 30 days after mating and the young remain attached to the nipples for about another 40 days.

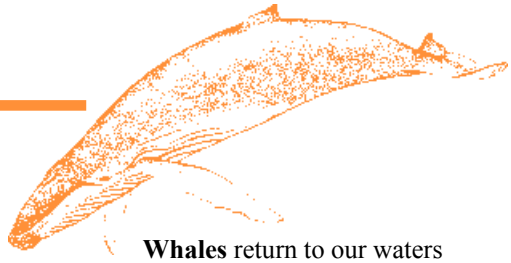
Crazy ant photo, Environment Australia

Crazy ants arrived in Cairns recently, leading to a full-scale eradication program. Crazy ants are now found in many places around the world, but probably originated in West Africa. Their common name comes from the erratic way in which they move, when disturbed. High up in the list of the 100 most invasive species in the world, they are not welcome in Australia. They breed prolifically, with 50-100 egg-producing queens in the average nest, although many hundreds have been found.

These ants spray formic acid on prey and enemies when disturbed. They are very destructive, ganging up on creatures larger than themselves. In Christmas Island they have killed vast numbers of the famous red crabs, leaving the empty carapaces standing in the forest.

When not breeding, the ants feed on nectar, visiting flowers and feeding on honeydew produced by scale insects. Protein is needed for the production of the brood, however, and that is when they turn carnivorous. That is also when baiting programs are most effective, when toxins can be incorporated into attractive protein baits.

Meanwhile, **big-headed ants**, another invasive feral species of 'tramp ant', originally from Africa, is invading rainforests at Howard Springs, south-east of Darwin. This aggressive ant exterminates almost all native ants as well as many other insects, is a major pest of pineapple and citrus and seems to attack native vegetation. For details see: www.publish.csiro.au/ecos/Ecos95/Ecos95C.htm



Whales return to our waters in winter, humpbacks migrating north from Antarctic to give birth, and mate, in the comparatively warm waters of the Great Barrier Reef. Dwarf minkes appear around the northern ribbon reefs, north of Cooktown, a little earlier, usually around June. Where they spend the summer months is still a mystery.

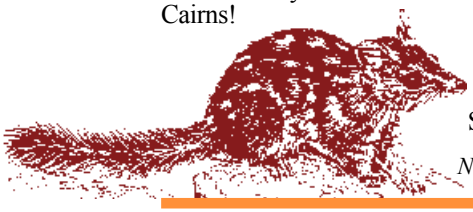
If you are out and about on the water, please be careful not to upset these magnificent creatures. If in a boat, do not approach closer than 100m but slow down and continue on course, avoiding potential collisions, or steer a straight course away from them. When within 300m, move at a constant slow speed, no faster than the slowest animal.

Full details of the Commonwealth regulations relating to marine mammals are available at Environment Australia's website: www.environment.gov.au/epbc/biodivconserv/cetaceans.html. GBRMPA's Whale and Dolphin Conservation Policy can be located on their website: www.gbrmpa.gov.au/corp_site/info_services/publications/whale_dolphin/index.html

Spotted-tailed quoll

Have you ever seen a **quoll**? Scott Burnett in the Atherton QPWS office would like to hear of any records of quolls seen in Queensland. He is interested in both spotted-tailed quolls and the more common northern quolls. He is also interested in all records, recent and ancient – old records give valuable clues to changes in species distribution. The information will be used to help map quoll distribution and will be included in the Wildnet database, with sources of records credited.

Quolls were once very widespread in Australia but have suffered persecution since Europeans arrived due largely to their liking for poultry but also because they thwarted initial attempts to introduce rabbits! Quolls are carnivorous marsupials with a feisty reputation. They have dark hair with white spots on the body and, in the case of the larger spotted-tailed quoll, on the tail as well. It is not unknown for quolls to turn up in urban areas – one recently wandered into the Kentucky Fried Chicken outlet on the Mulgrave Road, in the middle of Cairns!

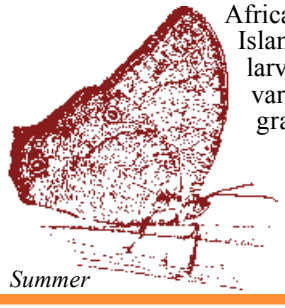


Northern quoll

If you have ever seen a quoll, please contact Scott Burnett on Ph: (07) 4091 4262 or by e-mail: Scott.Burnett@env.qld.gov.au. Likewise, if you know anybody else who has seen quolls ask them to contact Scott.

Winter

Evening brown butterflies have now adopted their winter colours. In the cooler months the undersides of their wings are a pattern of dark browns and russets, while the summer version is much paler, with several 'eye' spots. These elegant well-camouflaged butterflies tend to rest quietly on leaf litter during the day, waiting until the evening to fly, often visiting over-ripe fruit. They are a common open-forest species with a wide range, from Africa to the Pacific Islands. Their larvae feed on various types of grass.



Summer

Bookshelf

Cape York Peninsula
Dawn and Clifford Frith
Reed Books (1995)

Wildlife of Kakadu
Greg Miles
Barker Souvenirs (1988)

Waterplants in Australia
G.R. Sainty and S.W.L. Jacobs
CSIRO (1994)

Native Plants of Northern Australia
John Brock
Reed Books (1993)

Reptiles and Amphibians of Australia
Harold G. Cogger
Reed New Holland (2000)

Australian Freshwater Turtles
John Cann
Beaumont Publishing (1998)

Common Plants of the Kimberley
Department of Conservation and Land Management

Common Animals of Australia's Top End
Wildlife Identikit
Conservation Commission NT

Australian Wildlife Research Vol 13 No 3 1986 pp 461-480
Australian waterfowl do not necessarily breed on a rising water level
F.H.J. Crome

The Emu Vol 88 Part 4 Dec. 1988 pp 243-248
To drain or not to drain? – Intermittent swamp drainage and waterbird breeding
F.H.J. Crome

Floodplain Flora: Flora of the coastal floodplains of the NT, Australia
I. Cowie, P.S. Short & M. Osterkamp Madsen
Australian Biological Resources Study (2000)

National wetlands R&D program: regional review of wetlands management issues: wet-dry tropics of northern Australia
C.M. Finlayson, R. Hall & B. Bayliss
Jabiru: Land and Water Resources Research and Development Corporation (1998)

Nature Australia Vol 26 No 8 Autumn 2000
Let them eat grass!
Peter Whitehead and Terry Dawson
An article on magpie geese and the threats posed by introduced grasses.

Nature Australia Vol 25 No 7 Summer 1996-97
In a flap over dinner
Cormorants and shags flap wings to help digestion.

Wildlife Australia Magazine Vol 37 No 4 Summer 2000/2001
Curious crustaceans of Currawinya
Brian Timms

Nature Australia Vol 25 No 12 Autumn 1998
Hot lotus

Guardian Weekly May 10-16 2001
Lotus gives a lesson in cleanliness
Peter Forbes
See also: www.botanik.uni-bonn.de/system/planta.htm

Australian Geographic Magazine No 62
Let's dam Qld rivers
Malcolm McCulloch

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