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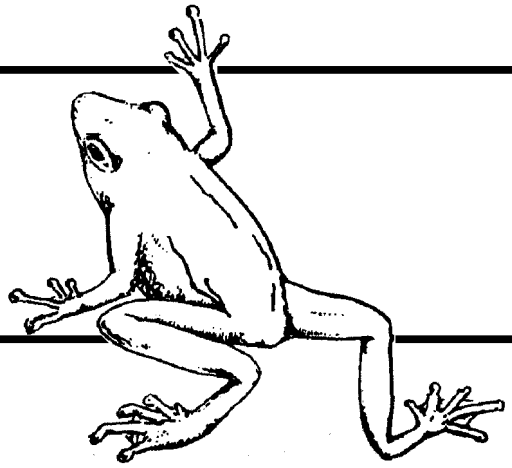

The Frog and Tadpole Study Group of NSW Inc
FATS GROUP

P.O. Box 296
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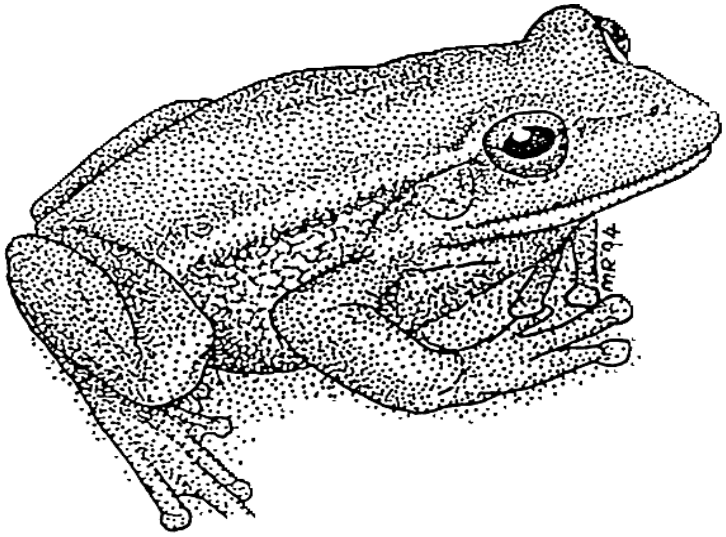
GREEN AND GOLDEN BELL FROGS

Introduction

The Green and Golden Bell Frog *(Litoria aurea*) is a species of frog that has gained much public attention in New South Wales in recent years. This attention has been roused by several events:

1. Since the 1960's there has been a rapid and so far unexplained decline and disappearance of the species over much of its range. This resulted in the species being listed as endangered under the NSW *Threatened Species Conservation Act 1995* and vulnerable under the Commonwealth's *Environmental Protection and Biodiversity Conservation Act 1999.*
2. Remnant populations of Green and Golden Bell Frogs have shown an ability to colonise highly disturbed artificial sites, such as deserted industrial sites, brick pits and quarry sites.
3. The ability of Bell Frogs to make use of human-made sites has created a quandary for wildlife officials seeking to conserve the remaining frogs, and for developers who wish to utilise their property assets.

Thus, the Green and Golden Bell Frog has fallen into the public spotlight and is currently the focus of a number of scientific studies, some of which are supported by private industry. This information sheet is a summary of our current understanding of the species and is based heavily on data gained by members of the FATS Group.



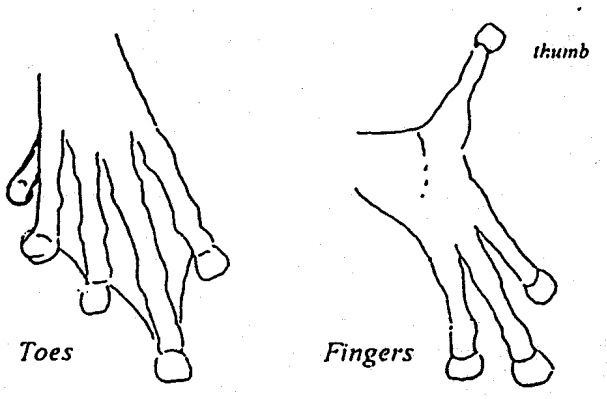
The Green and Golden Bell Frog

Description

A largish species with females ranging from 40 to 84 mm in body length; males are slightly smaller and range from 35 to 70 mm in body length.

Bell Frogs are generally green with golden/bronze stripes or patches over the back of the animal. Body patterns are variable in this species with some animals being almost completely green with very little gold marking, while others can be a dull coppery-brown colour. Bell Frogs with bold green and gold patterns are the ones that are usually depicted in books (e.g. see Cogger 1992 p128, Tyler 1992, p10, Robinson 1993 p79). The one colour feature that they all have is a gold and white stripe that runs from the eye, passes over the eardrum and runs along the flank of the frog to terminate near the hip. The eardrum is either all or partly golden in colour. In the colder or drier months the body colouration is less bold, the dorsal (back) colouration can fade to a bronze or dark bronze in mid-winter.

The limbs are most often a light bronze colour and the belly is off-white. The males may have a yellow-bronze discolouration of the outer skin of the throat. The toes have a conspicuous amount of webbing, with the webbing almost reaching the tips of all of the toes. The fingers are unwebbed.

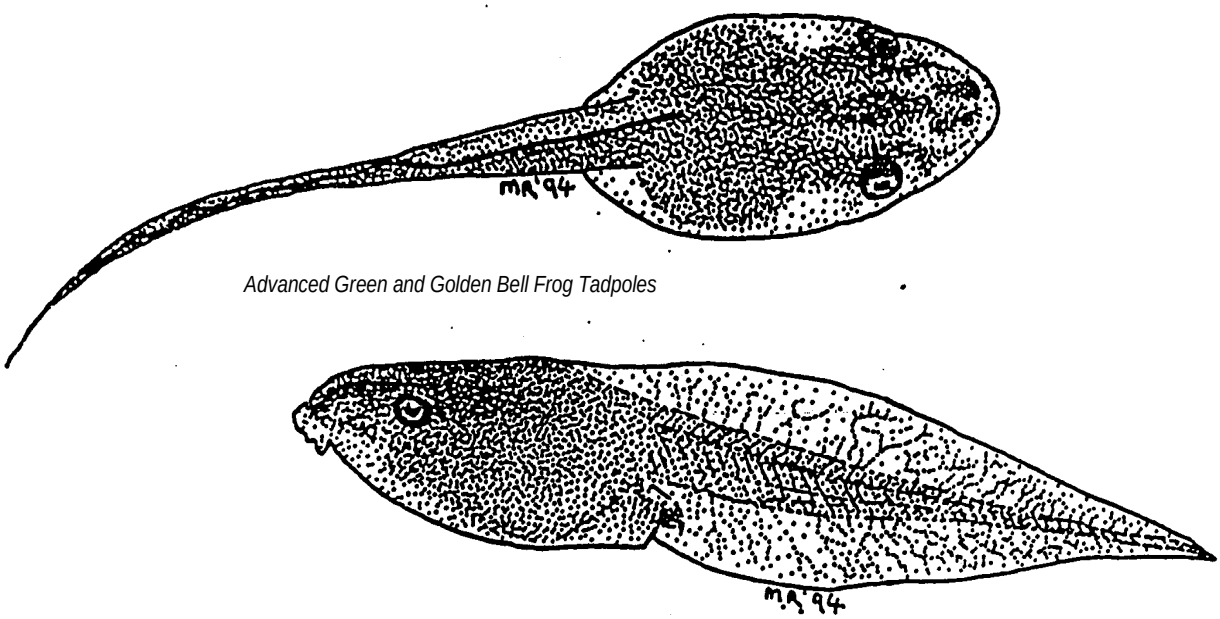


Large tadpoles can be readily recognised and identified. In general, there are several features that are useful for identifying Green and Golden Bell Frog tadpoles; these include:

1. Tail that is often a dirty yellow colour.

2. Body flanks have a metallic golden lustre.

3. Two narrow dark lines of pigment that run from the tip of the snout, between the eyes and back to the end of the body. They diffuse towards the rear of the animal and tend to merge into the general body colouration.



Advanced Green and Golden Bell Frog Tadpoles

4. In bright sunlight, a white canthal line is present on either side of the head-

5. The mouthparts are not distinctive, having a dental formula of:

$$\frac{1}{1\quad 1}$$
$$\frac{}{}$$
$$\frac{1\quad 1}{2}$$

See Tyler 1989, pp 73- 79 for discussion of tadpole mouthparts.

Newly emerged tadpoles or very small tadpoles are difficult to identify with certainty. In general, such small animals would need to reared to a larger size before a confident identification could be made. If positive identification is required, contact either the Australian Museum {Dr. Allen Greer, (02) 9339 8320} or the Frog and Tadpole Study Group {Dr. Arthur White, (02) 9599 1161}.

Historical and current distribution of *Litoria aurea*

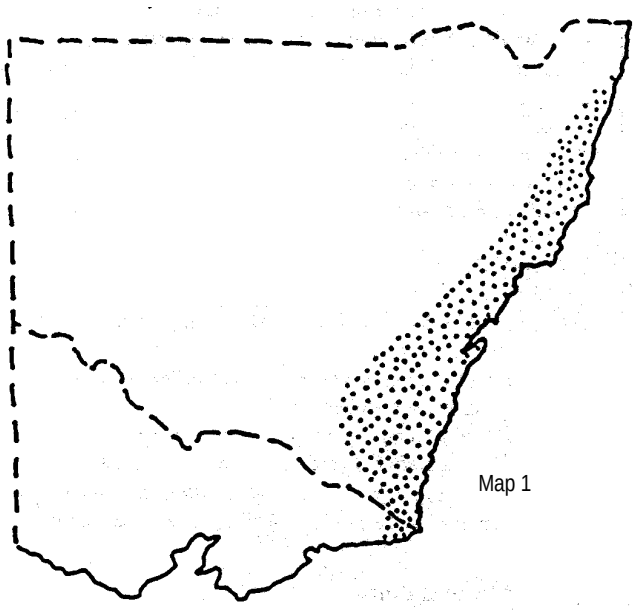
Map 1 over page depicts the distribution of *Litoria aurea* over a wide area of the southern highlands of New South Wales, as well as extending coastally from northern Victoria to northern New South Wales. This map is based on museum and historical records and indicates the area that this species once occupied. "

Map 2 is based on sightings and capture records of *Litoria aurea* from 1992 to 2004. (Many of the earlier sites have been checked.)

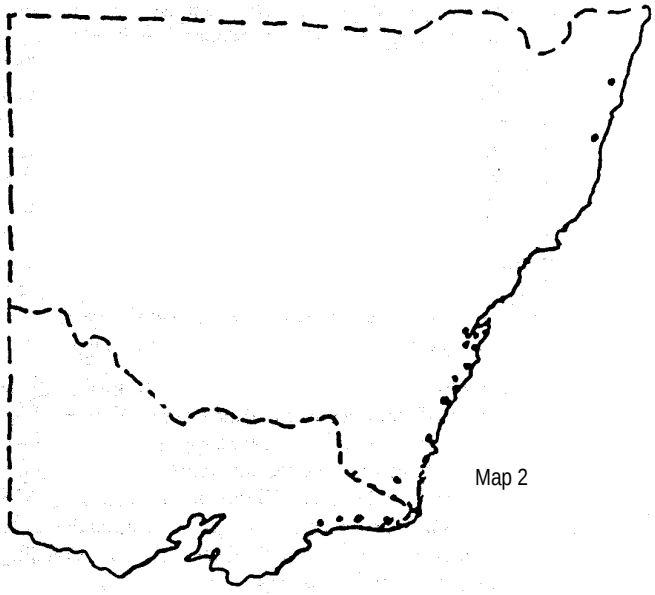
There are a number or points to note about the two maps; namely: -

- There has been a virtual elimination of Green and Golden Bell Frogs from highland areas. The species was regarded as being locally extinct in the southern highlands and the Australian Capital Territory (Osborne 1990, 1992) but one population has survived near Queanbeyan.
- The species has a more patchy distribution along the east coast of New South Wales. It has declined markedly in areas north of Sydney, whereas its decline south of Sydney has been less severe,
- The main known centres of population for remaining Green and Golden Bell Frogs in New South Wales are near large urban areas (such as Sydney, Nowra and Wollongong). These areas have been studied more intensively.
- This species, while having a limited distribution in Victoria, is regarded as being secure in that state.

The decline or Green and Golden Bell Frogs in New South Wales has not been adequately recorded. Observations by farmers and field



Map 1



Map 2

workers have indicated that the decrease did not commence uniformly across the state. Major declines began in the 1960's in the southern highlands and the A.C.T. The disappearance of Green and Golden Bell Frogs from many coastal areas seems to have occurred later (in the 1970's and 1980's). There is some weak evidence to show that the decline or Bell Frogs from coastal areas was associated with changes to local drainage patterns.

In the Sydney Metropolitan area, *Litoria aurea was* regarded as common in the mid-1960s with Bell Frogs readily being found at Eastlakes and Botany in the east, at various sites along the George's River to the south and west, and associated with the Nepean River to the north and west. By the mid-1970s the decline or Bell Frogs was apparent in Sydney. The species had disappeared from Centennial Park and Botany and were becoming less common at Eastlakes. The populations around Liverpool were reduced to discrete pockets. Some Bell Frogs were recorded from the Penrith and Richmond/Wilberforce area, but they have since disappeared from many of the Nepean River sites.

Today, one small population survives at Eastlakes and another at Rosebery, the last remnants of the widespread Bell Frog colony that had occupied the "Lachlan Swamps" system. In the Cook's River catchment, a tiny population of Bell Frogs survives at Cox's Creek at Greenacre. A few colonies still occur in the Liverpool area. More intriguing is the presence of a number of small populations in disused industrial sites, tips, stormwater overflow areas, mining sites or other disturbed land areas.

The only populations of Green and Golden Bell Frogs that occur in national parks are those found in the Botany Bay National Park and the Jervis Bay National Park.

Habitats

Most historical accounts of the Green and Golden Ben frog cite farms, dams, streams, swamps, lagoons and other still water bodies as their habitat (e.g. Barker and Grigg 1977, Cogger 1992). These water bodies were often lined with bulrushes (Typha sp.) or contained spike rushes (Eleocharis). Based on observations of the species since 1992, these habitats can no longer be regarded as "typical" for these frogs.

Recent intensive survey work on Green and Golden Bell Frogs has revealed some variety in the habitats that can be used by this species. All of the currently known sites are coastal or near coastal. The most inland site known is near Singleton in the Hunter Valley. The majority of sites are on sandy soil. The majority of sites are also temporary in nature and less than 20 years old. Many of the sites are highly disturbed and have had major habitat alterations. The water bodies found on most sites are ephemeral to some extent and may lack a well-developed emergent plant cover. They either lack fish or have a very low fish density. The water is generally free of chemical pollutants although it may contain floating, solid wastes.

Green and Golden Bell Frog survival

There are a number of requirements for *Litoria aurea* to survive in an area. These include:

The presence of diurnal shelter/basking sites. Bell Frogs will often bask during the day. There are many observations of these frogs sitting on bulrushes in the sunlight. In many of the highly disturbed sites, bulrushes may not be present and Bell Frogs have been observed basking on old tyres, on rubble mounds or on introduced vegetation. In the areas where the frogs bask, there is always an avenue for escape if the frogs are disturbed. Usually the frogs jump into water and dive out of sight or drop to the ground and move quickly into a secluded shelter site nearby.

The presence of refuge sites. Refuge sites differ from shelter/basking sites in that they are for long-term shelter. During winter Bell Frogs bruminate ("hibernate"). The length of brumination can be a matter of weeks during a mild winter or it can be 3 to 4 months in cold conditions. Refuge sites are usually below ground, often much deeper than normal shelter sites. For example, at Rosebery, during the warmer months or the year the Bell Frogs shelter in a rock pile, usually only 10 to 20 cm below ground level. In mid-winter, the Bell Frogs can be up to a metre below ground level, lying inactive in a tight-fitting, moist soil chamber.

Feeding areas. Adult Bell Frogs are carnivorous and prey heavily on cockroaches, crickets and grasshoppers. For this reason the frogs use the edges of pasture land for feeding. Around disused industrial sites,

cockroaches are the main food items. When food is scarce, or if the opportunity arises, Bell Frogs will call other frogs (including their own species). In some sites where insects are seasonally scarce cannibalism by the Bell Frogs is the only way that the adults can survive.

Breeding areas. Green and Golden Bell Frogs lay between 2,000 and 4,000 eggs per spawn mass. The eggs are laid in water, initially floating and entwined around fringing plants. A few hours after laying, the eggs sink. The time for hatching and tadpole development is highly variable. The time from egg-laying to metamorphosis into frogs can be as short as 2 months or it can be as long as a year. Bell Frogs do not defend the egg mass or protect the tadpoles. In many areas, where Bell Frogs have declined, there are indications that this decline is associated with the introduction of exotic fish species (such as Gambusia, carp and goldfish). Gambusia (the poorly named "mosquito fish") have been observed to eat the spawn as well as Bell Frog tadpoles. The surviving populations of Green and Golden Bell Frogs in New South Wales generally breed in fish-free water, such as temporal pools, storm water over-flows, pit ponds or flooded cow hoof prints in mud.

The reasons why Green and Golden Bell Frogs inhabit highly disturbed and artificial sites are a matter of some debate. What is clear is that their traditional breeding and feeding areas have been severely affected by the introduction or exotic fish, pollution or changes in land use. Highly disturbed sites are not easily colonised by many species (except for cockroaches) and it may be that Bell Frogs survive in these areas because they are unsuitable to competing species.

Frog cultivation

In view or the ability of Green and Golden Bell Frogs to survive in human-made habitats and the rather attractive appearance or the adult frogs, a number or people have enquired about establishing frog ponds in their back yards for raising and keeping Bell Frogs. This has been done for other frog species and theoretically it should work for Bell Frogs also. Bell Frogs are classified as endangered animals and are protected by law. Please do not interfere with Bell Frogs or their tadpoles or spawn. It is also an offence to interfere with Green and Golden Bell Frog habitat, which is also protected by law. This situation will remain until enough is known about the species to ensure its long-term survival. Attempts are being made to encourage Bell Frogs to naturally colonise back yard ponds or other recreated habitats within the normal movement range of known populations. Frogs such as the Green and Golden Bell Frog may ultimately rely on human help for their long-term survival.

Further reading

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Voigt. M. (1992) *Establishing Frog Habitats* on *your Property.* FrogFacts No.3. FATS, Sydney - see below.

FATS – The Frog and Tadpole Study Group of NSW

Postal address: P.O. Box 296, Rockdale NSW 2216.

Meetings: Every first Friday of every even month, 7 pm for a 7:30 start, at Newington Armoury, Bldg. 22, northern end of Jamieson St., Homebush Bay. Parking at boom gate.

Web site (with links to other frog groups): www.fats.org.au

Frogwatch Helpline: 0419 249 728.

FrogCall - Bimonthly newsletters of the FATS Group.

FrogFacts information sheets are available from the FATS Group. Please send your postal enquiries with stamped addressed envelope to the FATS Group, PO Box 296 Rockdale NSW 2216.

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