



# FAUNA *of* AUSTRALIA



## 2. HISTORY OF DISCOVERY OF THE ANURA

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The earliest descriptions of Australian frogs were based on material collected opportunistically, or on illustrations, by early travellers. The first species to be described was *Rana caerulea* (White, 1790), now *Litoria caerulea* the type of which is presumed lost (Tyler 1976b). The original figure is reproduced in Fig. 2.1. Shaw & Nodder described *Rana australiaca* (= *Helioporus australiacus*) in 1795, based on a drawing by Nodder.

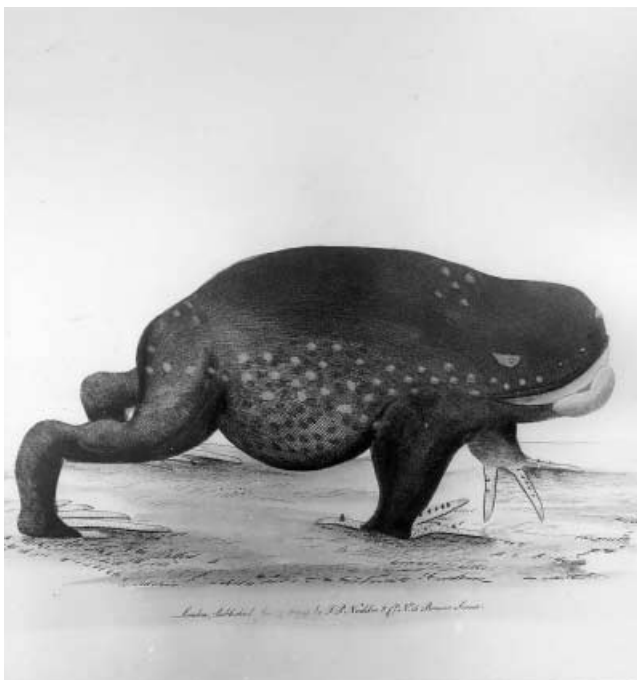
Subsequently, more intensive collections were made. Surprisingly, those of Péron and Lesueur, naturalists on the Baudin Expedition, received little more than a mention by Péron (1807). Indeed, the illustrations held in the Lesueur collection at the Muséum d'Histoire Naturelle in Le Havre, France have been published only recently. Bonnemaïn, Forsyth & Smith (1988) reproduced three vellums (77 001 to 77 003) of Lesueur, which are cross-referenced to Péron's notebooks 77 010 to 77 012, with identifications by M.J. Tyler, and are accompanied by Péron's name.

Seven of these were hylid species, referred to on the illustrations and by Péron (1807) as *Hyla citripoda*, *Hyla cyanea quadrimaculata viridi aurea*, *Hyla erythropoda*, *Hyla xanthogaster*, *Hyla bufonoïdes*, *Hyla nebulosa* and *Hyla violaceapoda*. They represent *Litoria lesueuri*, *L. aurea*, *L. phyllochroa*, *L. chloris*, *L. verreauxi*, *L. peronii* and *L. citropa* respectively. Three myobatrachid species were illustrated also: *Limnodynastes tasmaniensis*, as *Rana pustulosa*; *Limnodynastes peronii* as *Rana patersonia*; *Ranidella* species (now *Crinia*) as *Bufo leucogaster*. The above were all from Port Jackson with the exception of *Litoria peronii* which was from Parramatta. Also figured was the Western Australian *Litoria adelaidensis*, as *Hyla viridi aurea* from Terre de Nuyts.



**Figure 2.1** Two specimens of *Rana caerulea* (= *Litoria caerulea*) appear in White's (1790) illustration. The small frogs in the centre are probably *Crinia* species. The blue colour of White's specimens, embodied in the specific name, resulted from the alcoholic preservation medium, probably rum.

[Photo ©Australian Museum]



**Figure 2.2** Nodder's illustration of *Rana australiaca*, on which the type of *Heleioporus australiacus* is based. (From Shaw & Nodder 1795)

[Photo ©B. Main]

Gould's collector, Gilbert, made two visits to Western Australia, in 1839 and in 1842–1843. In the latter period, Gilbert visited Houtman Abrolhos (Gilbert 1843). Boulenger (1882) listed Gilbert as the collector of the type of *Myobatrachus gouldii* (Fig. 2.3), *Heleioporus eyrei*, and as having collected *M. gouldii* and *Limnodynastes dorsalis* on the Abrolhos. Specimens of *Crinia* from these islands presented to the British Museum (Natural History) by Günther are likely to have been collected by Gilbert. Frogs have not been collected recently on the Abrolhos, but the eucalypt copse noted by Gilbert in East Wallabi still persists and may be the site to look for *M. gouldii*. On West Wallabi the later guano workings may have so affected the water table that the samphire flat which 'very evidently displays a large body of water in the rainy season' no longer supports *Limnodynastes* or *Crinia*. Gilbert also collected the type of *Litoria adelaidensis*.

## TAXONOMIC DEVELOPMENTS

The difficulties of early taxonomists with poorly preserved specimens is shown by the following placement of species presently well known. Examples are *Rana aurea* Lesson, 1829 (*Litoria aurea*), *Bombinator australis* Gray, 1835 (*Pseudophryne australis*), *Breviceps gouldii* Gray, 1841 (*Myobatrachus gouldii*), *Alytes australis* Gray, 1842 (*Cyclorana australis*) and *Hylorana daemeli* Steindachner 1868 (*Rana daemeli*).

At the generic level, recognition of the distinctive nature of the Australian frog fauna began with the descriptions by Tschudi (1838) of *Crinia* and *Litoria*, two of 19 endemic genera presently recognised (Cogger, Cameron & Cogger 1983). When Boulenger described *Lechriodus* in 1882, 13 genera had been described, primarily between 1841 and 1867, including *Cyclorana*, *Heleioporus*, *Limnodynastes*, *Mixophyes*, *Myobatrachus*, *Neobatrachus*, *Notaden*, *Pseudophryne*, *Ranidella* and *Uperoleia*. The deposition in European museums of all known holotypes of type species for these genera reflects the domination of this phase of description by European taxonomists.



**Figure 2.3** Illustrations from Gray's (1941) descriptions of **A**, *Myobatrachus gouldii*, and **B**, *Heleioporus albopunctatus*.  
[Photo ©B. Main]

In the ensuing 70 years, only three new genera were added to the list (*Philoria*, *Adelotus* (Pl. 2.4) and *Metacrinia*). Fry (1912) added the family Microhylidae to the Australian fauna when he described species of *Austrochaperina*, which have been transferred subsequently to the Papuan genera *Cophixalus* and *Sphenophryne*.

A revival of scientific interest in Australian amphibians from 1950 onwards resulted in extensive new collections of material. These led to the description of the four new genera *Arenophryne*, *Megistolotis*, *Rheobatrachus* and *Taudactylus*, and the presence of the Papuan hyloid genus *Nyctimystes* (Pl. 1.7) in Australia was shown by Tyler (1964).

Taxonomic revisions based on these collections also resulted in the recognition of the new genera *Assa*, *Geocrinia* and *Paracrinia*, in which overall similarity in body shape had masked morphological differences between these and related taxa. This second phase of description was conducted primarily by Australian taxonomists, as reflected in the large proportion of type material deposited in Australian collections.

The genus *Bufo* was added to the Australian frog fauna with the introduction to Queensland of *Bufo marinus* (Pl. 1.2) in 1935 (Easteal 1981).

## EARLY OBSERVATIONS

The atypical calls and behaviour of many Australian frogs often misled or confused travellers. Thus Heirissons's party were transfixed with terror by a horrible cry 'like the bellowing of an ox' that appeared to come from the reeds close by, when they were attempting to camp overnight in June 1803 (Péron 1807). This has been interpreted by D.L. Serventy as undoubtedly the cry of the brown bittern (Marchant 1982). An alternative interpretation is offered by Landor (1847), who described the caution displayed by Stirling in his first

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passage up the Swan in March 1827, because they had the records of the French fully in mind and were kept 'in constant vigilance by the same fearful sounds'. Landor then related how the colonists had changed from believing the incessant noises to be made by wild bulls, the howling of wolves or cries of savages to being 'convinced that the dreadful sounds which assailed their ears at night proceeded from myriads of frogs'. The calling season of *Heleioporus eyrei* extends from March into June. As males characteristically chorus in unison, the sound alternates between a low moan or hum and a loud resonant sound not unlike the lowing of cattle, and possibly alarmed the French, Stirling, and the early settlers.

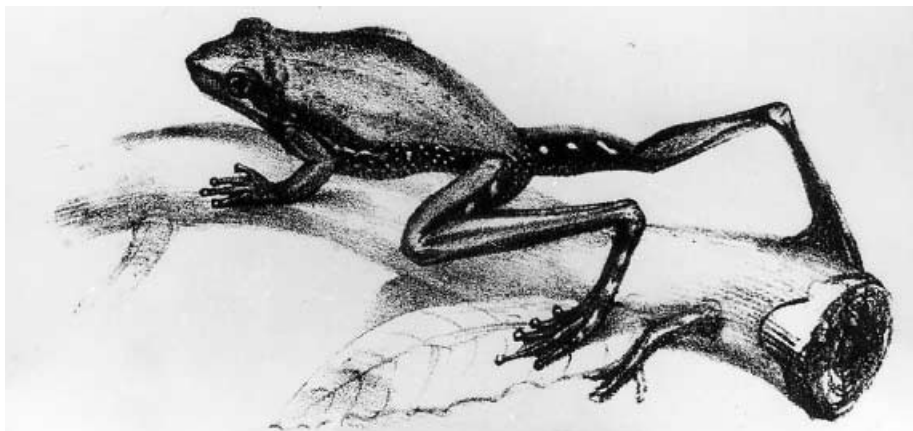
Landor also told of how he was startled by a loud 'bomb' when hunting ducks in tall bulrushes, and was ready to retreat 'when I espied a little frog perched on top of a reed ... which every now and then inflated his cheeks and uttered the fearful sound I had heard'. A single loud 'bonk' is often made by *Limnodynastes dorsalis* during daylight and *Litoria adelaidensis* perches on reeds and calls in daylight.

Grey (1841) described how Aboriginal women collected frogs in all seasons, but especially when the swamps were nearly dry by using long sticks or 'their arms which they plunge up to the shoulder in the slime', and how he had often seen them with 'ten or twelve pounds weight of frogs in their bags'. Moore (1884) recorded that the eggs of frogs most prized by natives were dug from the ground; these would have been eggs of *H. eyrei*. Moore also noted that frogs of a green colour were not eaten, and that the good ones lived in the ground.

Aitken (1870) described the finding of a water-holding frog in dried up water holes in central Australia, later identified as *Cyclorana platycephalus* by Spencer & Gillen (1912). Dakin (1920) described the larval life of *Heleioporus eyrei* (as *H. albopunctatus*).

### RECENT INCREASES IN KNOWLEDGE OF BIOLOGY

In the 1940s and 1950s, the status of named species as biological entities was unresolved and there was strong antipathy to any biological species concept or to considering frog species as populations as proposed by Dobzhansky (1950). At this time I was interested in using frogs in comparative studies on how Australian animals adapted to aridity and so needed to identify species as biological entities. Confidence in the status of nominal species was not encouraged by the differences of opinion between Parker (1940) and Loveridge



**Figure 2.4** *Hyla adelaidensis* (= *Litoria adelaidensis*), as illustrated by Gray (1841). [Photo ©B. Main]

(1935) on species limits for *Crinia signifera* and *C. georgiana*. While the absence of red indicated *C. georgiana* to Loveridge, Parker held that the colours of *C. georgiana* were 'fast' in alcohol but 'fugitive' in formalin. Clearly an objective measure was needed to identify living specimens. One such measure with potential was the comparison of male calls. This would be possible if male calls could be recorded on magnetic tape and subsequently analysed by means of an oscilloscope.

Staff of the Australian Broadcasting Commission cooperated in demonstrating that single calls could be recorded (Anon. 1953). Analysis of these calls showed that they were distinctive in duration, frequency of repetition and pulse rate. This discovery was exploited by M.J. Littlejohn, who constructed a portable tape recorder in 1954, and soon demonstrated the presence of many distinctive calls indicative of cryptic or sibling species in *Crinia*, *Heleioporus* and *Neobatrachus*. The species status was confirmed by genetic crosses, using the *in vitro* technique of Moore (1946).

These studies showed a great range of calls within genera and rapidly clarified the taxonomy and so established comparative physiology on a sound basis. Littlejohn & Lee (1955) published illustrations of the oscillographs of *Heleioporus*, and species specific calls of this genus and of *Neobatrachus* were analysed by Littlejohn & Main (1959). A comparative analysis of the calls of *Crinia* species by Littlejohn (1959) demonstrated the great differences between the calls of species within a genus. Taken in association with the results of crosses using the *in vitro* techniques, these call differences enabled Main (1957) and Lee (1967) to resolve the taxonomy of *Crinia* and *Heleioporus*, respectively.

Over the period of the foregoing studies in Western Australia, W.F. Blair had used tape recordings and a sound spectrograph in the United States to analyse frog calls (Blair 1958). Littlejohn was able to continue the analysis of calls previously recorded in Australia in Blair's laboratory (Littlejohn & Main 1959). John Moore, a Fulbright Scholar at Sydney, showed by crossing eastern and western *Crinia* that the western form, hitherto believed to be conspecific with eastern *C. signifera*, was a genetically separate entity which he named *C. insignifera*. He demonstrated also that eastern and western *Litoria* attributed to *L. aurea* were also genetically distinct (Moore 1954). These studies were later placed in a broader context of the frog fauna of eastern Australia by Moore (1961).

The comparative physiology of *Heleioporus* and *Neobatrachus* (Bentley *et al.* 1958) showed that the species recognised on biological criteria were also unique with respect to their ability to tolerate dehydration. Similarly, Main & Bentley (1964) showed that burrowing frogs and tree frogs were distinctive.

Earlier workers, such as Loveridge (1935), interpreted the different dorsal patterns in *Crinia* as morphological species, while Parker (1940) interpreted the differences as morphological variation. Main (1965b) showed by breeding experiments that variations in dorsal patterns in *C. insignifera*, *C. pseudinsignifera*, *C. glauerti* and *C. georgiana* could be interpreted as a polymorphism controlled by a simple genetic system.

A review of the studies of calls, *in vitro* crosses, biology, physiology and ecology initiated in the 1950s (Main 1968), together with Moore's (1961) review, demonstrated the richness of the frog fauna, and its suitability for studies on speciation, evolution and isolating mechanisms. The fauna also provides a wide range of life histories and physiological abilities appropriate for comparative studies. This early work thus kindled interest, and provided the basis for the subsequent wide-ranging studies on frogs which are reviewed in the following chapters.