



Red-crowned Toadlet

Pseudophryne australis (Gray, 1835)

Other common name(s): None

The following information is provided to assist authors of Species Impact Statements, persons undertaking Development Activities that require fauna and flora studies, and consent authorities and others who are required to prepare or review reports or assessments of potential impacts on threatened species, pursuant to the provisions of the Environmental Planning and Assessment Act 1979.

These guidelines should be read in conjunction with the NPWS Information Circular No 2: Threatened Species Assessment under the EP&A Act: The '8-Part Test' of Significance (November 1996).

Survey

Identification of Habitat

All available evidence indicates that the Red-crowned Toadlet is restricted to the Triassic Hawkesbury and Narrabeen Sandstones of the Sydney Geological Basin. The geological characteristics of this region may be found in Branagan, Herbert and Langford-Smith (1976). The restricted distribution of the Red-crowned Toadlet has a literature base extending back over 100 years, but see Cogger (2000), Thumm (1997), Thumm and Mahony (1997, 1999) and Tyler, M.J. (1994) and the references contained therein for recent mentions, as well as the NPWS Species Information Profile for additional references.

The habitat may be found in steep escarpment areas and plateaus, as well as low undulating ranges and outcroppings. Ironstone capping is a common feature of many sites where this species has been observed. Favoured microhabitats for shelter sites are under flat sandstone rocks ('bush-rock') either resting on bare rock or damp loamy soils. They have also been found under logs on soil, beneath thick ground litter and in horizontal rock crevices near the ground.

Within these geological formations, this species mainly occupies the upper parts of ridges, usually being restricted to within about 100 metres of the ridgetop. Although

they also occur on plateaus or more level rock platforms along the ridgetop this area is usually less preferred than the first tallus slope areas below the upper escarpment or just below benched rock platforms.

Red-crowned Toadlets usually live in the vicinity of permanently moist soaks or areas of dense ground vegetation or leaf litter along or near head-water stream beds. They prefer the first or second order ephemeral drainage lines commonly called 'feeder creeks' which drain the ridges, benches, cliffs and tallus slopes. These watercourses are often dry or reduced to ponded areas for much of the year and only sustain flow for short periods. Under natural conditions these feeder creeks have flows of high water quality and low nutrient loads.

The principal vegetation community occupied by this species is Sydney Sandstone Ridgetop Woodland (mainly dominated by *Eucalyptus gummifera* and *Eucalyptus haemastoma*, although a number of different associations within this community are utilised depending upon the area). Other vegetation communities have also been recorded as representing this species' habitat: viz Sydney Sandstone Gully Forest (dominated by *Eucalyptus piperata*, *Eucalyptus pilularis* and *Angophora costata*, but utilised mainly at the ecotone between this community and the former, rather than in the gullies proper); Coastal Sandstone Heath community (dominated by *Banksia spp.*, *Hakea teretifolia*, and *Baekea spp.*), and the Blue Mountains Sandstone Plateau Forest community (dominated by *Eucalyptus sieberi* and *Eucalyptus piperata*). Tree cover when present is usually open and low (10-20m), and the understorey is dominated by a complex range of xeromorphic shrubs. Definitions of these vegetation communities and associations may be found in Benson (1986, 1992), Benson and Fallding (1981), Benson and Howell (1994), Benson and Keith (1990), Benson, Thomas and Burkitt (1990), Fisher, Ryan and Lembit (1995), Ryan, Fisher and Schaeper (1996) and Keith and Benson (1988).

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Survey Techniques

A description of the species is provided in the Threatened Species Information profile. It is unlikely to be confused visually with any other species where it occurs. It is a nocturnal species with a semi-fossorial lifestyle and so is often overlooked in its habitat. This species may be active throughout the year during favourable conditions, however, the best time to search for Red-crowned Toadlets is between late August to early May.

Call detection is the most common method used to locate this species but only males elicit the recognisable advertisement call. Red-crowned Toadlets may call during both the day and night and in any month of the year. However most calling occurs during the late afternoon and early evening and most often just after periods of heavy rainfall. Highest activity occurs after thunderstorms in Summer but the species is regularly heard calling between late August to April under appropriate weather conditions. Ambient temperatures recorded during calling range from 5°C to 30°C, but 17°C to 25°C are more usual conditions.

The call of the Red-crowned Toadlet varies depending upon the prevailing weather conditions. Where possible, it is always preferable to follow a frog call to its source to verify the species identity. The call of this species may be mistaken for other species therefore caution should be observed in interpreting survey works which have identified this species on the basis of call only. It is important that field biologists should be able to accurately discriminate between the call of the Red-crowned Toadlet and those of *Pseudophryne coriacea*, *Pseudophryne bibronii*, *Uperoleia fusca*, *Uperoleia laevigata*, and even *Crinia signifera*. Call misidentification may result in a false record of the Red-crowned Toadlet's presence in an area, or even the species' exclusion from survey results because it was believed to be one of these other more common species. It is known that Red-crowned Toadlets will call in response to unusual noises such as a loud retort, and such a technique has enabled some survey workers to detect or locate individuals that are otherwise reluctant to call. However this technique is not always successful and may sometimes actually cause call suppression. The failure of individuals to respond to such a survey method should NOT be taken as a 'proof' of absence. The use of tape-recorded calls of this species to elicit a response call (known as the call-playback technique) has some value for survey, but at times may also

have the reverse effect of silencing individuals. This may be a consequence of call differences between populations or the volume and quality of the recording. Survey techniques should not rely solely on call-playback to detect this species.

Tadpole searches are also a useful method of detecting the species. The near-ridgetop ephemeral breeding locations are rarely utilised by other species, and the uniform dark colouration and small size readily distinguishes Red-crowned Toadlets from the only other similar sized but variably mottled tadpoles of *Crinia signifera*.

Pit-trapping has been employed but has limited success and only during ideal weather conditions. Pit-trapping on an adequate scale in the rugged sandstone habitat of this species is often extremely difficult or even impossible due to the shallow soils. It can also seriously disturb a site and trap many other non-target organisms. Pitfall trapping is not considered a preferred method and the technique should only be employed after careful consideration and exhaustion of other methods.

Active searching involves the turning of exfoliated sandstone rocks and other ground cover along ridges and the upper talus slope, as well as raking amongst moist leaf litter accumulations along non-perennial feeder stream beds and at the bases of trees. These techniques should be carried out with care as such locations are fragile and likely to be critically important to the species' survival in an area. When examining accumulated leaf-litter the material should be raked back into its original position, following examination, to ensure moisture is retained. When checking sandstone rocks, these may be easily damaged or broken especially when wet, and should be carefully replaced so as to minimise disturbance of microhabitats. They are the products of thousands of years of weathering and therefore will not be replaced quickly if damaged.

Based on the above information it is recommended that surveys for this species should commence with an aural survey to detect any calling males during several nights of suitable weather conditions. An initial inspection of a nearby reference site where the species is known to occur will improve the reliability and likely success of aural surveys. Any calls should be traced to their source for positive identification as the calls can be confused with those of a few other species (see above). In the absence of calls or where calling is intermittent call playback and 'loud retort' methods may be successful in

eliciting a response, but not always. Surveys for the species when call detection is not successful should include active searching of microhabitat features such as beneath rocks, logs and amongst leaf litter. Pools of water in any suitable drainage lines in the vicinity should also be inspected for tadpoles of the species. Survey effort should be commensurate with the area of habitat present.

Life Cycle of the Species

The ecology of the Red-crowned Toadlet is summarised in the threatened species information profile and the references listed therein.

The Red-crowned Toadlets specialised terrestrial reproductive strategy and reliance on ephemeral water flow means that it may be particularly vulnerable to a range of activities that impact on hydrology or water quality.

Development adjacent or near Red-crowned Toadlet habitat should assess impacts of runoff, pollution and changes in pH. Red-crowned Toadlets are sensitive to changes in pH outside of the range 5.5 to 6.5. Red-crowned Toadlets have not been recorded breeding in sites that are even mildly polluted nor in permanently flowing watercourses.

Most of this species' life is spent under some form of cover, such as rocks, deep leaf-litter, or in rock crevices. It is known that sandstone exfoliations or 'bushrocks' are particularly important to this species, so activities that impact on this microhabitat have the potential to affect this species. Similarly, their utilisation of the ground litter layer may result in them being significantly affected by fire and other activities that cause the destruction of the leaf litter layer.

Red-crowned Toadlets are usually found as small colonies scattered along ridges coinciding with the positions of suitable refuges such as drainage lines or other breeding sites. Due to this tendency for discrete populations to concentrate at particular sites, a relatively small localised disturbance may have a significant impact on a population if it occurs on a favoured breeding or refuge site.

Threatening Processes

Schedule 3 of the Threatened Species Conservation Act 1995 lists bushrock removal and high frequency fire as key threatening processes that affect the Red-crowned Toadlet.

The past and continuing illegal collection of exfoliated sandstone rocks from the habitat of this species appears to have had a destructive impact. Habitat that has lost this resource is ecologically disrupted through the reduction

of shelter sites and food supply for many species, including the Red-crowned Toadlet. Another factor that appears to significantly impact on this species' habitat is fire. There is a growing body of anecdotal evidence that suggests the intensity and frequency of bushfires plays a significant role in the modification of Red-crowned Toadlet habitat. The observation has been made that Red-crowned Toadlets appear less abundant in habitats affected by wildfire or regularly exposed to hazard-reduction burns. Thumm (1997) has suggested that Red-crowned Toadlet habitat should not be subjected to planned fire frequencies of greater than once in a 10 year cycle. However an appropriate scientifically-based fire regime for this species' habitat has yet to be determined.

Other factors that may threaten populations of the Red-crowned Toadlet include habitat loss and changes to water quality and flow rates. Such impacts may be result from urban development along sandstone ridges. These impacts may directly threaten Red-crowned Toadlets due to habitat destruction or indirectly, via pollution or siltation of watercourses and alterations to the local hydrological regime. Ridge-tops, although less suitable for breeding, may be used as important foraging habitat, so activities that disturb these areas may have consequences for the species in nearby relatively undisturbed habitat.

Viable Local Population of the Species

All existing colonies of the Red-crowned Toadlet that provide indications of successful reproduction and recruitment of new members into the population must be regarded as viable. The presence of calling individuals, gravid females, deposited eggs and larvae strongly supports the presumption that a site has resources available to the species to support a viable local population. The viability of any local population of this species is likely to be compromised by the above threatening processes if they result in a decrease in the quality of breeding and/or foraging habitat.

Additionally, protection of habitat surrounding these viable local populations is also likely to be essential as connectivity between different colonies allows gene flow between them.

A Significant Area of Habitat

It is difficult to determine the significance of an area of habitat for the Red-crowned Toadlet. Population size in defined areas of habitat and their natural fluctuations have not been determined. Nor has the range over which the species moves been established.

It is important that investigations establish which population or 'evolutionary significant unit' occupies a given area of habitat. Indications from preliminary genetic studies and morphology suggest that there may be three or more separate evolutionary units. On a precautionary basis, and until such time as more definitive and 'whole of distribution' data is available, the Central Coast, southern Sydney and Blue Mountains populations should be considered independently. North western and southern extremities of its range have not been included in studies to date. Other considerations in determining the significance of an area of habitat should include the spatial extent, quality and disturbance history of the habitat present.

Isolation/Fragmentation

The Red-crowned Toadlet presently survives across its entire range as a number of apparently isolated populations since the end of the last glacial period. Its current distribution pattern suggests that it has naturally contracted to a post-glacial montane refuge situation. Given the species' ancient evolutionary history as derived from molecular data (Glasby et al, 1993) and the known climatic history of the region, it is likely that the Red-crowned Toadlet has expanded and contracted in range many times in its existence. Thus, expansion of the species' range during future climatic change could be compromised by the loss of any of its existing populations and habitat.

Additionally, some populations are becoming increasingly fragmented due to various human-induced changes such as roads, urban development and other activities that destroy parts of their habitat within a particular area. The further fragmentation of already naturally restricted areas of habitat may have unforeseen consequences for the survival and evolutionary potential of the species in the long term.

Regional Distribution of the Habitat

The TSC Act defines region as the regions defined in the Interim Biogeographic Regionalisation of Australia. The known distribution of the Red-crowned Toadlet is confined to the Sydney Basin and north east margin of the South Eastern Highlands regions.

Limit of Known Distribution

The species has been recorded within an area bounded by Pokolbin State Forest and Wollemi National Park in the north, the Nowra district in the South and Mt Victoria in the west. The species could potentially occur over a wider area than the currently recorded distribution suggests, as its

predicted habitat extends beyond these known limits. Further survey of potential habitat may therefore identify additional populations and range extensions.

Adequacy of Representation in Conservation Reserves of other similar Protected Areas

Although the species is protected in a number of conservation reserves, it is not presently known whether the genetic variation of the species is adequately reserved. Genetic studies currently underway have revealed significant genetic variation between the populations so far tested (A. Stauber pers.comm.). Based on current information no area stands out as having greater or lesser conservation significance but this situation may change as new genetic information becomes available on the degree of differentiation and the clarification of evolutionary significant units.

Similarly, there is little understanding of population sizes, normal fluctuation trends and habitat carrying capacity across the various portions of the species range.

Until this information becomes available it is not possible to make an informed decision of the adequacy of the species conservation within the reserve system.

Populations of this species are currently reserved in Blue Mountains, Bouddi, Brisbane Water, Dharug, Garigal, Heathcote, Ku-ring-Gai Chase, Lane Cove, Marramarra, Morton, Popran, Royal, Sydney Harbour, Wollemi & Yengo NPs; Barren Grounds, Muogamarra, & Nattai NRs; Bargo, Dharawal & Parr SRAs. Additionally, although not set aside primarily for conservation purposes, the species is also afforded some conservation benefit via its occurrence in a number of State Forests, Water Catchment areas and Department of Defence lands (Holsworthy) within the Sydney Basin.

Critical Habitat

Critical habitat cannot be declared for the Red-crowned Toadlet as it is not listed on schedule 1 of the TSC Act. Therefore, this issue does not need to be considered.

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