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# Male Calling Sites in Two Species of Australian Toadlets (Anura: Myobatrachidae: *Uperoleia*) at Two Ponds in New South Wales

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## Introduction

"Toadlets" of the myobatrachid genus *Uperoleia* are commonly encountered calling around ponds located in southeastern Australia. Usually one species only is present at any given pond, but two species occasionally can be calling around the same site. The Smooth Toadlet (*Uperoleia laevigata*) and the Dusky Toadlet (*U. fusca*) call at the same time on the same nights around two ponds on the central coast of New South Wales, Australia, and observations suggest that the males call in relatively discrete groups that differ to at least some degree in location. The two species are closely related (Tyler et al. 1981), the advertisement calls of the two species are similar (Barker et al. 1995, Cogger 2000), and they possess similar calling seasons and preferred breeding sites (Barker et al. 1995, Cogger 2000, Anstis 2002). Under such circumstances the two species may be expected to show differences in their call site selection (Littlejohn and Martin 1969) that will assist in distinguishing the males of the two species by females moving to the pond to breed.

A calling male *Uperoleia fusca.*

We collected data on the calling positions of the males of each species to determine if the males were selecting different calling areas or types of calling sites. We compared locations of calling males relative to the ponds and also microhabitat information associated with the calling positions to determine what features the males of each species might be selecting for a calling site and how much they differ — if at all.

## Methods

The study site consists of two adjacent ponds (within 5 m) that are located approximately 15 km northwest of Kulnura on the central coast of NSW, around 120 km north of Sydney (33° 07' 58.9" S, 151° 12' 22.6" E). Both ponds have been present since at least the late 1970s and are roughly circular in shape. The smaller pond is approximately 10 m in diameter and 0.3 m deep, and the larger 14 m in diameter and 0.9 m deep (depths vary with rainfall).

A calling male *Uperoleia laevigata.*

Native vegetation in the surrounding area consists of dry open woodland dominated by Smooth-barked Apple (*Angophora costata*), Red Bloodwood (*Corymbia gummifera*), and Stringybarks (*Eucalyptus oblonga*), with a sclerophyllous understory (Forestry Commission 1989). Approximately 25% of the surrounding land has been cleared for grazing by livestock.

We collected data on calling males on the night of 20 February 2006, locating males of both species by their calls from 2000–2300 h. Locations of males were marked with a bamboo skewer color-coded for each species. We returned to the pond during daylight hours and obtained a digital photograph from a height of one meter of each calling site, with the skewer in place. We recorded the following attributes of each calling site, either at the time of taking the photograph or from the photograph: (1) Distance from the edge of the water to the calling site (in meters), (2) percentage bare ground (rock or soil) within a 10-cm radius of the call site (as opposed to being covered with leaf litter or vegetation), and (3) percentage shading of the calling site within a 10-cm radius of the call site. This measure provides an indication of the level of cover afforded to the calling male.

Each category of data was inspected visually to determine if it was normally distributed. This was the case for distance from the pond. Percentage of bare ground and percentage of cover were arcsine transformed to meet test assumptions. We used t-tests in Microsoft Excel 2007 to compare the measurements made for the two species using $P < 0.05$ as the accepted level of significance.

## Results

We collected data for 19 calling males of *U. fusca* and 16 calling males of *U. laevigata* (Table 1). Comparisons of the data from the call sites of the males indicated that the distance of the calling sites from the edge of a pond was significantly greater for *U. laevigata* than for *U. fusca* ($t = 7.39$; $df = 33$; $P < 0.001$). The percentage of bare ground was greater around the calling sites of *U. laevigata* than at those of *U. fusca* ($t = 4.14$; $P < 0.001$).

**Table 1.** Mean (± one standard deviation) and range of habitat variables at syntopic calling sites for males of *Uperoleia fusca* and *U. laevigata.*

| | Species | |
|---|---|---|
| Variable | ***Uperoleia fusca* (n = 19)** Mean (range) | ***Uperoleia laevigata* (n = 16)** Mean (range) |
| **Shading** | 18 ± 24.7% (0–90%) | 9 ± 22.7% (0–100%) |
| **Bare Ground** | 9 ± 16.1% (0–70%) | 39 ± 26.4% (0–84%) |
| **Distance to Pond** | 2.1 ± 2.9 m (0.0–8.9 m) | 10.9 ± 4.1 m (1.9–18.2 m) |

View of the study ponds (left). Males of *Uperoleia fusca* generally call in the vegetation around the edges of the ponds, whereas male *U. laevigata* tend to call on or next to the road on the left hand side of the image. On the right is the larger of the two adjacent ponds showing the areas of vegetation on the banks as well as areas of bare bank from which the males call.

The mean percentage of cover above the calling sites was greater for *U. fusca* males than *U. laevigata,* but the difference was not statistically significant ($t = 1.62$; $P > 0.10$), although this result might have been influenced by one male *U. laevigata* that called from under 100% cover. A number of *U. laevigata* males were observed calling on patches of bare sand, whereas *U. fusca* males almost always chose locations where they rested on leaf litter or vegetation. *Uperoleia fusca* males generally called from under some form of vegetation, but also called from positions partially concealed by rocks or deadfall.

## Discussion

The males of the two species do appear to have slightly different preferences in calling site location. Male *U. fusca* call significantly closer to the edge of the pond than do male *U. laevigata.* They also prefer sites afforded protection by some cover above the calling site, whereas male *U. laevigata* often call from exposed positions.

The preferred calling distance from the pond may provide a simple means of separating the two species at a common calling site. Both species call consistently on the same nights of the year, often in combined choruses of more than 40 males and sometimes over 150 males (F.L. Lemckert, unpubl. data). At the time of maximum calling activity, a syntopic chorus is very complex and noisy, and a spatial separation of the males of the two species would likely be of considerable assistance to females attempting to locate conspecific males.

*Uperoleia fusca* males were more likely to call from positions that were at least partially obscured by vegetation. We noted that the densest vegetation cover was close to the pond and the most open areas were farther from the pond. Hence, the relative location of the habitats that provide the preferred calling sites for the males may be enough to allow for the observed separation of the two species.

The separation of sites might also be a response to calling competition, as predicted by Littlejohn and Martin (1969). They predicted that males, in the presence of acoustic competition, would change their calling sites or patterns to reduce this competition and avoid heterospecific matings. Determining the characteristics of chosen calling sites at ponds where males of only one of the two species call would indicate if the males have different preferred calling locations in the absence of the other species. If no change in behavior is evident, then data could be collected on the spatial structure of suitable ground cover to test if the difference in structural elements influences the choice of calling site or whether the selection of a calling site is simply a function of distance from the edge of the pond.

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Amplexus in *Uperoleia fusca.*