

Long-range movement in the rare Cooloola sedgefrog *Litoria cooloolensis*

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Understanding habitat usage is essential for the proper management of rare and threatened species in the wild. However, current knowledge of habitat usage by many rare and threatened Australian frog species is inadequate in this regard. Knowledge of non-breeding habitat usage in Australian amphibian species is particularly poor (Hines *et al.* 1999), with current understanding of the habitat requirements of many species based largely on habitat usage by calling animals during the breeding season, when frogs are more readily detectable. However, like other fauna, the use of different habitats by amphibians can vary daily and seasonally as well as between different sexes and life stages (Law and Dickman 1998). Female frogs, for example, are likely to occupy habitat further away from a breeding water body while males tend to stay near the breeding site (Bartelt *et al.* 2004; Johnson *et al.* 2007; Rittenhouse and Semlitsch 2007). A majority of aquatic breeding amphibians will also undergo embryonic and larval development within the aquatic environment while spending their adult and juvenile lives in the terrestrial environment. Unlike developing larvae, post-metamorphic adult and juvenile amphibians are not restricted to the aquatic body of their birth (Johnson *et al.* 2007) and thus have the ability to disperse or migrate into adjacent, non-breeding, areas for the purposes of foraging, overwintering (Regosin *et al.* 2003) or refuge use (Semlitsch and Bodie 2003).

The Cooloola sedgefrog (*Litoria cooloolensis*) is a rare, largely arboreal species restricted to coastal wallum (i.e., coastal sand dunes and plains) in south-east Queensland. Though known to occur 'some distance' away from breeding habitat within the terrestrial landscape (Meyer *et al.* 2006), details of non-breeding habitat usage in this species (e.g., the type of habitat utilized by non-breeding animals and movement distances from areas of breeding habitat) remain poorly documented. Herein, we present detailed observational records of *L. cooloolensis* from non-breeding areas in wallum habitat, thus providing additional insight into non-breeding habitat usage by this species.

On a summer's night in late January-early February 1999, upwards of 50 *L. cooloolensis* were heard calling from trees along a walking track through rainforest near Lake Poona, within the Cooloola section of the Great Sandy Region National Park, south east Queensland. The majority of animals heard calling at this time appeared to be calling high up in the forest canopy, producing the

same loud 'kik' call as that made by male *L. cooloolensis* heard calling later at Lake Poona and elsewhere (EM, pers. obs.; Naturesound, 1998). While most animals were heard calling from forest habitat close to Lake Poona (i.e., within 100 metres of suitable breeding habitat), between 30-50 animals were heard calling much further (> 300 m) from water. This includes 5-10 animals heard calling from rainforest at Bymien Picnic Area (-25.9544° / 153.1045°) approximately 900 m from Lake Poona, the nearest known breeding site for this species. On the same night, numerous *L. cooloolensis* (upwards of 200 animals) were heard and/or seen calling from vegetation fringing at Lake Poona (-25.9637° / 153.1104°). Male calling activity within forest habitat surrounding Lake Poona, including rainforest at Bymien Picnic Area, continued well past midnight.

Small numbers of *L. cooloolensis* (between 10 and 20 animals) were again heard calling from rainforest along the same walking track to Lake Poona on the evening of January 29, 2000. As before, animals were heard calling from Bymien Picnic Area at the start of the walking track to Lake Poona, 900 m from the lake itself. Large numbers of *L. cooloolensis* (upwards of 200 animals) were again heard and/or seen calling at Lake Poona. Male calling activity within forest habitat away from Lake Poona (as far away as Bymien Picnic Area) continued through to dawn.

Diurnal calling of *L. cooloolensis* was also opportunistically recorded in the southern Cooloola section of the Great Sandy Region National Park (-26.2389° / 153.0684°) on the 29th April, 9th July and the 13th July of 2010 in open *Eucalyptus* forest trees at an elevation of approximately 95 metres above sea level. The calls made by animals at this time were the same as described above. In contrast with the above observations, calling activity was short-lived, lasting no longer than 30 seconds. The maximum number of calling individuals at this site was two (recorded on the 29th April 2010). The nearest known breeding habitat for *L. cooloolensis* is a wetland/coastal swamp located approximately 1.3 kilometres from the location of the calling individuals (-26.2351° / 153.0556°). No other suitable breeding habitat was located near this site during surveys conducted along a 5km east-west transect or on examination of Google Earth satellite images.

The presence of *L. cooloolensis* up to 1.3 kilometres from suitable breeding habitat demonstrates this species is capable of moving widely across forested terrain. The large numbers of animals heard calling from rainforest

near Lake Poona, moreover, suggests forest surrounding breeding areas can, at times, support large numbers of this rare species. The loss or degradation of forest habitat in wallum areas occupied by *L. cooloolensis* (e.g., as a result of intense wildfire) may therefore have a significant impact on numbers of this species and, potentially, the ability of animals to move within the broader landscape.

The ability of *L. cooloolensis* to move large distances is a trait shared with the closely-related common sedgefrog (*Litoria fallax*), a species often encountered in dry eucalypt forest hundreds of metres from suitable breeding habitat (CAS, EM, J-MH pers. obs.). Like *L. cooloolensis*, *L. fallax* can often be heard calling from the canopy of forest trees, occasionally on dry ridges many hundreds of metres from water (EM pers. obs.). Why these small, diminutive (SVL <45 mm) frogs should travel so widely is presently unclear. In the case of *L. cooloolensis*, movement of animals away from breeding areas could occur in response to: (1) increased competition amongst males at breeding sites during times of heightened calling activity; or (2) limited availability of food in breeding areas (due to increased competition with congeners at breeding sites during peaks in breeding activity). As well as helping animals avoid competition, large scale movements of *L. cooloolensis* could potentially promote

gene flow between isolated populations, as well as facilitate establishment of new breeding populations (Krebs 2009). Further data on competition, movement and gene flow in *L. cooloolensis* are needed to determine which, if any, of these scenarios is correct.

Though male frogs may call for a number of reasons, most call either to attract a mate (i.e., for breeding purposes) or to advertise their presence to other males (i.e., for territorial purposes) (Zug *et al.* 2001; Wells 2007). In the case of *L. cooloolensis*, calling at distance from breeding sites is unlikely to facilitate breeding, as females mating with males remote from areas of breeding habitat would have to move many hundreds of metres in order to spawn. Observations of more than one calling *L. cooloolensis* in the described areas suggests observed calling activity away from breeding sites could instead be a territorial response towards other male *L. cooloolensis* in the area. Whether this calling behavior represents practiced territorial calling in response to calling by conspecific males or calling for some other purpose (e.g., defence or delineation of foraging territories) (see e.g., Ryan 2001) is presently unclear as visual observations of calling individuals, remote from breeding areas, were not made. More detailed study of the calling and social behavior of this species are needed to ascertain the functional significance of calling by animals in non-breeding habitat.

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