

## IN212: Demography and influence of hunting on the giant stream frogs on Buton Island, Indonesia

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Amphibians are considered to be one of the most threatened animal groups globally, having suffered unprecedented rates of decline in recent decades (Stuart et al., 2004). In addition to habitat loss, a range of other factors are also responsible for amphibian declines around the world, including emergent disease (Berger et al 1998), climate change (Sohdi et al 2008), invasive predators and competitors (Blaustein and Kiesecker 2002; Collins and Storfor 2003), chemical pollutants (Sparling et al. 2001) and over harvesting for human consumption (Warkentin et al 2009). In many parts of the world, especially Southeast Asian, the impacts of these threatening processes on amphibians, and how they may interact, are poorly known (Laurence and Useche 2009).

Southeast Asia is a global hotspot for amphibians (Rowley et al. 2010). Amphibian diversity reaches its peak in tropical forests; this factor combined with the complex biogeographical history and extensive mountainous island archipelagos of the equatorial regions of Southeast Asia, has led to high levels of speciation and endemism (e.g. Setiadi et al. 2011). However, in contrast to the neotropics (Central and South America) and Australia, where many declines have been documented, the amphibian fauna of tropical Southeast Asia remains poorly studied. Little is known about the basic ecology of most species and new species are being discovered all the time (e.g. Setiadi et al. 2011). For example, we recently discovered a new species of tree frog at several of our study sites on Buton Island, Sulawesi, and several other species present are yet to be formally described. For many species, so little is known that it has not yet been possible to confidently assess their conservation status (see IUCN Redlist for Threatened Species: <http://www.iucnredlist.org/>).

Whilst habitat loss and alteration is probably the biggest threat to Southeast Asia's amphibian biodiversity (Wanger et al. 2010, Sodhi et al. 2010), all other threatening process listed above are operating in the region as well. Unlike the neotropics and wet tropics of Australia, the amphibian chytrid fungus does not yet appear to be a major threat in the region; however, other threatening processes are also operating in Southeast Asian that may compound the problem of habitat loss for some species. Southeast Asia is a big exporter of amphibians, mostly for food but also for the pet trade (Schlaepfer et al. 2005; Warkentin et al 2009). Although recognised as a threat to amphibian species and a possible contributing factor to the declines of some species, very little has actually been documented on the actual demographic impact of harvesting on any populations of any species (Schlaepfer et al. 2005). Information is urgently required on this topic so that more informed assessments of its significance as a threat can be made.

To date, 13 species of frog have been documented on Buton Island, Sulawesi. Several of these species remain undescribed and the ecology of most of them is poorly known (Gillespie et al 2003). Despite the low species richness, the frogs of Buton comprise a number of unusual species, including one of the world's smallest species and one of the largest. The Buton giant stream frog (*Limnonectes* species)

attains a size of over 20 cm and over 900 gm. It is part of a complex of 'fanged frogs' that occurs throughout Sulawesi and the Philippines (Setiadi et al. 2011). This is an interesting Asian genus, which includes species with reversed sexual dimorphism (larger males; unusual in frogs); viviparity (Iskandar and Tjan 1996); nest attendance (Brown and Iskandar 2000); male territoriality, fangs, and combat (Emerson 1992; Orlov 1997; Tsuji and Lue 1998); and purported male voicelessness (Emerson 1992).

Unlike most frogs, the Buton giant stream frog appears to have very few natural predators, since Sulawesi simply has very few predators (e.g. frog-eating snakes, birds and mammals) that are large enough to tackle adults of this species. The only vertebrate predator potentially capable of eating adults in its natural environment is the Malay Civet (*Viverra zibetha*). In addition to natural predators though, the species is hunted for human consumption. Frogs are readily consumed in Indonesia and many rural people or those working in forest environments may supplement their protein intake by hunting frogs. There is also large scale commercial harvesting in some parts of Indonesia. Anecdotally we know that hunting of giant stream frogs occurs on Buton Island, but we do not know what impact it is actually having on frog populations; are they coping with this hunting pressure or declining? Previous research on Buton indicates that large frogs in populations subjected to strong hunting pressure are more wary of people than at more remote sites where hunting pressure is presumed to be lower or non-existent. However it is very difficult to evaluate hunting pressure because hunting is rarely observed and it is not possible to see how many frogs are hunted in any given time period. Furthermore, local people are not inclined to talk in any detail about their hunting activities, or indeed may deny that they hunt frogs at all.

We aim to get more robust data on the population ecology of this species at disturbed and undisturbed population sites in order to evaluate the impact of hunting. In addition we are collecting information on the ecology and reproductive biology of this species. Monitoring transects 1 km in length have been established along streams supporting populations of the giant stream frog near the research centre of Labundo Bundo and the Lapago, Anoa and Bala node camps. Populations will be censused at each site, using mark-recapture techniques. Life history, behaviour and microhabitat associations will also be measured. Each site will be sampled on consecutive nights for 4-5 days. Spatial and temporal variation in population density, key life history traits, and behaviour will be compared between sites and across years.

As part of the above study, dissertation students will assist scientists collecting data at each node camp and in the vicinity of Labundo Bundo. This project involves walking in forest streams along transects at night, looking for and trying to catch frogs with the aid of a headtorch. Each week or so the team will move to a different stream at a different node camp. There are several options for developing a dissertation with this project:

The population and morphometric data can be used to generate population density estimates and size structures for each site, and examine whether or not these change amongst streams with respect to human access and therefore potential hunting pressure.

Habitat associations can be examined; comparing microhabitat preferences of males, females and juveniles amongst streams with different habitats or different levels of human access, in order to see what environmental factors are influencing microhabitat associations.

We are having difficulty sexing this species. We suspect that males are large than females, which is very unusual for frogs (Wells 2007). Other members of this genus exhibit sexual dimorphism in the size of their fangs. A project could examine the variation in fang size of frogs in relation to other morphometric measurements and observed behaviour in order to elucidate which characteristics are most diagnostic of sex.

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