

## IN213: Demography and influence of hunting on stream-breeding frogs on Buton Island, Indonesia

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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. The Wallacea Flying Frog *Rhacophorus georgii*, listed by the IUCN as Data Deficient, was rediscovered by Operation Wallacea Scientists in the Lambungsango Reserve after nearly 100 years of complete absence. 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/>).

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 Asia, the impacts of these threatening processes on amphibians, and how they may interact, are poorly known (Laurence and Useche 2009). 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 (see Swee et al. 2011); however, other threatening processes are also operating in Southeast Asian that may compound the problem of habitat loss for some species.

Three species of Sulawesi endemic tree frogs (Family Rhacophoridae) are found on Buton Island but almost no information exists on their ecology or conservation status. The Lambusango Reserve represents a high proportion of the total distribution and population extent of these species, especially the Wallacea Flying Frog, and the newly discovered Yellow Flying Frog (*Rhacophorus* sp. new), for which Lambusango contains the only known populations (IUCN 2008; Gillespie & Ul-Hasanah pers. com.). Although more widespread in Sulawesi, the Loka Flying Frog (*Rhacophorus* cf. *monticola*) has probably suffered some population declines and is currently listed as Near threatened by the IUCN. This species is locally abundant in the Lambusango Reserve; however the taxonomy of this species is poorly resolved and the population on Buton Island may be a distinct and locally endemic species as well. We have previously observed predation of egg masses of these species by the larvae (maggots) of a calliphorid fly species. Previous surveys indicate up to 60% of all Loka Flying Frog egg masses are predated by maggots! How do populations persist with such high predation rates? Egg predation by similar fly larvae has been observed in other rhacophorid frogs species elsewhere in Southeast Asia (Yorke 1983; Lin et al. 2000). The results of a study in peninsular Malaysia suggest that forest loss or disturbance may

be exacerbating the effects of predation of rhacophorid frog embryos by predaceous fly larvae. Indirect effects of forest loss or disturbance, such as this, have been documented elsewhere such as new road construction allowing invasive species, such as the cane toad in Australia (Seabrook and Dettmann, 1996), to colonize new areas where they prey on native species. Such examples suggest that even if populations

The overall goal of this project is to contribute to a greater understanding of threats operating in Lambusango Reserve upon these frog species, and to improve our understanding of their conservation needs. Specifically we aim to gain more information on the demographic impact of fly larvae predation on populations of these species, and how this is affected by habitat characteristics, in particular the effects of human disturbance to forest. We have established a monitoring program for these species; this project will contribute to the annual monitoring of population status of these species in the Lambusango Reserve. In addition we are collecting information on the ecology and reproductive biology of this species.

Transects have been established along streams supporting populations of these frog species near the research centre of Labundo Bundo and the Lapago, Anoa and Bala node camps. Frog populations will be studied at each site. Number of each species will be counted, breeding activity will be monitored, and microhabitat associations will also be measured. Fly activity and egg predation will also carefully measured at each site. Spatial and temporal variation in population density, fly activity, predation rates and habitat characteristics 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 and during the day, counting frogs, looking for egg nests and measuring a range of forest and stream habitat characteristics. 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:

How do frog population densities vary with relation to habitat characteristics and what can be inferred from this with respect to direct impact of human disturbance?

How do egg nest predation rates vary with respect to fly relative population density and stream habitat characteristics.

What factors (such as climatic variables) influence the breeding activity of each frog species, and fly activity?

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