ESSAY 7.3. PHILIPPINE AMPHIBIAN SPECIES DIVERSITY IS INCREASING BY LEAPS AND BOUNDS

The discovery and description of the diversity of Philippine amphibians began with early European and American professional naturalists who made ancillary collections of amphibian specimens and returned these to museums in their native countries. Descriptions of these specimens were later prepared by early herperslogists such as Dummer, Blyth, Peters, Boettger, Boulenger, Günther, Martens, Wietsz, and Stejneger, among others. The first published descriptions of endemic Philippine species were soon followed by discoveries of strange and unique species that captured the attention and curiosity of biologists around the world.

Looking back at students of the history of herpetology in the Philippines, it is convenient now for us to think of five separate chapters in the story of Philippine herpetological diversity (Brown et al. 2002). These include the initial period of exploration described above, followed by the work of Edward Taylor (1913-1975). We think of Taylor as the “father” of Philippine herpetology because his work involved multiple detailed monographs, results in descriptions, and of so many of the truly spectacular Philippine amphibians and a first appreciation of the staggering magnitude of herpetological diversity in the archipelago. The third phase was marked by the work of Robert Fitch and the publication of his monograph “Systematics and zoogeography of Philippine Amphibia” (1954). Fitch’s comprehensive review of Philippine amphibians marks a turning point in the history of herpetology in the country because of his systematic application of an explicitly stated species concept, statistical treatment of natural variation, and other advances. The fourth stage of Philippine herpetology includes the coverage and publication of the Atlas Alcala and the late Walter Brown (1958-2000). This body of work included numerous comprehensive taxonomic reviews, new species descriptions, and a variety of the first ecological and developmental studies in Philippine herpetology. Finally, we consider the present day, an ongoing effort to review the amphibians and reptiles of the Philippines from the present day, a five-phase development of the story of the herpetofauna of the country. An examination of species accumulation over these five periods (Figure 1) provides us with an appreciation of the magnitude of taxonomic contributions from each of these five distinct periods in Philippine herpetology.

In 1993, the discovery of a new species of forest frog in the genus Platymantis from the marshy forests of Panay Island in central Philippines triggered a major reconsideration of species boundaries within this group. The new species (P. panayensis) differs from an adjacent population (P. hamata) on nearby Negros Island by visible differences in morphological proportions, slight differences in coloration, and by its distinctly male advertisement call (Brown et al. 1997). The realization that closely related species may differ primarily by advertisement call was a first step in the use of acoustic signal patterns in amphibian systematics. In 1999, we undertook a comprehensive assessment of the acoustic diversity of Philippine forest frogs along with a thorough re-evaluation of the species diversity in the Philippine members of the genus Platymantis. The other major advance in improving our understanding of species diversity in the Philippines has been the application of molecular phylogenetic approaches (Brown and Guttman 2002; Evans et al. 2003; Brown 2004) to new collections of genetic samples of amphibian species from a robust geographic coverage throughout the major landmasses of the Philippines. The combination of these new tools has provided new insights into species boundaries and helped uncover the presence of numerous cryptic species that have been unsolved for so many decades. Initial results of this ongoing work fortify our understanding of the degree to which biodiversity in Philippine Amphibia has been grossly underestimated by traditional, primarily morphometric-taxonomic taxonomic practices (Figure 2). The result is a new appreciation of biodiversity that provides a fuller, more balanced, and biologically meaningful appreciation of the complex interactions of characteristics that have surfaced as most meaningful for the process of lineage differentiation in Philippine amphibians (Figure 2).

Our current understanding of amphibian species diversity in the Philippines stands at 97 indigenous species (Brown et al. 2002; Diessens et al. 2002). However, species descriptions of new frogs of the genus Platymantis currently in progress will soon increase number to around 130 taxa. And, if work on other undescribed species of frogs of other genera that we are aware of were to be completed, the total number would eventually reach at least 150 species. It would not be unlikely to find another species of Platymantis in the Philippines or another species of termite-eating tree frogs from the genus Philautus in the next two decades.

The irony of the astonishing rates of species discovery, even as so many species are declining (Hopkins 1999; Stuart et al. 2004; Kohler et al. 2003), coupled with the devastating loss of forested habitat in the Philippines, convinces us that no higher conservation urgency in the world exists than that of the megadiverse Philippine global biodiversity hotspot (Myers et al. 2000, Carino-Singh and Hume 2008). With so few trained workers actively working to discover and describe new species of Philippine amphibians, we are left with doubts about whether we can survey and characterize the Philippine amphibian biodiversity within the timeframe of our own careers. Consequently, there can be no greater priority than training new students in amphibian field studies and doing everything possible to overcome logistical and bureaucratic obstacles to field work while at the same time investing in collections and related repositories. It is through the building of natural history collection resources (including digital photographic videos, sound libraries, and genetic collection resources) that will enable tomorrow’s generation of biologists the opportunity to reassess our work in light of technological advances of the future. Coupled with constant and regular conservation status assessments, we are convinced that these efforts provide the best chances for preventing impending catastrophic amphibian extinctions that loom on the horizon if we fail to take action now (Lips et al. 2003; Soll et al. 2004, Stuart et al. 2004).

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Figure 1. Species accumulation curve for Philippine amphibians, including endemic (circles) and non-endemic (squares) species. Estimates of numbers of new species awaiting description are based on a combination of morphological, behavioural, and ecological character differences, with species’ distinctiveness confirmed by bioacoustics and molecular data.
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References


Figure 2. Representatives of the species complexes defined by Brown et al. (1997). A: anophthalmus of the Philinopsis dolius Complex (ground frogs); B: the Philinopsis nitidus Group (jump frogs); C: an enigmatic intermediate Philinopsis robusta (a terrestrial species, nested within the treefrog clade). All photos © Ryle Brown. 2006. Courtesy of HerpMatch Philippines.

ESSAY 7.4. AMPHIBIAN SPECIES DISCOVERY IN MAINLAND SOUTHEAST ASIA

The number of recognized amphibian species has risen dramatically over the past two decades (Hanken, 1993). Köhler et al. (2005) suggest that increasing amphibian species richness is due primarily to the discovery of "new" species or species groups that were previously unreported or understood. Like many other groups of animals, amphibians have been subject to an increased level of scientific investigation and exploration, and as a result, more species have been discovered and described in recent years.

The sociological nature of species discovery and description in the past has changed over time. Historically, scientists working on amphibians in the region tended to work alone or with very few colleagues. Today, the process of discovering and describing species in the region involves collaboration among scientists from within and outside of the region. For example, the average number of authors on species descriptions increased over time in years, with 1.0 in 1937, 1.7 in 1962, 2.0 in 1973, 3.2 in 2005, and 2.94 in 2009. The 2005-2006 boom in species descriptions of amphibians from mainland Southeast Asia is consistent with the trends in species discovery and description that have been observed across the region (Figure 1). Most strikingly, the years 2005 and 2006 (through the time of writing in early November) each yielded 10 new amphibian species, the highest number of annual descriptions from the region since the advent of Linnean classification. The descriptions of 2005-2006 came from every country in the region, suggesting that the "hotspot" boom is not explained by increased collecting in a localized "hotspot." Prior to the last few years, there have been three peaks of discovery in mainland Southeast Asia, with 1911 currently recognized species described in each of the years 1973, 1982, and 1983 (Figure 1). These peaks reflect the significant contributions of 11 new species from Vietnam by Boudriot (1937) and 14 new species from Guangxi Province, China, by Liu and Hu (1962), as well as the coincident discovery of species descriptions from China by several of the prominent Chinese amphibologists.

Every amphibian species described to date from mainland Southeast Asia has been distinguished from its closest relatives on the basis of morphological differences. However, a number of studies have used bioclimatic data (e.g., Graham and Wright 1997; Vosog et al. 2003) or molecular genetic data (e.g., Iwai et al. 2003; Shim et al. 2003) to either discover a new species, or corroborate the morphological distinctiveness of a new species. Every molecular genetic study to date that has broadly sampled populations across the range of a widespread frog species in mainland Southeast Asia has uncovered genetic diversity that has been interpreted as unrecognized species diversity (Stuart et al. 2004). These findings suggest that species diversity in the region remains significantly underestimated. Molecular genetic and bioclimatic tools are likely to play increasingly important roles in the process of discovering amphibian species diversity in the region.

The most striking examples of recent Southeast Asian amphibian species discoveries are found in the freshwater frogs of the genus Odanosoma. Of the 14 species of Odanosoma described from the region, 11 species have been described since 2002.

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