

## Neotropical Frog Biogeography: Paradigms and Problems<sup>1</sup>

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**SYNOPSIS.** The distributions and relationships of exemplary species groups of the Neotropical frog genera *Cycloramphus* and *Leptodactylus* are discussed in terms of current biogeographic models. From this exercise, the following conclusions emerge: (1) frog biogeography is and will remain primarily a correlative science; (2) both morphological and genetic data are required to choose among alternate biogeographic models; (3) frog speciation events significantly predate recent distributional events complicating the understanding of past and recent distributions; (4) both data and theory are inadequate to completely understand Neotropical frog biogeography at present.

### INTRODUCTION

The basic adaptations of a jumping morphology and amphibious life cycle suggest that frogs are a distinctive eco-evolutionary vertebrate unit wherever they occur. Thus, study of frog biogeography would be predicted to add an additional perspective to the total biogeographic picture for any area of consideration. Frogs are a major component of Neotropical ecosystems, especially in the wet lowlands and lower Andean slopes. Ideally, this paper would represent a synthesis based on the distributions and relationships of the almost one thousand species of frogs occurring in South America (Duellman, 1979). The available data base does not allow the luxury of having too much data to effectively manipulate, however.

The systematic knowledge of Neotropical frogs is just beyond the initial exploratory phase. Generally, names are available and can be associated for most Neotropical frog species. However, when

individual collections are identified or groups revised, the inadequacy of the systematic base is clear. For example, in a collection of 74 species of frogs from the Rio Madeira and Rio Purus, Brasil, 58 were confidently identified, seven were tentatively identified, two were described as new, and seven were unidentifiable and probably represented new species (Heyer, 1977). As another example, until recently the genus *Cycloramphus* from the Atlantic Forests of Brasil was thought to have 7-9 species (Lynch, 1971). In a revision in progress, 21 species are recognized (Heyer, 1982). Needless to say, we need to know what the evolutionary units (species) are before the relationships among them can be determined.

Biogeographical analyses also depend upon accurate distributional and ecological data. These data are partially available for most species of Neotropical frogs. Reasonably accurate distributions are available only for abundant species which have been recently revised based upon examination of all available museum materials, including materials from South American museums. A most fundamental piece of ecological data, the species habitat fidelity, is not available for most Neotropical frogs. Species habitat fidelities throughout the

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