

HM331 Landscape genetics of amphibian species in Honduras

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Amphibian populations are experiencing rapid declines across the globe with many species having already been driven to extinction. The major causes of these dramatic declines include habitat loss and degradation, environmental pollution, introduced invasive species and disease. Combating amphibian declines is at the forefront of the global conservation agenda, and protected areas are being designed and managed in order to best conserve amphibian diversity.

Within Honduras, Cusuco National Park is of particular conservation importance due to the high levels of biodiversity and endemic species that occur there. Amphibian diversity is especially high within Cusuco, with 6 species endemic to the park and a further 10 species listed as 'threatened' on the IUCN red list.

Amphibian surveys within the park have helped to identify the species present and the areas where they occur, however, the connectivity of these populations is relatively unknown. Altitudinal gradients may mean geographically close populations are actually relatively isolated from one another, whereas rivers and streams may facilitate geneflow between distant populations. Understanding gene flow between small, potentially isolated populations is of high importance for developing appropriate conservation management strategies for endangered species. It is also particularly interesting to identify connectivity between populations in order to investigate likely paths of transmission of disease.

Amphibian chytrid fungus (*Batrachochytrium dendrobatidis*) is an emerging infectious disease which is causing catastrophic amphibian population declines throughout Mesoamerica. Surveys conducted in 2007 and 2008 confirmed the presence of this pathogen within Cusuco National Park and through the examination of museum archived material collected in 1996 it has been proven that *B. dendrobatidis* has been present in Cusuco for at least 15 years.

A new field in population genetics, Landscape Genetics investigates population structure and connectivity in the context of barriers and facilitators within the environment. The detailed satellite imagery and habitat mapping which exists within Cusuco allows a particularly fine-grained analysis of gene flow among populations of species within the park. Also, the presence of a field genetics laboratory at the Cusuco Base Camp provides researchers with the necessary facilities to conduct population genetic studies in the field.

Inter-simple sequence repeats (ISSR) can be used as a relatively simple and inexpensive alternative to microsatellite genotyping in order to investigate population structure and geneflow between isolated or fragmented populations. ISSR uses the primers developed from two neighbouring microsatellite loci to amplify the region of DNA between the two microsatellites. Amplification of ISSR fragments is conducted by Polymerase Chain Reaction (PCR). ISSR-PCR products of different lengths are then separated using gel electrophoresis and the resulting bands used for DNA fingerprinting. The resulting data can then be analysed using a wealth of population genetic software packages to investigate population structure and geneflow and relate this to landscape features that may be influencing these parameters.

Students will collect DNA samples by swabbing amphibians encountered on transects at different sites within Cusuco. Animals will be captured by hand only by researchers wearing disposable gloves in order to prevent the potential transmission of chytrid between individuals. Species will be identified by an experienced herpetologist or a photo taken for later identification if necessary. Samples will then be processed at the DNA laboratory at Base Camp.

DNA will be extracted and ISSR-PCR performed using a number of primers available for the amphibian species being studied. ISSR-PCR products will then be screened using gel electrophoresis. The data obtained can be input into a number of population genetic software packages such as BAPS, TESS and GENELAND to look at population structure and levels of gene flow in relation to landscape features such as altitude, rivers and streams, habitat type and areas of human disturbance.

The data from this research will help to inform management strategies about the connectivity of amphibian populations within the park and also highlight possible routes of transmission of chytrid between populations.

Suggested Reading

Books

Reptiles of Central America, 2nd Edition (2008) by Gunther Kohler

The Amphibians of Honduras by James R. McCranie and Larry David Wilson

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