



CONSERVATION RESEARCH REPORTS

Choosing the Survivors?

A GIS-based Triage Support Tool for Micro-endemics: Application to Data for Mexican Amphibians

Given the current speed of land use change, a question is looming ever closer. Will it be possible to conserve everything? Or will limited financial resources constrain our efforts to just a subset of species? Are we explicitly condemning species to extinction? Or through the application of the maxim “choose the battles that you can win,” should we focus our strategies and prevent the greatest number of species extinctions through the use of conservation triaging tools? OCHOA-OCHOA ET AL. (2011. *Biological Conservation* 144:2710–2718) proposed a simple conservation triage method that evaluates the threat status of different species, assesses current potential threat abatement responses derived from existing policy instruments and social initiatives, and combines both indicators to provide broad-scale indicators of conservation strategies that would best suit each area under consideration. The authors focused on micro-endemic Mexican amphibian species. Based on locality records of 145 micro-endemic species, they drew buffered areas (AMBAs) in order to evaluate threats and the potential abatement response. To prioritize the AMBAs, they used existing and newly compiled spatial databases of territo-



Axolotl (*Ambystoma mexicanum*) habitat includes areas with unsuitable habitat outside the Xochimilco and Chalco wetlands. These unsuitable areas include federally protected areas, a World Heritage site, and environmental services program. Nevertheless, the most significant conservation action that needs to be implemented for the long-term survival of *A. mexicanum* is to increase the quality and quantity of water available within its wetland habitats. Hence, the prospects for this species are not strongly related to/dependent on the territorial policy instruments and social initiatives utilized in the present analyses. Photograph by Stan Shebs.



Poza Turipache Rainfrog (*Craugastor pozo*) habitat presents a high value conservation instruments index and a medium level of threat, which placed it in the “consolidation of conservation practices” category. However, field-verified interactions between *C. pozo* and human activities (litter extraction to sell as organic fertilizer), suggest that this species is actually being subjected to greater pressures than those expected from the presence of existing instruments and initiatives. Implementation of a monitored litter extraction management program, in coordination with local communities, is urgently needed to preserve, restore, and maintain this species’ habitat and associated traditional land use practices. Thus, *C. pozo* habitat should be in the high conservation priority category, a judgment that was not, however, reflected in the coarse scale analysis conducted during this study. Photograph by Sean Michael Rovito.

rial conservation instruments, threats, and amphibian range distributions for Mexico. They identified 50% of Mexican micro-endemic amphibians as requiring urgent actions. Based on the location of the AMBAs, using the different conservation instruments existing in Mexico, recommending a conservation strategy for the majority of these species was possible. However, almost 25% urgently need field-based verification to confirm their persistence, due to the small percentage of remnant natural vegetation within the AMBAs, before any sensible conservation strategy could be recommended.

This tool is only a coarse scale filter and should certainly not be used as the single tool for selecting and prioritizing strategies that could be implemented in the field. Nevertheless, because it is specifically focused on existing conservation instruments and their implementation feasibility, it becomes a basic starting point to reduce the gap between assessment and implementation while proposing an overarching conservation strategy. Based on these considerations, the use of this tool would be useful to allocate (or re-allocate) resources to different sites within a country or region to reinforce and enlarge a pre-existing conservation strategies network. This triage tool could also ultimately help to identify places too devastated to justify further conservation investment and where *ex-situ* strategies could be considered as better options.

Reptiles as Vectors or Hosts of the Chytrid Fungus

Chytridiomycosis, the disease caused by *Batrachochytrium dendrobatidis*, is considered to be a disease exclusively of amphibians. However, *B. dendrobatidis* may also be capable of persisting in the environment, and non-amphibian vectors or hosts may contribute to disease transmission. Reptiles living in close proximity to amphibians and sharing similar ecological traits could serve as vectors or reservoir hosts for *B. dendrobatidis*, harboring the organism on their skin without succumbing to disease. Using qPCR analysis, KILBURN ET AL. (2011. *Diseases of Aquatic Organisms* 97:127–134) surveyed for the presence of *B. dendrobatidis* DNA among 211 lizards and eight snakes at eight sites at varying elevations in Panama where the syntopic amphibians were at pre-epizootic, epizootic, or post-epizootic stages of chytridiomycosis. Evidence of the amphibian pathogen was present at varying intensities in 29 of 79 examined *Anolis humilis* lizards (32%) and 9 of 101 *A. lionotus* lizards (9%), and in one individual each of the snakes *Pliocercus euryzonus*, *Imantodes cenchoa*, and *Nothopsis rugosus*. In general, *B. dendrobatidis* DNA prevalence among reptiles was positively correlated with the infection prevalence among co-occurring anuran amphibians at any particular site. These reptiles, therefore, may likely be vectors or reservoir hosts for *B. dendrobatidis* and could serve as disease transmission agents. Although no evidence is indicative of *B. dendrobatidis* disease-induced declines in reptiles, cases of coincidence of reptile and amphibian declines suggest this potentiality. This study is the first to provide evidence of non-amphibian carriers for *B. dendrobatidis* in a natural Neotropical environment.



Ground Anoles (*Anolis humilis*) are sometimes phenomenally abundant in the leaf litter of Central American forests. However, a recent study revealed that these lizards can harbor the chytrid fungus, *Batrachochytrium dendrobatidis* (*Bd*), with nearly a third of sampled lizards testing positive. Prevalence of *Bd* in reptiles (including *A. humilis*) was positively correlated with infections in sympatric amphibians. So, reptiles likely are vectors or reservoirs for the fungus, and might serve as disease-transmitting agents. Photograph by Herschel D. Raney.

Mammalian Populations Decline with Proliferation of Invasive Burmese Pythons

Invasive species represent a significant threat to global biodiversity and a substantial economic burden. Burmese Pythons (*Python bivittatus*), giant constricting snakes native to Asia, now are found throughout much of southern Florida, including all of Everglades National Park (ENP). Pythons have increased dramatically in both abundance and geographic range since 2000 and consume a wide variety of mammals and birds. DORCAS ET AL. (2012. *Proceedings of the National Academy of Sciences of the United States of America*; pub-



Burmese Pythons (*Python bivittatus*) are invasive in Florida, where surveys have documented huge decreases in the frequency of mammal observations where pythons are established. Mammals are considerably more abundant where pythons have been discovered only recently and outside the snake's current range. Photograph by Kenneth L. Krysko.

lished online before print 30 January 2012, doi: 10.1073/pnas.1115226109) reported severe apparent declines in mammalian populations that coincide temporally and spatially with the proliferation of pythons in ENP. Before 2000, mammals were encountered frequently during nocturnal road surveys within ENP. In contrast, road surveys totaling 56,971 km from 2003–2011 documented a 99.3% decrease in the frequency of raccoon observations, decreases of 98.9% and 87.5% for opossum and bobcat observations, respectively, and failed to detect rabbits. Road surveys also revealed that these species are more common in areas where pythons have been discovered only recently and are most abundant outside the python's current introduced range. These findings suggest that predation by pythons has resulted in dramatic declines in mammals within ENP and that introduced apex predators, such as giant constrictors, can exert significant top-down pressure on prey populations. Severe declines in easily observed and/or common mammals, such as raccoons and bobcats, bode poorly for species of conservation concern, which occur at lower densities and often are more difficult to sample.

**Newly Described
Dwarf Chameleons are Endangered**

One clade of Malagasy Leaf Chameleons, the *Brookesia minima* group, is known to contain species that rank among the world’s smallest amniotes. GLAW ET AL. (2012. *PLoS ONE* 7: e31314. doi:10.1371/journal.pone.0031314) described a previously unrecognized radiation of these miniaturized lizards comprising four new species. The newly discovered species appear to be restricted to single, mostly karstic localities in extreme northern Madagascar. These dwarf chameleons represent striking cases of miniaturization and microendemism, suggesting the possibility of a range size-body size relationship in Malagasy reptiles. The newly described *B. micra* reaches a maximum snout-vent length in males of 16 mm, and its total length in both sexes is less than 30 mm, ranking it among the smallest amniote vertebrates in the world. With a distribution limited to one very small islet, this species may represent an extreme case of island dwarfism.

Such small ranges translate into immediate concerns regarding the future of these species; that concern is reflected in the names given to two of the new species. The name of one species (*Brookesia tristis*) is derived from the Latin for “sad” or “sorrowful,” which “refers to the fact that the entire known range of this species (Montagne des Français) suffers from severe deforestation and habitat destruction despite recently being declared as a nature reserve.” Another, *B. desperata* for “desperate,” was so named because “its habitat is in truth barely protected and subject to numerous human-induced environmental problems resulting in severe habitat destruction.” “Most urgent is to focus conservation efforts on



Brookesia micra has a distribution limited to one very small islet off the coast of Madagascar, and might represent an extreme case of island dwarfism. Photograph by Frank Glaw.

these and other microendemic species in Madagascar, which are heavily threatened by deforestation,” said herpetologist Frank Glaw, lead author of the study, in a press release.



This aptly named juvenile *Brookesia micra* perches on a match head. These diminutive chameleons reach a maximum snout-vent length of 16 mm and are among the smallest amniote vertebrates in the world. Photograph by Joern Koehler.