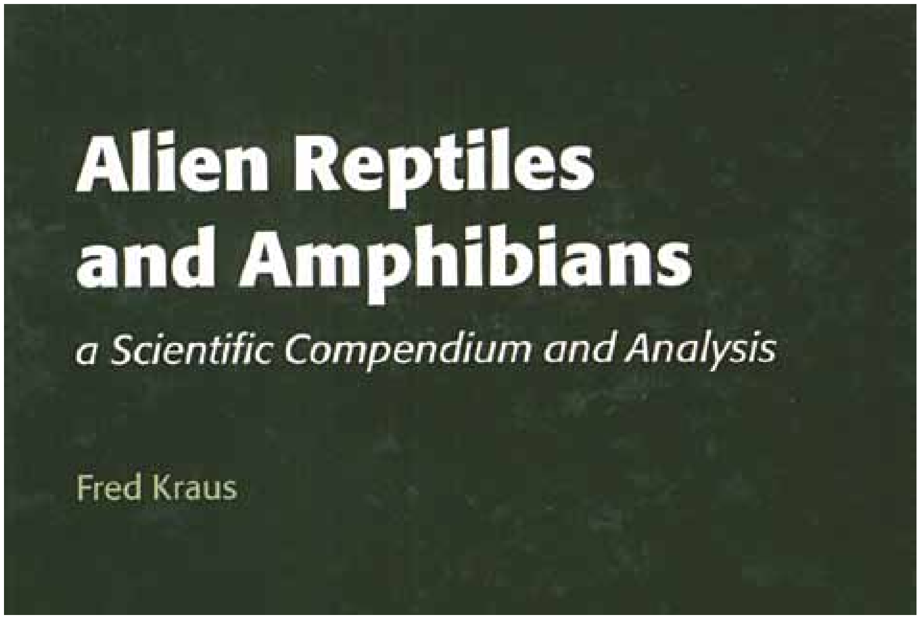
CONSERVATION RESEARCH REPORT

Drowning in a Sea of Development

Many reptilian species are declining, yet few studies address the current distribution and conservation status of most species, let alone how these may change with future development of natural habitats. **Pike and Roznik** (2009. *Herpetological Conservation and Biology* 4:96–105) studied the distribution, habitat associations, and conservation status of Florida Sand Skinks (*Plestiodon reynoldsi*), a fossorial sandswimming lizard endemic to Florida. They used data collected between 1912 and 2006 to map the distribution of this species and used Geographic Information System (GIS) data layers to determine the habitats in which it occurs. They determined that Florida Sand Skinks occupy many different habitat types throughout their range, including human-altered areas used for agriculture. However, Florida Sand Skinks appear to be absent from urban areas. Between 1974 and 2004, the amount of natural habitat available to support populations declined by 17.8% (5.9% per decade), and this trend is predicted to continue until at least the year 2060. Projections of future development of natural and disturbed habitats show linear increases during this same time, and will further fragment the remaining natural habitats. This makes protection of habitat for this species an immediate and real concern. Florida Sand Skinks (and other sympatric species) are rapidly losing habitat due to urbanization, and much of the remaining natural habitat outside of protected areas could be lost during the next several decades.



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Between 1974 and 2004, the amount of natural habitat available to support populations of Florida Sand Skinks (*Plestiodon reynoldsi*) declined by 17.8% (5.9% per decade), and this trend is predicted to continue until at least the year 2060.

NATURAL HISTORY RESEARCH REPORTS

Green Ratsnake Ecology

The Green Rat Snake (*Senticolis triaspis*) has a broad range that extends from Central America north into the Madrean region of southeastern Arizona and southwestern New Mexico, yet very little is known about its ecology. **Radke and Malcom** (2009. *Herpetological Conservation and Biology* 4:9–13) used radio telemetry to examine activity patterns, thermoregulating behavior, and habitat use of rat snakes in southeastern Arizona. Telemetered snakes maintained an average temperature near 25°C throughout the active season (May through October), and preferentially used desert scrub and rocky east-facing slopes (females) or riparian areas (male). The scarcity of Green Rat Snakes dictates that ecological information, and a more complete picture of their conservation needs, will be gathered slowly.

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Female Green Rat Snakes (*Senticolis triaspis*) in southeastern Arizona occupy desert scrub and rocky east-facing slopes, whereas males are more likely to be in riparian areas.

Legless Frog Mystery Solved

Ballengée and Sessions (2009. *Journal of Experimental Zoology (Molecular and Developmental Evolution)* 312B: Published online at www.interscience.wiley.com. DOI: 10.1002/jez.b.21296) presented evidence that the most commonly found deformities in wild-caught amphibians, those featuring missing limbs and missing limb segments, may be the result of selective predation. Predatory dragonfly nymphs can severely injure and even fully amputate developing hind limbs of anuran tadpoles. Dragonflies apparently like to eat the hind legs because, as tadpoles mature, poison glands develop elsewhere on their bodies much earlier than in the skin of their hind legs, rendering the hind legs a far more palatable meal. Developmental responses of the injured/amputated tadpole limbs range from complete regeneration to no regeneration, with intermediate conditions represented by various idiosyncratic limb deformities, depending mainly on the developmental stage of the tadpole at the time of injury/amputation. These findings were reinforced by experimental amputations of anuran tadpole hind limbs that resulted in similar deformities. These studies suggest that selective predation by dragonfly nymphs and other aquatic predators may play a significant role in the most common kinds of limb deformities found in natural populations of amphibians.

THE MYSTERY OF DEFORMED FROGS

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The reason we set out to research this question is a long story, dating back more than 15 years to when I published my first paper on deformed amphibians with supernumerary limbs. We discovered that those had been caused by parasites (i.e., parasitic flatworms, or trematodes). However, since 1995, deformed (or "malformed") frogs became one of the most contentious environmental controversies of all time (at least in the United States), with the parasite researchers on one side and the "chemical company" (as I call it) on the other. A veritable media firestorm ensued, and millions of dollars of grant money were at stake, almost all of it going to research on chemical pollution.

By now, however, I am pleased to say that the evidence that frogs with extra limbs (the oddest of the deformities) are caused by parasites is widely accepted among scientists. We have had publications in both the *Journal of Experimental Zoology* (summarized previously) and *Science*, and a couple of my colleagues (Pieter Johnson of the University of Colorado and Andrew Blaustein of Oregon State University) summarized the whole thing in an article in *Scientific American* in February 2003 (www.scientificamerican.com/article.cfm?id=explaining-frog-deformiti).

However, that's not the end of the story. Frogs with extra limbs may have had the most dramatic-looking deformities (indeed, these frogs have been used by everyone as the "poster child" of the deformed frog problem), yet everyone has always realized that they are by far the least common deformities found. The most commonly found deformities occur in frogs with missing or truncated limbs and limb segments (as in the paper summarized here), and, although parasites can occasionally cause limblessness in a frog, these deformities are almost never associated with trematode infections (or at least not with the trematode species known to cause extra limbs). So, this has remained a mystery, and again the controversy has continued to brew between those who suspect chemical pollution (or even UV-B irradiation) and those who suspect (in this case) some kind of predation.

Supporters of the chemical pollution hypothesis as a cause of limbless frogs point to the range of deformities seen in these

A cleared and stained multi-legged Pacific Treefrog (*Pseudacris regilla*; left). The deformity was caused by parasites, specifically a trematode in the genus *Ribeiroia*. The Northern Leopard Frog (*Lithobates pipiens*; right) has a missing left hindlimb (the left forelimb is normal, just bent back). The spike indicates that the limb was bitten off in the course of a selective predation event.

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