

CONSERVATION RESEARCH REPORTS

Wind Energy Production and Desert Tortoises

LOVICH ET AL. (2011. *Herpetological Conservation and Biology* 6:161–174) studied an Agassiz’s Desert Tortoise (*Gopherus agassizii*) population at a large wind energy generation facility near Palm Springs, California over six field seasons from 1997 to 2010. The authors compared growth and demographic parameters to populations living in less disturbed areas, as well as populations of the closely-related and newly-described Morafka’s Desert Tortoise (*G. morafkai*) elsewhere in the Sonoran Desert of Arizona. They marked 69 individuals of all size classes and estimated a population size of 96 tortoises, or about 15.4/km². Growth rates for males were lower than reported elsewhere, although maximum body size was larger. The smallest female with shelled eggs was 221 mm and males mature at over 200 mm. Mean male size was greater than that of females. The adult sex ratio was not significantly different from unity. Size frequency histograms were similar over time and when compared to most, but not all, *G. morafkai* populations in the Sonoran Desert. For a cohort of adult females, mortality was estimated at 8.4% annually due, in part, to site operations. This value was low in comparison to many other populations during the same time period. Other than possible differences in growth rate of males and the high survivorship of females, few differences are evident between this population and those in more natural areas. The high productivity of food plants at the site and its limited public access may contribute to the overall stability of the population. However, the effects of utility-scale renewable energy develop-

ment on tortoises in other, less productive areas are unknown. Additional research (especially controlled and replicated before and after studies) is urgently needed to address this deficiency because of forecasted expansion of utility-scale renewable energy development in the future.

Risk Assessment of Exotic Reptiles in Southern Florida

The recent explosion in the number of exotic reptiles in southern Florida requires effective management strategies. The objective of this study was to use ecological correlates and quantitative modeling methods to facilitate the development of management strategies by providing the foundation for a screening procedure that will identify potentially invasive species and assess adverse impacts associated with those species. FUJISAKI ET AL. (2010. *Biological Invasions* 12:2585–2596) considered 17 variables and, based on model selection procedures, identified the following significant predictors of establishment success: Taxonomic order, maximum temperature match between a species’ native range and Florida, animal sale price, and manageability (defined as a species’ maintenance cost, aggressiveness, proneness to escape, and venomousness). Applying the models to predict establishment success of 33 reptiles that were most frequently imported through Miami and St. Petersburg ports from 2000 to 2005 and two additional reptiles of concern in Florida, the authors identified eight lizards and four snakes as potentially successful invaders. They further assessed adverse impacts associated with potential invaders, should they become established, by identifying species that are (1) dangerous to humans, (2) dangerous to the



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The Puff Adder (*Bitis arietans*, top) and the Long-tailed Grass Lizard (*Takydromus sexlineatus*) are among four species of snakes and eight species of lizards identified as potentially successful invaders in southern Florida. The Puff Adder is potentially dangerous to humans, consumes vertebrates, and thus could become an upper-level predator in the ecosystem. The Long-tailed Grass Lizard is a potentially fast-spreading species that can produce large numbers of eggs annually.

ecosystem (upper trophic-level predators), and (3) capable of spreading rapidly. Controlling exotic reptiles can be expensive and labor intensive once they are established. Information on which species are potential invaders based on screening procedures and what impacts these species might cause will be a valuable contribution to the development of proactive management strategies.

Environmental DNA Detection of Rare Vertebrates in Streams

Stream ecosystems harbor many secretive and imperiled species, and studies of vertebrates in these systems face the challenges of relatively low detection rates and high costs. Environmental DNA (eDNA) has recently been confirmed as a sensitive and efficient tool for documenting aquatic vertebrates in wetlands and in a large river and canal system. However, this tool had not been tested for detecting low-density vertebrates in fast-moving streams where shed cells may travel rapidly away from their source. To evaluate the potential utility of eDNA techniques in stream systems, GOLDBERG ET AL. (2011. *PLoS One* 6:1–5) designed targeted primers to amplify a short, species-specific DNA fragment for two secretive species of stream amphibians in the northwestern United States (Rocky Mountain Tailed Frogs, *Ascaphus montanus*, and Idaho Giant Salamanders,



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An Agassiz’s Desert Tortoise (*Gopherus agassizii*) at a large wind energy generation facility near Palm Springs, California.



Environmental DNA (eDNA) was recently confirmed as a sensitive and efficient tool for documenting low-density aquatic vertebrates in fast-moving streams by successfully detecting Rocky Mountain Tailed Frogs (*Ascaphus montanus*; top) and Idaho Giant Salamanders (*Dicamptodon aterrimus*; bottom) in central Idaho.

Dicamptodon aterrimus). The authors tested three DNA extraction and five PCR protocols to determine whether they could detect eDNA of these species in filtered water samples from five streams with varying densities of these species in central Idaho. They successfully amplified and sequenced the targeted DNA regions for both species from stream water filter samples, detecting Idaho Giant Salamanders in all samples and Rocky Mountain Tailed Frogs in four of five streams and determining that these species are more difficult to detect using eDNA in early spring than in early fall. While the sensitivity of this method across taxa remains to be determined, the use of eDNA could revolutionize surveys for rare and invasive stream species. With this study, the utility of eDNA techniques for detecting aquatic vertebrates has been demonstrated across the majority of freshwater systems, setting the stage for an innovative transformation in approaches for aquatic research.

Snakes and Conservation Buffer Strips in an Agricultural Landscape

In regions of the United States that are predominantly devoted to agricultural production, most



The Smooth Green Snake (*Lioclorophis vernalis*) was one of five species captured during a study that showed a positive correlation between buffer-zone width along grassed waterways in southeastern Iowa and the presence of snakes.

grassland habitat remains as linear strips, including areas along roads and within conservation buffer strips. While land management agencies in the United States promote conservation buffer strips as beneficial to wildlife populations, we know little about the use of these habitats by snakes, especially in relation to multiscale factors. Our poor understanding of these relationships hinders effective design and management of these habitats to conserve biodiversity. **KNOOT AND BEST** (2011. *Herpetological Conservation and Biology* 6:191–201) evaluated the influence of buffer design, management, and surrounding landscape characteristics on snake occurrence in grassed waterways in southeastern Iowa. The authors documented snakes at nearly 80% of the grassed waterways and captured 119 individual snakes of five species; one of which, the Smooth Green Snake (*Lioclorophis vernalis*), is listed as a species of conservation concern in Iowa. They used a multiple logistic regression and an information theoretic approach to determine the most parsimonious local and landscape variable models

that best explained snake species occurrence. The “local” waterway design variable, width, occurred in the best local variable models for three of the five species and was positively associated with snake presence for all three species. Landscape variable models also helped explain snake presence; individual species responded differently to the various landscape metrics. Insights gained from this study might provide opportunities for improving the conservation value of buffer strips to snakes in these fragmented landscapes.

Ecotourism has Negative Effects on Northern Bahamian Rock Iguanas

HINES (2011. *Herpetological Conservation and Biology* 6:250–259) evaluated effects of tourist visitation and supplemental feeding on Northern Bahamian Rock Iguanas (*Cyclura cyclura*) in the Exumas, Commonwealth of the Bahamas. The study examined flight behavior and diet on islands that were visited versus those not visited by tourists. Iguanas on visited islands were less wary of human presence than those on non-visited islands. Unlike on non-visited islands, iguanas on beaches where they were fed by tourists consumed people-influenced items including trash (e.g., styrofoam, aluminum foil), non-native fruits and vegetables (e.g., grapes, tomatoes), and sand. Non-native fruits provided a higher liquid content diet than did native vegetation, which, when mixed with sand, created cement-like feces that may have medical consequences. Tourism has encouraged an increase in these iguana populations, but negative impacts, such as loss of wariness and dietary shifts as well as possible demographic consequences, also are occurring. These adverse effects might be ameliorated by changed practices, but such changes must be instituted with full participation by local stakeholders.



Tourists feeding Northern Bahamian Rock Iguanas (*Cyclura cyclura*) on the landing beach at Leaf Cay in the northern Exuma Islands.

Changes in the Trade of Amphibians and Reptiles over a 10-year Period

TAPLEY ET AL. (2011). *The Herpetological Journal* 21:27–34) compared the trade in reptiles and amphibians in the United Kingdom between 1992–3 and 2004–5. In particular, the impacts of captive breeding and color and pattern morphs on price structures were examined. The number of amphibian and reptilian species in the trade more than doubled over this period, and less than a third of the species traded were common to both trading periods. More traded species were listed by CITES in 1992–3 than in 2004–5. Taking into account inflation, the study showed that the price of all groups of reptiles and amphibians recorded increased over the ten-year period, and that some snake species had done so dramatically when color and pattern morphs were considered. The price change of chelonians was probably the result of responses to changes in various trade regulations. Price increases for amphibians seemed to represent their increased popularity, coupled with the overhead costs of captive breeding on a commercial scale being transferred to the hobbyist. The increased popularity of captive-bred color and pattern morphs could alleviate pressure on



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Despite many conflicts with human interests, non-native Green Iguanas (*Iguana iguana*) are ubiquitous in southern Florida and are not currently subjected to any systematic, organized management efforts.

wild stocks. On the other hand, as such animals are predominantly being produced outside their countries of origin, no benefits accrue to local people and trade could undermine sustainable-use programs for wild animals.

Exotic Reptiles in Florida

Florida and Hawaii have the two worst invasive species problems in the U.S. Florida in particular is especially susceptible to the establishment of alien reptiles. In addition to the sheer numbers of established non-native reptilian species in the state, many of these species present novel difficulties for management, or have other characteristics making effective management extremely challenging. Moreover, initiation of management action requires more than recogni-

tion by experts that a potentially harmful species has become established. It also requires the political will along with concomitant resources and appropriate personnel to develop effective methods and apply them. ENGEMAN ET AL. (2011. *Current Zoology* 57:599–612) reviewed the situation in Florida, including assessment of risk for establishment, and used a subset of prominent species to illustrate in more detail the array of circumstances involving invasive reptilian species in Florida, including routes of introduction, impacts, and potential and implemented management actions. These examples not only highlight the severity of the invasive reptile problems in the state, but they also show the diversity in resolve and response toward them and the factors that motivate these responses.



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Red-eared Sliders (*Trachemys scripta*) showed the greatest (754%) price increase over a 10-year period of all turtles traded in the United Kingdom.

NATURAL HISTORY RESEARCH REPORTS

Survival, Breeding Frequency, and Migratory Orientation in Jefferson Salamanders

Accurate estimates of demographic parameters, such as survival and breeding frequency, are necessary for the conservation and management of animal populations. Additionally, life-history data are required for gaining an empirical understanding of the ecology of natural populations. DE LISLE AND GRAYSON (2011. *Herpetological Conservation and Biology* 6:215–227) monitored a population of Jefferson Salamanders (*Ambystoma jeffersonianum*) breeding in a permanent mountain-top pond at the southern limit of this species' geographic range in Virginia over four years. The authors used closed mul-

tistate mark-recapture models with Pollock's robust design to estimate the demographic parameters of this population. Additionally, they used point-of-capture data to compare the orientation of migrations into and out of the pond within and among years. The model selection results support consistent annual adult survival across years with higher estimates for males compared to females. Estimates of the probability of breeding in sequential years were high for both sexes during the four years of the study. Model rankings and capture probability estimates indicate that females had a higher probability of detection when entering the breeding pond, likely reflecting differences between the sexes in arrival time at the pond. Directionality

was evident in some but not all annual migrations, despite indications of individual fidelity



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Our understanding of reproduction and natural history of pond-breeding amphibians benefited greatly by a study of Jefferson Salamanders (*Ambystoma jeffersonianum*) in Virginia.