

# Alien Snake Threatens Pacific Islands

by Thomas H. Fritts  
and Gordon H. Rodda



*Micronesian kingfisher*

Photo by Jessie Cohen/National Zoological Park, Smithsonian Institution

**The reproduction of endangered Mariana crows (*Corvus kubaryi*) is intensively monitored, nests are protected, and (when necessary) eggs or young are moved to the safety of lab conditions until they are less vulnerable to the threats in natural habitats. Barriers on tree trunks and judicious pruning of adjacent trees are used in attempts to exclude snakes from nest trees. Two birds unique to Guam—the Micronesian kingfisher (*Halcyon cinnamomina cinnamomina*) and Guam rail (*Gallirallus owstoni*)—are maintained at captive propagation facilities on Guam and in mainland zoos. Studies of these and other species, in captivity and on nearby islands, are underway to bolster our biological understanding of their behavior, reproduction, habitat use, and population biology.**

Until the 1950's, the island of Guam, like many oceanic islands, lacked predatory snakes, but the abnormally high ship and air traffic immediately after World War II resulted in the accidental introduction of the brown treesnake (*Boiga irregularis*) from the Admiralty Islands in the South Pacific. The nocturnal, arboreal snake quickly spread throughout Guam, feeding on the island's lizards, birds, and mammals. As the snake grew in numbers, it reduced the populations of several native species and ultimately causing unprecedented changes in the ecology of the island.

By the 1980's, when the snake was identified as the cause of the declines in the native fauna, 10 of 13 Guam's native forest birds had disappeared, along with several species of seabirds and lizards. Other species were reduced to precariously low numbers. The mildly venomous snake also created other problems: causing numerous power outages when contacting high voltage lines; consuming poultry, pets, and other domesticated animals; entering homes and biting children; and invading cargo leaving Guam for other destinations.

The U.S. Fish and Wildlife Service and Guam's Division of Aquatic and Wildlife Resources have made an intensive effort to protect and recover endangered bird and bat species on Guam using a wide array of conservation techniques and strategies. These efforts have been supplemented by researchers and cooperators from other Federal agencies (U.S. Geological Survey, U.S. Department of Agriculture's Wildlife Services, U.S. Departments of the Navy and Air Force) and a host of cooperators from universities, zoos,

conservation organizations, and other island governments. The severity of the conservation crisis led to the establishment of the Guam National Wildlife Refuge to preserve habitat and serve as a focal point for research and recovery.

Only recently have we gained enough knowledge about the many biological problems caused by the snake to begin controlling snake populations by protecting habitats rather than individual bird nesting sites. One experiment involving the removal and exclusion of snakes from 2.5 acre (1-hectare) forested plots in northern Guam has demonstrated the potential role of snake barriers in promoting the restoration of important habitat areas for wildlife recovery. However, much work is needed to solve problems of costs, durability, and application in order to protect the broadest spectrum of native fauna. Recently, such snake exclusion technology was used to facilitate the repatriation of 15 captive-bred Guam rails to a 22-ha area of forest habitat on Guam National Wildlife Refuge.

The predation pressure exerted by high snake populations resulted in the disappearance of most of Guam's native birds within four decades of the snake's arrival. At the peak irruption, snakes outnumbered birds about 4 to 1. Even the most common birds were vulnerable to the numerical superiority and agility of the snakes, which foraged at night when birds were sleeping and defenseless in trees. As many as five native lizard species are gone or exceedingly rare on Guam due to snake predation and the ecological changes that the snake produced.

Several factors contribute to the concern that snakes could be trans-

ported accidentally from Guam to other areas: the abundance of snakes on Guam, even in areas near humans and commercial areas; the tendency of snakes to hide in all sorts of artificial objects, including vehicles, cargo containers, and buildings; and the large volume of ship and air traffic from Guam to other parts of the world. The brown treesnake has been discovered in and near transportation facilities on three other islands in the Marianas Archipelago, elsewhere in the Federated States of Micronesia, the Republic of the Marshall Islands, Okinawa, Diego Garcia, the State of Hawaii, and, in one case, Corpus Christi, Texas. The snake already has successfully colonized the island of Saipan in the Northern Marianas, and an irruption of snakes on that island could further threaten both its ecology and economy, as well as contribute to the spread of the snake to other islands.

Trapping of snakes is an intensive but effective tool for controlling snake numbers in localized areas, and most control efforts at present (coordinated by the U.S. Department of Agriculture's Wildlife Services Program) are in and around air and seaport facilities that are potential dispersal sources. Guam's Department of Agriculture also manages a large trapping effort in areas contiguous with U.S.D.A. control areas, but the area represents a fraction of the island. Reduction of snake populations by trapping over larger areas of Guam would not be practical. The difficulties of capturing snakes while working at night in Guam's dense vegetation and rough terrain would severely handicap any bounty or commercial hunting program. U.S.D.A. personnel conduct searches with dogs trained to use their keen sense of smell to find snakes in cargo leaving Guam. Detector dogs are used by quarantine personnel in Hawaii and the Northern Marianas Islands, but the cost of dog handler teams is high for the number of snakes detected.

Snake-proof barriers are a recent innovation that ultimately may be used

to protect transportation facilities, electrical installations, and critical natural habitats, and to reduce the numbers that must be captured by hand or trapping. But there are limits to the usefulness of this approach in situations where cargo is brought in daily from other areas, where snakes are abundant, and where large areas of natural habitat are needed to protect core wildlife populations. Research also is underway to develop toxicants, attractants for baiting snakes, innovative traps, repellents, and even biological methods of control, but all of these depend upon having a complete understanding of the snake's biology, habits, movements, and numbers.

An expanded effort involving both innovative research and control programs is essential to reduce damages and curb the spread of this pest to much larger areas of the Pacific and elsewhere in the world.

---

*Thomas H. Fritts and Gordon H. Rodda are with the U.S.G.S. Midcontinent Ecological Science Center in Fort Collins, Colorado. For more information, consult the following internet address: <http://www.nbio.gov/browntreesnake/>*

---

*The average density of snakes in forested and most suburban areas of Guam is much higher than that of comparable snakes in other parts of the world. At the peak of the invasion, and prior to the collapse of Guam's bird and mammal fauna, snake densities may have exceeded 100 per hectare (40 per acre). Even today, densities in forested areas average 20-50 snakes per hectare (the equivalent of 8-20 snakes per acre). These high numbers of snakes fed on a broad array of Guam's vertebrate fauna (birds, rats, shrews, bats, and lizards). Snake populations on Guam have subsided by as much as 50 percent since 1985 and, contrary to their expectations, visitors to Guam are unlikely to see many snakes. However, enough snakes remain on Guam to suppress wildlife populations and inhibit their recovery.*

*Photo by Thomas H. Fritts*

