Creating the Nation's first BioPark

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Letter From the Desk of David Challinor
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When I was a college student 50 years ago, conventional wisdom predicted that predators could not eliminate a prey population. The work then done on such mammalian carnivores as wolves, foxes and lynx indicated that predator populations fluctuated with prey populations; predators' hunting behavior was effective in dampening an excessive rise and fall of prey animals. The half-century study of wolf-moose interactions on Lake Superior's Isle Royal supported this hypothesis: there was never a concern that the wolves would kill all the moose on this island any more than biologists worried that wolves introduced last spring into Yellowstone Park would wipe out the elk and bison there.

Biological control of animal populations thus evolved to keep disparate but interdependent organisms in tolerably balanced conditions. Native predators play a relatively benign role in population control of their prey, whose population is more often determined by extreme climate conditions or unexpected diseases than by predators. When exotic predators or pathogens are introduced, however, control conditions change drastically. Prey species or pathogen hosts seldom have adequate time to develop a defensive strategy or resistance to the new "enemy." For example, Bermuda cedar (Juniperus bermudiana) suffered about 95% mortality over a little more than a decade when a scale insect was accidentally introduced to these islands during World War II. The closely related Virginia cedar on the mainland is quite resistant to this insect, as is about 5% of the Bermuda population that has survived. The Bermuda cedar used to be the dominant tree on the islands and evidently some individual trees have harbored a long-unused genetic resistance to this insect that has allowed them to still grow. In another one or two centuries, Bermuda cedar might regain its dominance of the island landscape; if introduced, exotic trees cannot compete with it.

Perhaps the most ruinous and ominous exotic predator of our time is the brown tree snake (Boiga irregularis) that was unwittingly introduced to Guam after World War II. Never has a reptile been found to be so destructive of local fauna. After more than a decade of research, scientists are beginning to understand its amazing success in occupying an island 30 miles long at a density of 25 to 30 snakes per acre. No other snake has ever approached such a density per unit area. There are so many brown tree snakes on Guam that they have extirpated 9 of the 18 forest dwelling birds and have threatened the survival of the rest. They have also reduced drastically populations of all the small

native rodents as well as local skinks and geckos (two small lizards).

Scientists believe the snake reached Guam from Manus, an island off the north coast of New Guinea that is about three times larger and more lush than Guam. Manus was one of the world's biggest naval bases during World War II, and following the Japanese surrender, it was a major transshipment point for scrap metal being sent to Guam for sorting and ultimate distribution to the steel mills of the world. The snakes probably hid in the equipment destined for scrapping and transshipped through Guam. The first snake was found on Guam in the early 1950's. They were seen infrequently for almost 20 years until in 1971 they became plentiful enough for a local legislator to propose a bounty on them. The bounties were never introduced and the snakes spread so rapidly that by 1982 they caused 65 power blackouts in that year alone by climbing power poles and shorting the lines.

In early 1983 the Smithsonian became involved in the problem because then Secretary Dillon Ripley was an expert on rails, a Guam bird species that was being extirpated by the snakes. Ripley offered the facilities of the National Zoo to breed the endangered local birds. Under the tireless efforts of Scott Derrickson today the Zoo has about 20 Guam rails and two pairs of Micronesian kingfishers, both of which no longer exist in the wild. In the Bird House at the Zoo a pair of kingfishers and rails are on exhibit, and in an adjacent enclosure is a 9-foot brown tree snake.

The snake looks innocuous, if any snake can fit that description. Its color can range from brownish to greenish and with plenty of food it can grow to 9 feet like the one on display. Although it is thin, the tail is prehensile and strong enough to support 3/4 of its total length. This adaptation allows it to move rapidly in the canopy, where it is so agile and quick that it can seize a bird even after it has flushed it from a branch. Besides its agility it has other characteristics helpful for colonizing new areas. The female can store sperm for years and thus lay fertile eggs long after contact with a male. The snake can also withstand hunger and thirst for long periods and thus survive extended sea voyages by hiding in cargoes. It is venomous and can quickly kill its prey.

With a population explosion of perhaps two million snakes on Guam, biologists wondered what aspect could have deviated from the classic pattern usually associated with predator-prey relationships. After the snakes virtually eliminated the forest dwelling birds, they switched to small mammals, reptiles and young fruit bats. The local skinks (also introduced) and the geckos, however, seem to remain relatively common on Guam, perhaps by reproducing faster than the snakes can eat them. It

is unlikely that all the snakes will disappear from lack of food, but scientists are currently seeking ways to control them, such as developing a selective poison or an irresistible bait to trap them. So far Smithsonian scientists and their outside colleagues have not found the ideal control agent.

Meanwhile at Front Royal, the Zoo has successfully raised a few Micronesian kingfishers and many Guam rails so that we may soon be faced with what to do with the expanding zoo-bred rails. Rota, an island half way between Guam and Saipan, is free of snakes and in February 1990 Secretary Ripley ceremoniously released some of the zoo-bred rails there. Unfortunately, the 22 released birds either died or disappeared within a couple of months. A year later, in February 1991, 32 more rails were released on Rota. None of these evidently survived either. Then in the fall of 1991 and into 1992, Guam was hit by four typhoons which destroyed the rail-raising facilities there. Breeding started again in 1994 and 15 birds were released on Rota again in March 1995. Other releases are scheduled as more birds become available. The kingfisher, on the other hand, is not doing well and the world population is down to about 50 individuals. The only hope now is to release them in snake exclosure plots on Guam. After a number of experiments, a chicken blood scent has been developed that attracts tree snakes into traps. In ten nights of trapping, an exclosure area can be cleared of snakes. The method is labor intensive but at least it is working until a better system is devised. Other release sites are also being considered, including the small uninhabited island of Aguijan a few miles south of Tinian.

Meanwhile Don Nichols of the National Zoo's Department of Pathology is searching for a virus that might be lethally specific to the brown tree snake as a way to control it. Clearly it will take the combined efforts of many scientists to save the rails and the kingfisher.

For those interested in learning more about the snake and its remarkable adaptations to new conditions, I recommend Mark Jaffe's book (And No Birds Sing, Simon and Schuster, N.Y. 1993). No longer can we assume that starlings, raccoons and other common birds and mammals are master generalists, and at least the brown tree snake must be added to this growing list of "nuisance" animals. Were Alfred Hitchcock still alive, I think we could expect a film about this creature, but in this instance, what scientists have learned about the brown tree snakes is stranger than fiction.

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