

Return of the Tuatara

A relict from the age of dinosaurs gets a human assist

By CHRISTINE MLOT

Titi Island, the new, 30-hectare home for tuatara. Part of the New Zealand mainland is in the background.

Photos: B. Robertson/Victoria Univ.

They're cold, they're old, they're slow.

Tuatara, spiny cousins of lizards, are among the coldest of the cold-blooded reptiles, living on brisk, wind-whipped islands off the mainland of New Zealand. They take years to develop and hatch but then make the most of that effort. Growing to almost 2 feet long, tuatara live at least the biblical threescore and ten years, and probably a century or more.

Tuatara are also a zoological rarity, the lone members of the order Sphenodontida. The rest of the order probably went extinct with the dinosaurs, leaving only the tuatara to carry on. Their Maori name means "spiny back"; it could easily stand for "staying power."

Tuatara are now gaining some new ground. In the last decade, researchers in New Zealand studying the animal's unusual reproduction set up an incubation program for eggs collected from the wild. Two years ago this month, a cohort of the nursery-hatched tuatara was sent to recolonize an island that the animals once inhabited.

Although it will be years before it's known whether the colonists have established a lasting population, the tuatara seem to be thriving. "The indications so far are very good," says zoologist Charles H. Daugherty of Victoria University of Wellington in New Zealand.

The repopulation experiment is one small step for tuatara, one giant leap for Reptilia. Many reptiles today are threatened with extinction—21 species have gone the way of the dinosaurs in the last 400 years—but they attract little of the public concern bestowed on furry or

feathered animals.

While restorations of bird and mammal populations are relatively common, efforts to conserve reptiles have lagged. The attempt to reestablish tuatara may provide insights into restocking other reptile populations on islands or in other ecosystems where they've been eliminated, says Daugherty, who described the project at last summer's meeting of the Society for Conservation Biology in Victoria, British Columbia.



Male tuatara can weigh up to 1 kilogram. The fleshy spines are usually soft and pliable, but they stiffen during aggressive displays.

There's a certain symmetry in the human-assisted return of the tuatara, since mammals probably played a part in their near demise. Tuatara and other sphenodontids were once more common than lizards and were found all over the world.

They had their heyday, along with dinosaurs and other reptiles, beginning about 220 million years ago. By the time the Mesozoic era was winding down, about 65 million years ago, only four groups of the once-dominant reptiles survived: snakes and lizards, the most diverse with thousands of species; turtles and tortoises, with a couple hundred

species; about 2 dozen alligator and crocodile species; and tuatara.

Their abundance in the fossil record stops short just before mammals began to flourish. Explains Daugherty, "When the dinosaurs went extinct, it appears that most of the sphenodontids did as well. There are no fossils more recent than 80 million years ago anywhere. But because apparently there were a few tuatara that gained safety on this little raft of New Zealand, they hung on."

When New Zealand rafted away from the other landmasses about 80 million years ago, it carried no mammals that threatened tuatara. So the reptiles persisted unperturbed, adapting to the cool, sea-side habitat with little physical change from their dinosaur-era ancestors.

About 1,000 years ago, Polynesians arrived in New Zealand, bringing with them rats and dogs, which took to preying on tuatara. The tuatara populations dwindled further with the arrival of Europeans, including collectors avid for the reptilian throwback. By the middle of the last century, tuatara were extinct on the New Zealand mainland.

Only on the roughest, most inaccessible islets have tuatara survived, about 55,000 in all. Tuatara have been protected since 1895—one of the first reptiles to obtain that legal status. Still, 10 of the 40 populations reported at the time have disappeared in the past century, and four more are on the brink.

Tuatara share their island sanctuaries with flocks of shearwaters and petrels. The reptiles spend their days in burrows left by the nesting

seabirds, thus avoiding the hawks that fly by the island as well. At night, the tuatara come out to feed on the abundant beetles and other creatures that live amid the scrub.

Life is laid-back, even when these reptiles hunt. "Tuatara are sit-and-wait predators," says Daugherty. "They sit in front of their burrow all night, in a sort of advertising display [to ward off] other tuatara and hoping a food item will wander by." They aren't fussy about what they eat: skinks, worms, giant weta crickets, even young tuatara or birds—anything that moves.

Their sangfroid suits the island's average 50°F temperature, which can plunge nearly to freezing. Researchers consider tuatara to be an extraordinarily modified version of the basic heat-seeking reptile. "If you take them up to the normal temperature for most reptiles, they'll die," says herpetologist Louis J. Guillette Jr. of the University of Florida in Gainesville.

Because of their penchant for cold, tuatara take a long time to grow and reproduce. Their eggs go through a 12- to 15-month incubation, unusually poky for a reptile. Once hatched, tuatara take 15 years to mature sexually. A female then requires about 3 years to lay in enough yolk for the dozen or so eggs she will produce and another 8 months to encase them in shell in her oviducts. The whole process of egg production takes about three times longer than it does in lizards. No wonder females manage to nest, on average, only once every 4 years.

"The only way to deal with that is to live a long time," Daugherty points out—and tuatara do. Once they mature and "get to reproductive size, then their odds of living another 50 years are pretty good. That means they'll get to reproduce another 10 or 15 times."

On one island, tuatara that were individually identified in the 1940s as fully grown adults are "still alive, still breeding, still the same size, and looking right in the pink of health," says Daugherty. He estimates they are now more than 75 years old.

"I'd be quite confident they live to be 100, and I couldn't convincingly argue they don't live 50 or 100 years beyond that. Nobody knows," he adds.

In terms of life span, tuatara are more like the long-lived turtles and crocodiles than like the lizards they appear to resemble, which typically live 2 to 10 years. Says Guillette, "They're not big lizards. They're something different."

Physically, the differences start with the head, in the appearance of the skull openings that researchers use to classify reptiles. The tuatara's skull and skeleton

are generally considered more primitive than those of lizards.

The part of the brain known as the pineal body forms a light-sensing organ on the top of the tuatara's head. Lizards also have this so-called third eye, which may help in sensing light and thus regulating body temperature.

Instead of separate teeth, tuatara use a serrated jawbone to clamp and tear food—or, on memorable occasions, a researcher's finger. In old animals, the serrations wear down to smooth bone.

Tuatara have another distinguishing feature, or lack thereof: Unlike all other



At 3 to 4 weeks, these finger-long hatchlings weigh 5 to 7 grams. Young tuatara are more cryptically colored than adults.

living reptiles, male tuatara have no penis. They deposit sperm internally, cloaca to cloaca, as birds do and as perhaps dinosaurs did.

Not least for their mating apparatus, the International Union for Conservation of Nature and Natural Resources calls the tuatara simply "of extraordinary zoological interest." Says Guillette, "This is a great beast."

Until recently, tuatara were thought to be all of a kind, but the scattered islands contain more diversity than was officially recognized.

In the late 1980s, Daugherty and his colleagues looked at the variation of enzyme structures, as an indication of genetic differences, among tuatara populations on different islands. They discovered that tuatara from one of the islands differ significantly from other tuatara in a cluster of enzymes. The differences are as great as those separating some species of New Zealand lizards.

Their finding, reported in the Sept. 13, 1990 *NATURE*, fit with the observations of a naturalist who in 1877 had picked out some slight differences in appearance, especially the colors and "habits and disposition," among some of the tuatara. At the time, the suggestion that there were two species of tuatara was disregarded. With the recent genetic evidence, New Zealand officials have recognized a second species, the olive yellow *Sphenodon guntheri*, as distinct from the more abun-

dant but drabber *S. punctatus*.

There aren't many members of the newly named species. Only about 500 of these tuatara occupy tiny North Brother Island. With a helping hand, however, their numbers and range are expanding.

As seed for the repopulation, researchers collected 209 eggs from 35 females. At the end of their long incubation, 81 percent hatched. The hatchlings were raised in a head-start program of seminatural conditions in preparation for their return to the wild.

In 1995, 50 of these captive-born juveniles and 18 adults from North Brother Island were resettled on Maori-owned Titi Island, which had been cleared of rats. The tuatara were ceremoniously welcomed, then placed in burrows specially prepared for them.

Keeping tabs on the new colonists is a challenge. The tuatara abandoned the prefab burrows, and the few outfitted with radio transmitters wriggled out of their harnesses. As nocturnal animals, tuatara fade easily into the vegetation on the rugged island, about the size of 100 football fields. Still, a checkup earlier this year tallied 46 percent of the original colonists, including most of the adults.

They seem to be making themselves at home, says Nicky Nelson of Victoria University. "All the tuatara we have seen since translocation appear healthy, and the adults have thrived, gaining large amounts of weight." Nelson is slated to check up on them again in a few months.

Fishing boats and sailboats ply the waters around the tuatara islands, but no one sees much of the ancient reptiles. Access to the rocky outposts is difficult—researchers in some cases have had to be airlifted—and strictly regulated, and the animals are active mainly at night.

For now, the most likely place to see tuatara is on New Zealand's 5¢ coin or in zoos. Several zoos in the United States, including those in San Diego, St. Louis, Toledo, and Dallas, have tuatara in their collections or on display.

If tuatara successfully repopulate other New Zealand islets, one of the sanctuaries may someday be open to the public, says Daugherty. He envisions a preserve where people might mingle with these dinosaur compatriots in their natural habitat—a kinder, gentler Jurassic Park. □



Coin of the tuatara realm.