Dipsosaurus catalinensis from Isla Santa Catalina, Baja California Sur, México.

Dipsosaurus dorsalis has a circum-Gulf of California distribution and is a popular symbol of southwestern desert ecosystems.

Gulf of California showing the location of Isla Santa Catalina. *Illustration by John Binns.*

Santa Catalina Island Desert Iguanas, *Dipsosaurus catalinensis*: An Evolutionary Experiment in Progress

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All photographs by the author.

The islands in the Gulf of California, México are renowned for being among the most evolutionarily dynamic regions of North America. Indeed, studies of the flora and fauna of these islands have contributed significantly to much of what we currently understand about the evolution of insular ecosystems and insular biogeography. Reptiles have figured prominently in many of these studies, largely because they are represented in the Gulf of California by a number of endemic forms and adaptive types. Many of the iconoclastic species of North America's Sonoran Desert have given rise to insular populations in the Gulf of California that, for a variety of reasons, have attained full-species status subsequent to their isolation. The processes of sampling error, genetic drift, and the new selective pressures attendant with insular systems have driven many of these species to evolve into highly adapted, sometimes bizarre forms.

One of the most conspicuous species of lizards with a geographic range that coincides with the circum-gulf distribution of the Sonoran Desert is the Desert Iguana, *Dipsosaurus dorsalis*.

Dipsosaurus dorsalis has a distribution that borders much of the Gulf of California. This individual is from San Diego County, California.

Dipsosaurus catalinensis: note the short, blunt head, the constriction near the base of the tail, the colored tail, and the dark throat.

Its relatively large size, high density, docile behavior, and general lack of fear of humans has made this lizard a popular symbol of southwestern desert ecosystems and a relatively well-studied species — but, like many of its sympatric desert associates, the evolutionary history of *D. dorsalis* has been affected by the formation of the Gulf of California, and an isolated population of *Dipsosaurus* on Isla Santa Catalina off the eastern coast of Baja California Sur just south of Loreto, has attained species status.

This species, *Dipsosaurus catalinensis*, was named by John Van Denburgh in 1922 after the island on which it is found. In 1954, at a time when the concepts of species and subspecies were much different than they are today, this lizard was relegated to subspecific status within the *D. dorsalis* complex. Only in recent years, with the advent of a more accurate understanding of species boundaries has its original status been reestablished. However, unlike its mainland and peninsular counterpart and despite a considerable amount of herpetological research in the region, virtually nothing is known about the life history and ecology of this endemic species, making it one of the least known of all iguanas. Still, after only a few minutes on the island spent watching these lizards, the differences in morphology, color pattern, and behavior that separate them from *D. dorsalis* become quite evident.

Anyone familiar with *D. dorsalis* will be struck immediately by the distinctly shaped head of *D. catalinensis*. Its snout is shorter and more blunt than that of its mainland counterpart. This gives its head a relatively more square and an almost "stubby" appearance. The reasons for this are unclear. These lizards may be feeding differently or constructing burrows in a manner that is facilitated by the blunt head. Scientists lack any reasonable explanation, mainly because this species has never been studied.

Many Santa Catalina Island Desert Iguanas have a noticeably constricted base of the tail. Again, the reasons for this are unclear, and even the most reasonable attempts to explain it are highly speculative. Constricted tails usually are associated with fracture planes that facilitate tail loss (autotomy) and regeneration after attacks by predators or violent intraspecific interactions. However, this does not seem to be the case in this instance, as tail breakage frequently does not correspond to the constriction. Hatchlings and juvenile *D. catalinensis* have an orangish tail. Brightly colored tails in lizards frequently serve to distract predators from the more vulnerable heads and bodies,

Dipsosaurus catalinensis is found only on Isla Santa Catalina.

but the bright tail color in these young iguanas often serves as a target for aggression by other iguanas. What selective advantage could be served by the latter? Again, a question with no certain answer. Maybe the orange color does distract predators effectively, maybe even to the extent that the apparently deleterious responses generated in conspecifics are negligible in comparison. Certainly, colors in the red to orange portion of the spectrum are known to elicit strong reactions in many species of iguanas.

One of the most curious differences of this species, however, is its solid, chocolate-brown throat. This is most noticeable in males and probably has some function in courtship or aggression. Certainly, many other species of iguanas regularly use throat and dewlap colors to signal status or intent.

Behavioral differences are profound and very evident after even casual observations. Unlike its docile cousin, *D. dorsalis, D. catalinensis* is difficult to approach and aggressive when cornered. This wariness is somewhat of an anomaly because insular lizards in the Gulf of California generally exhibit much shorter flight distances than their adjacent peninsular counterparts — and the most common explanation for this phenomenon is that the island populations are subjected to less intense predation pressures. However, during early April 1992, I noted that, of approximately 90 lizards observed, 35–40% had freshly regenerated tails, suggesting that predation on this population may be quite high. That, of course, might account for their uncharacteristically long flight distances. As noted above, I also have observed a great deal of aggressive behavior among hatchlings and juveniles, which are commonly seen biting and chasing each other. The orange tail is the body part most frequently bitten, and the number of individuals in those age classes with broken or regenerated tails seems disproportionately high when compared to populations of many other lizards. Although tail breakage is common in young animals too inexperienced to effectively evade predatory attempts, the percentage of broken tails in a population usually doesn't reach the level seen in very young Santa Catalina Desert Iguanas until the lizards are much older.

Dipsosaurus catalinensis occurs both in the arroyo bottoms, where it takes refuge in the thornscrub, and on the rocky hillsides, where it usually retreats in crevices between or under rocks. These lizards generally are active throughout the year, but the least amount of activity occurs during fall and winter months, when most individuals seen are juveniles. Smaller lizards heat up more quickly and they are presumably able to utilize the relatively limited environmental sources of heat more effectively than older, larger animals.

As with most diurnal lizards, *D. catalinensis* emerges in the early morning to bask and then spends most of the remainder of the day going about other activities like courtship, territorial defense, and feeding. *Dipsosaurus catalinensis* is omnivorous and probably exploits opportunistically the most abundant seasonally available foods. At certain times of the year, finding groups

Isla Santa Catalina, Baja California Sur.

Some populations of *Dipsosaurus dorsalis;* are established on islands in the Gulf of California. These individuals are from Isla Cerralvo, Baja California Sur. Note the longer head, the lack of a constriction near the base of the tail, the tail colored as the body, and the light throat.

of two to six individuals feeding communally on the fallen fruits of Cardón Cacti (*Pachycereus pringlei*) is a common occurrence. This is most obvious where the cacti occur in stands. I once found a carcass of an individual with an intestinal tract filled to capacity with Cardón Cactus seeds. The seeds were mixed with several small rocks of the same approximate size. These appeared to be chipping away at the seeds' hard outer covering, serving much the same function as pebbles stored in the gizzards of seed-eating birds or the much larger gastroliths that have been found with fossilized remains of herbivorous dinosaurs. In the large intestine, essentially only the shells were left, as the fleshy pulps had been digested. I also have seen iguanas as high as one meter above the ground in Pitahaya Ágria (*Stenocercus gummosus*) feeding on ripened fruits.

Dipsosaurus catalinensis serves as a good example of how insular situations can produce sometimes substantive changes in organisms over even relatively short periods of time. Faced with unique selection pressures, different suites of predators and competitors, and reduced genetic variation, populations will do whatever they are genetically capable of doing to continue the lineage. In the case of *Dipsosaurus*, nature has taken a common, docile species and sculpted its descendants into wary and aggressive lizards. What selective forces were responsible for this change? Are they still operative today? Are similar pressures molding populations of other insular lizards? If so, are they eliciting results comparable to those observed in the Santa Catalina Desert Iguana or are they having profoundly different effects on populations of lizards with different genetic compositions and lifestyles? These are some of the interesting questions that evolutionary biologists could be asking about *D. catalinensis*. A modicum of fieldwork leading to even tentative answers might teach us a great deal about the evolution of insular systems in general.

Reference

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SPECIES PROFILE

Banded Sand Snakes (*Chilomeniscus stramineus*)

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Sand Snakes in the genus *Chilomeniscus* have a circum-Gulf of California distribution very similar to that of Desert Iguanas (*Dipsosaurus*). Similar also is the association with sandy areas in open deserts, washes, and arroyos. Two species of Sand Snakes occur in the region: *C. stramineus* is most widely distributed and occurs on most of the Baja California Peninsula, in desert regions to the north and east of the Gulf, and on several Gulf Islands, whereas *C. savagei* occurs only on Isla Cerralvo.

Considerable confusion has clouded taxonomic relationships within the genus, most caused by the extremely variable patterns that range from distinctly banded to totally unicolored. Not until studies demonstrated that pattern variants coexisted at many localities was the clarification of relationships within the genus possible.

Sand Snakes are common in areas of loose soil and are an important component of many dune ecosystems. They are specialized for burrowing. A countersunk lower jaw and valved nostrils exclude small particles as these snakes "swim" through sand. Very smooth scales reduce friction both above and below the surface. Sand Snakes are nocturnal, but their abundance is obvious in some areas as a consequence of numerous tracks left in the sand by snakes that were actively foraging during the previous night. Sand Snakes apparently feed exclusively on small arthropods.

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Chilomeniscus stramineus from near Loreto, Baja California Sur, México. *Photograph by Robert Powell.*