UCSD biologists stage gecko wars to find out how invading animals win

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UCSD BIOLOGISTS STAGE GECKO WARS TO FIND OUT HOW INVADING ANIMALS WIN

Abandoned airplane hangars built in Hawaii during World War II are now serving as the staging area for another war, except this time the competing forces are two clans of small geckos.

For the past 40 years or so, the rival lizards have been waging fierce battles for survival on exotic ports-of-call throughout the South Pacific. To biologists at the University of California, San Diego, their struggle represents a classic model of how invading animals take over a habitat from an indigenous species. It also is an opportunity to study this process firsthand, with the abandoned airplane hangars serving as a laboratory for their observations.

"In ecology, we refer to the 'ghost of competition past' because you don't usually get to see the dynamics of these struggles work their way out," said Ted Case, UCSD professor of biology. "This was a real opportunity provided by these geckos."

In an article in today's issue of Science, Case and two of his graduate students, Kenneth Petren and Douglas T. Bolger, describe how they staged their own version of the gecko wars at Barbers Point Air Station in Oahu, and what they observed from their front-row seats.

Their results offer the first detailed look at how one species of animal replaces another in a specific location, in a process called competitive displacement.

"You see situations where invaders can cause a lot of havoc and you wonder what is it about some ecosystems that allows some invaders to come and repulses others," said Case. "These are the important questions."

To help find some answers, over the last five years Case and his graduate students have been studying the gecko wars across various tropical islands of the South Pacific, including Fiji, Samoa, Tahiti and Hawaii.

In each case, the battle followed a predictable pattern: the invader, the Hemidatylus frenatus--or common house gecko--hops from island to island, generally stowing away on a boat, plane or other vehicle of human transport. Once a beachhead is established, the house gecko--seemingly hypnotized by the bright lights and attractive insects under them--moves into urban neighborhoods that house the gecko's distant cousin, the Lepidodactylus lugubris, or mourning gecko.

For several thousands of years, human residents of the Pacific islands shared their domiciles with the mourning gecko, who arrived with the Polynesians colonizers of the region. Because all mourning geckos are

asexual females, who can lay eggs without any need for a mate, they populated these islands all by themselves. House geckos come in male and female versions, so only half of their species can lay eggs. However, they are generally longer and heavier than their asexual relatives.

Since World War II, house geckos have been invariably winning the battle for food and territory throughout the South Pacific, pushing the mourning gecko out of their urban homes into rural communities or island forests far removed from the bright city lights.

"The questions was, what makes the invading sexual competitor more superior to the asexual resident species," said Case.

In one experiment, Case and his graduate students placed the two competing lizards in glass enclosures and watched their gecko-to-gecko encounters up close. The results suggested that the larger house geckos were denying the smaller mourning geckos an equal opportunity to feast on insects.

To test this hypothesis and document what actually was taking place in nature, Case, Petren and Bolger designed an experiment that would simulate, as closely as possible, what was happening in the real world.

With the cooperation of the Navy, the group converted 18 airplane hangars--built following the attack on Pearl Harbor to protect U.S. planes--into gecko battlegrounds.

Each of the half-domed concrete structures--roughly 45-feet long, 55-feet wide, 18-feet tall--was renovated to keep a controlled group of geckos inside and trespassers outside. As a barrier, the team constructed a foot-high wall across the entrance, painted with a Teflon-like coating called Fluon that was too slippery even for the Velcro-like feet of the gecko. A strip of Fluon also was painted across the ceiling and along the walls to prevent any unwanted entrance or exit.

The hangars were fitted with eight friendly gecko hiding places, each made of black carpet and plexiglass. Half were equipped in the center with eight-watt fluorescent lights; the remaining hangars were unlit.

Once the remodeling was complete, the scientists placed 20 geckos into each hangar, using six different experimental designs, with and without light: mourning geckos alone; house geckos alone; house and mourning geckos together. All experimental populations were taken from lighted urban environments in which both species were present.

A census of the populations was taken every eight days, with geckos measured for weight, snout-length and egg production.

The results confirmed that the invader became competitively superior only in the lit environments, which attracted dense populations of insects. Under these conditions, the larger house gecko gained weight and thrived, while the smaller mourning gecko wasted away because it was denied access to food.

"We found that the submissive species retreats from the invader," said Petren.

Case noted that the mechanism exhibited for competitive displacement among these small lizards might provide a model for how other creatures are displaced as a result of human intervention.

"The implication here is that these native communities would persist and resist invaders if man hadn't come along and modified the habitat," said Case.

"Here, it was modified in a way to simplify the structure of the habitat to make a flat wall (of a building) where a gecko could see competitors coming and fight them off.

"In the forest, there would be more heterogeneous, three- dimensional structures and the food resources wouldn't be as concentrated in a few local points that are easily defended by aggressive males of a larger species.

"So you don't get that kind of rapid, competitive displacement."

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