



An annual excursion to an exclusive Caribbean island has yielded an impressive body of ecological fieldwork. Just don't call it a holiday, says **Mark Schrope**.

It's supper time on Guana Island in the British Virgin Islands and a dozen diners are relaxing on a candlelit veranda atop a cliff overlooking the Atlantic Ocean. They're enjoying a four-course meal and several bottles of wine. The privilege of staying at this very private resort — the only sign of civilization on the 340-hectare island — typically costs guests between US\$700 and \$8,000 per night. But these aren't typical guests. They're biologists, and if the constant talk of taxonomy isn't enough to prove it, they have physical evidence. After the meal, zoologist James 'Skip' Lazell (pictured above), produces from his shirt pocket a small bag containing a live snake, *Liophis exigua*. It had been captured that evening and would soon be measured and returned to where it was found.

Lazell, president of the non-profit organization the Conservation Agency in Jamestown, Rhode Island, has been coming to Guana every year for nearly three decades to lead a study of this distinctly unspoiled island's flora and fauna. He and a rotating crew of collaborators have produced what is arguably the most comprehensive, long-term record of the natural history of an island in the Caribbean, where high-volume tourism and frequent catastrophic weather shape the ecosystem. They have revealed a remarkably diverse ecological cast: including some 12 species of reptiles, 100 birds, 160 fungi, 330 plants and hundreds of insects, several of them new.

"I can't really think of another place where

exactly these kinds of data for a whole bunch of species all at the same time have been gathered year after year," says Daniel Simberloff, an ecologist at the University of Tennessee Knoxville. That record has lent itself to increasingly sophisticated ecological modelling approaches that may ultimately help to predict the regional effects of global climate change. Moreover, the work challenges the prevailing theory on what drives island biodiversity.

Development on the island has been minimal, making the place attractive not only to the 30 or so guests the island can house at any given time, but also to scientists: the island offers a relatively unspoiled baseline for healthy Caribbean plant and animal life. "It is in the best ecological condition and the least screwed up, certainly, of all the islands on the Greater Puerto Rico Bank," Lazell says. Most other islands in the region have undergone significant development and human settlement for at least some portion of their history.

Welcome to the island

But on Guana, before the resort there was only a short-lived Quaker plantation in the 1700s and a native American settlement centuries before that. Gloria Jarecki, who with her husband, Henry, bought Guana in 1975, says the plan had always been to maintain as small a footprint as possible, "and try to pass [the island]

on in the condition we found it in or better". So they were receptive when Lazell first proposed a long-term study of the island in the early 1980s. A foundation run by the Jareckis covers the cost of the team's accommodation in October, during tourism's low season for the area. Scientists typically only have to pay for travel. (The author of this article was similarly accommodated.)

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— James Lazell

One can be forgiven for assuming, as some of their colleagues have, that the whole enterprise is a tropical junket. In addition to the dinners, the team meets most afternoons on a palm-lined, white-sand beach with a well-stocked

bar. "It's about as cushy as you can get on the domestic end," says Clint Boal, an ornithologist with the US Geological Survey based at Texas Tech University in Lubbock, and long-time Guana team member. But the days on Guana are anything but pampered. The vast majority of the island is accessible only by rugged footpaths, some of which descend precipitously down boulder-strewn gulches. The scientists typically slog kilometres every day with their gear, conducting general surveys or working at regular study plots. "It is a very difficult place to work in many ways," Boal says.

For the first few years, the goal was mainly to catalogue the plant and animal species. In parallel with the survey work, Lazell also worked with the owners to preserve the ecosystem and restore it as much as possible to its pre-human

condition, recommending efforts such as limiting the population of wild sheep and removing cats, dogs and invasive plant species such as Australian pines. He also established a programme to replace animals thought lost, based on historic and archaeological records, including flamingos, red-legged tortoises, and critically endangered stout iguanas.

The team also watches island populations. For birds and reptiles, the researchers measure survival rates and demographics — data that could reveal the factors most important to maintaining a healthy Caribbean island. To monitor the birds, Boal and his colleagues spread lightweight mist nets across bird thoroughfares. After weighing captured birds and taking other measurements, researchers mark them with leg tags.

That doesn't work for reptiles, however, as many have legs that grow substantially and some don't have any. So, the team began implanting radio-frequency identification devices in 2001. Brent Bibles, a population biologist at Utah State University in Vernal, points to an adult stout iguana (*Cyclura pinquus*) on a trail near the resort. These reintroduced animals now number in the hundreds, from the eight that were brought to the island in 1984 (J. D. Lazell *Island: Fact and Theory in Nature* Univ. California Press, 2005).

The team hopes soon to begin recapturing adults. Bibles, who has bite marks all over his right hand from an encounter with a metre-long Puerto Rican racer snake (*Alsophis portoricensis*), is excited by the prospect. But at up to 30 kilograms, the iguanas, he says, are, "kind of nasty to handle".

Barry Valentine, a retired entomologist from Ohio State University in Columbus, has been collecting insects since he was ten. In 1946 he joined a group of adventurous undergraduates at the University of Alabama in Tuscaloosa. In his book *Naturalist* (Island Press, 1994), Edward O. Wilson describes chasing down specimens while hanging off the hood of Valentine's car. Still, it's difficult to imagine Valentine any more exuberant in his work than he remains today at 85. On a clear night, Valentine flips on a black light at his cottage and darts after interesting visitors.

Tropical futures

In recent years Valentine has found four new beetle species, but also some puzzling shifts in the number and types of various insect groups on the island. Most years he collects about 40 ground beetles, for instance; this year he found just six. He is working with others in the Guana team to see whether they can spot corresponding trends between weather patterns and animal populations. "There are always questions being raised," says Valentine, "Which is one of the things that makes it so much fun."

Some species of birds show troubling patterns with fewer young and lower body mass. Because the Lazell team's data set stretches back so far and covers so many groups, they can look for explanations for shifts in popula-



A team including Barry Valentine (top) catalogues insects, reptiles and birds on Guana Island.



tions. "That's exactly the kind of data you need to demonstrate the impacts of climate change," says Simberloff.

Boal, Bibles and others are looking at rainfall data from the National Oceanic and Atmospheric Administration to see if they can spot correlations between drought years and population declines, for example. Others are looking at water retention in the reptiles on the island for clues to how a changing climate could affect animals.

To Lazell, though, the most important application of the Guana data set, along with his related, but less extensive, studies on other islands around the world, is to inform the ongoing debate over whether mathematical formulae can reliably predict the diversity on a given island. One of the most prominent theories, proposed in the 1960s by Wilson and Robert MacArthur (R. H. MacArthur & E. O. Wilson *The Theory of Island Biogeography* Princeton Univ. Press, 1967), correlates the number of species on an island with its area. But the number of species on Guana far exceeds the theory's predictions, even ignoring reintroduced species. "We took the MacArthur-Wilson species-area notion and blew it out of the water," says Lazell, who is not known for mincing his words.

Lazell argues that human impact, although difficult to quantify, may be the main controlling factor of diversity. MacArthur and Wilson "were looking at islands that were just wrecked", he says, and that skewed their results. Overall, Lazell says that ecology may be too complex for broadly applicable formulas. Gad Perry, a herpetologist and conservation biologist at Texas Tech who helps to coordinate the Guana programme, has similar suspicions. "There are people that say this is not rocket science, but rocket science is so much simpler," he says. "Our systems have a lot more variables and that's what makes them interesting."

Simberloff, who was a student of Wilson's, agrees that a universal theory of biodiversity will probably remain elusive. "I don't think anyone would say that Guana resolutely rejects any prominent theories," he says, "but it could be that in a few years people reviewing literature on some particular theory might use Guana as one of several examples to say, 'Look, it doesn't hold up as strongly as we hoped.'"

For his part, Lazell says that more studies like those conducted at Guana may be needed. But, he says, "there's not much more I can do in one lifetime". Although he's crisscrossed the island more times than he can count, his health now confines him mainly to the resort, where he spends most of his time facilitating the work of others, and reigning as the self-proclaimed "Curmudgeon in Chief". As for Guana itself, with its trails through virgin forest and its collegial, candlelit dinners, his conclusions are difficult to argue. "This is my favourite place to do work," he says, "You can't beat it."

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