

10

Watching Lizards in the Savanna



The Surinam striped whiptail, *Kentropyx striata*, is common in the savannas of Alter do Chão. Photo by Bill Magnusson.

My essentially chance encounters with lizards were indicating that they had complex behaviors that made each species unique. As there was considerable interest in the early 1980s in how behavioral differences led to lizard species living in the same area having different diets, I decided to start some more detailed investigations of the relationship between diet and foraging mode.

Our first attempts were made near Alter do Chão, a small village nestled in savanna near the Tapajós River in the eastern Amazon. I had received a request from seven students from southern Brazilian states to do work study in the Amazon, so I suggested that they go to Alter do Chão in January 1982. The students were arriving by boat in Santarém, 25 km from the village, and I flew into Santarém the day before to buy food for the time we would be in the field.

Albertina suggested that we stay at her house overnight in Santarém and I accepted, even though I felt we were imposing. Her extended family lived in a group of three houses on the outskirts of Santarém that were reached through a narrow alley. The family was decidedly matriarchal. Albertina's great grandmother lived in one house, and her grandmother, aunt, two second cousins and a second niece in the second. Her mother, two sisters, one with a new born baby, her two-year-old daughter, her 6-year-old brother and her father, who was terminally ill, lived in the third, which was the size of a small sitting room with a semi-detached kitchen. All the houses were made of bare planks and roofed with sheets of corrugated asbestos-cement. Apart from her young brother, the extended family had no male that had not left, died or was dying.

I wasn't sure how we were going to fit in. The living/sleeping room in her mother's house was only about three arm spans long, two arm spans wide, and was already partially occupied with her father's bed. Nevertheless, when darkness fell, Albertina found room to string our hammocks together with the other five. It had been a long day and I was sleeping soundly when the door banged open and one of Albertina's male relatives, who used to live in the

house, barged in and pushed the hammocks with their occupants aside to get to where Albertina's sister was sleeping with her newborn baby.



Photo 10.1 Albertina Lima with her daughter Jaci in 1980. Photo by Bill Magnusson.

The irate male, who I'll call Ozório, took off his shoe and started to beat the young girl with it, who was huddled over trying to protect her baby. He screamed that she had dishonored the family by having a child out of wedlock and kept smashing his shoe into her. I looked at Albertina, she nodded, and I grabbed the drunken idiot and bundled him out of the house. I was shaking with rage and fighting to stop myself thumping the life out of him even though I knew that people only act the way he did when they have grave personal problems. In any case, he was shorter than I and stone drunk, so he may not even have known what I was trying to chastise him for.

I put him in an arm lock and pushed him down the alley. He was still muttering about dishonoring the family and that was when my restraint gave way. As I pushed him onto the street I gave him a kick up the backside that must have left his tail bone throbbing for hours and he staggered off.

My foot tingled a bit as I lay back in the hammock, but rage is a good anesthetic and I didn't realize that I had sprained my ankle until I tried to stand the next day. The best I could do was to hobble across to the tap in the front yard that served as the family wash room and try to cool it with water. I was now cursing myself. How was I going to do field work and take care of seven students with a sprained ankle?

Albertina gave me coffee and fresh bread for breakfast and I was feeling a bit better when Ozório turned up waving a knife and saying that he was going to get even. Hoping he hadn't seen me hobbling, I stood facing him with both feet firmly planted. I said in rudimentary Portuguese that I don't know if he understood "You know what I did to you yesterday. If I were you I'd put that knife down and go away before I have to knock you down again."

I stared him straight in the eye with a slight smile on my face as though I had faced so many six-inch blades in my life that the one he was holding was of no threat. He made a few tentative moves as though trying to get courage to strike, then put his head down, turned and slunk down the alley. As soon as he was out of sight, I stumbled over to a stool, sat down and gripped my throbbing leg so tight that I left white finger marks.



Photo 10.2 Left to right - student volunteers, Liliana de Paiva, Rosana da Rocha, Suely Marques, Christine Strüssmann, unknown child and Marcelo Meneghini in front of the house we rented at Alter do Chão in 1982. Photo by Bill Magnusson.

Ozório did not come back and my anger at him gradually dissipated into pity. Albertina's sister who he was berating for dishonoring the family is now happily married and one of the most respected employees of a federal institution. The baby Ozório was trying to beat up is now a police officer. In contrast, Ozório has never made much of his life. He is tolerated when he turns up, but the family gives a sigh of relief whenever he leaves; a sad creature seemingly without a place in the World. Sitting on that stool back in 1982, I was less angry at him than at myself for being so stupid as to have possibly injured myself so badly that I would have to cancel the field work and disappoint the students who had come so far to work with me.



Albertina did most of the organizing and I just hobbled along as she got the students onto the bus and installed them in the wattle and daub cottage with palm-thatch roof that we had rented at Alter do Chão. We did not know much more about the area than the students, but Dna Vivi and Sr Secundinho, who lived next door, took us all under their wings and resolved the domestic problems associated with a very rustic dwelling. Sr Brálio and Dna Nikita, another couple from down the street, also helped us enormously. Coincidentally, Sr Secundinho and Sr Brálio were brothers and Dna Vivi and Dna Nikita were sisters. The results of most of the dozens of studies we published about the fauna and flora of Alter do Chão over the next 35 years would owe much to the efforts of our adopted families, even though their names are not among the authors.

Many generalizations had been made about the relationships between the way a lizard foraged and its diet, based on studies in North America and Africa. Most researchers had just put the lizards into two categories: sit-and-wait hunters and wide foragers. These categories largely coincided with taxonomic families; wide-foragers were mainly teiids, lacertids or varanids, and sit-and-wait hunters were generally in other families. We figured that if we could measure how actively the lizards foraged, we would be able to compare species even within families.

There were seven major generalizations about lizards. Activity temperature, the weight of eggs relative to the weight of females, relative tail length, number of termites in the diet and overall food intake were thought to increase with the activity of the lizards while hunting, and the amount of active insects in the diet

and mean size of active prey were thought to decrease with the degree of movement.



Photo 10.3 Braulio (left) and Nikita (right) Vasconcelos (background) and Secundino and Vivi Vasconcelos (middle). Sr Braulio e Sr Secundino and their families were responsible for much of the success of our studies of savanna lizards.
Photos by Tânia Sanaiotti.

To test these ideas, we would have to watch lizards of several different species to see how they behaved and collect samples of each species to see what they were eating. I also thought that there might be a relationship between the number of individuals and the type of vegetation, some species preferring areas with more bushes and trees and others preferring areas with more grass. Because answering the second question required a lot of walking, I was considering abandoning it because of my sprained ankle.

The area on the peninsula between Verde Lake and the Tapajós River in front of Alter do Chão seemed ideal for the studies. The sandy beaches are backed by open savannas with scattered trees and bushes. The grass in the savannas tended to be either less than a hand span high, or in large tufts separated by bare ground. Therefore, it was relatively easy to watch free-ranging lizards without having to get too close to them.

Other researchers had followed lizards and recorded what they did, but they followed each individual only for a few minutes. We soon realized that we would have to follow them for much longer. The problem is that it is much easier to see a moving lizard than a stationary one. Therefore, most lizards will be moving when you first see them, either because you have disturbed them or because they are in an active phase, meaning that you will overestimate how active they are. We decided that we should only record data from lizards several minutes after we had found them and that we should use data only for lizards that we had followed for at least an hour. That turned out to be much more difficult than we had imagined.

Very often, we had been watching a lizard for nearly an hour when something disturbed it and it shot into thick vegetation so quickly that we couldn't follow it. At other times, the lizard would walk into one side of a patch of bushes and two lizards the same size would leave the other side, so we didn't know which one we had been following. Despite the setbacks, we slowly accumulated data on the behavior of each species.

There were four common species in the savanna. The most obvious was the rainbow lizard, not only because the males had bright blue heads and yellow down the sides, but also because there were many of them and they allowed us to get quite close as long as we moved slowly. They were only about the thickness of my little finger, but their almost constant movement attracted

attention. They moved in starts. An individual would walk or run a meter or so, stop, lift up its head and wave one or both legs as though saying “Come here.”



Photo 10.4 Lizards, such as this Surinam striped whiptail, forage in the ashes soon after a fire passes. Photo by Bill Magnusson.

After a half a minute or so, the lizard would start digging under the leaf litter or move to another position, always waving its front legs when changing from one activity to another. I had seen similar arm waving by bearded dragons¹³⁷ in Australia and had believed the story that it was a sexual display. As male, female and juvenile rainbow lizards waved their hands, I started to doubt that it had anything to do with sex, but I'll come back to that later.

Adult giant ameivas at Alter do Chão generally had reticulations on a grey background that were very different from the dark lines and almost uniform back color in the same species from forested areas. The reticulated pattern

dominates in most savanna areas within its range and would make the lizards inconspicuous if not for their bright blue tails.

Unlike the rainbow lizards, they were sensitive to our presence and we only managed to follow them at distance and watch their behavior with binoculars. They were much bigger than the rainbow lizards, some being as thick as a medium sized carrot, and they moved much faster. We could run as fast as the rainbow lizards and they avoided us by swift maneuvers, but if you startled a giant ameiva, it just shot off like a rocket, leaving nothing but the sound of rustling leaves in the distance. They used the same intermittent movements as the rainbow lizards, walking quickly from one place to another and then remaining stationary with head up for a short time before starting to fossick in the leaf litter. However, the rainbow lizard was the only species at Alter do Chão that waived its front legs.

The third species was the Surinam striped whiptail¹³⁸. Much like the forest whiptail in size and behavior, individuals spent most of their time fossicking in leaf litter under the scattered trees or perched in small bushes. They were relatively fearless and we could follow them close up, the lizards sometimes walking across our feet. If you grabbed one, it generally just lay calmly in your hand waiting to be released, behavior very different from the giant ameivas and rainbow lizards, which struggled violently and bit whenever they could.

All the species I have listed so far are teiids, but the fourth species we studied was the grass anole¹³⁹, in the family Dactyloidae. It differed from the others in just about every way. It was small, the thickness of a grass blade, with nondescript brown, grey and black stripes down its body making it look like a dead grass stem. It also moved little and never fossicked in the leaf litter. It just sat motionless on a vertical grass stem or twig until it saw an insect moving close by, ran to grab its prey, then returned to its head-down vertical position waiting for another victim. The main problem with the anoles was that they

were small enough to hide behind a blade of grass, and we would often lose concentration as they remained motionless for long periods.



Photo 10.5 The giant ameiva, *Ameiva ameiva*, at Alter do Chão, and most areas that the species occurs in savannas, has dark reticulations rather than the broad bands seen in individuals from forested areas. Photo by Bill Magnusson.

The only species of lizard at Alter do Chão I have seen being captured by a predator during that or subsequent studies is the rainbow lizard. On four occasions, I was watching a rainbow lizard running past a bush when a Lichtenstein's green racer¹⁴⁰ struck from under the bush and grabbed the lizard at mid body. The snakes were so well camouflaged that I would not have seen them if they had remained motionless under the bush and not struck the lizard.

The results of the foraging study¹⁴¹ basically just confirmed the general conclusions of other famous researchers, such as Eric Pianka, Ray Huey and Laurie Vitt. However, some of the details were a bit different. We did not find

relationships between foraging mode, relative tail length, mean size of active prey or overall food intake, but the more active lizards had higher body temperatures, more termites in the diet, ate fewer active insects and generally had lower relative clutch masses, at least within the Teiidae. While the hours I spent watching the lizards did not result in any major new discoveries about foraging mode and diet, I started to make links in my mind between activity, color, sex and predation that would only evolve into a general pattern several years later.



I had imagined that my sprained ankle would make it impossible to walk through the savanna. However, three days of taking it easy and walking slowly along the beach got my foot working again and I found that I could get about quite well, though I would not have risked running. My idea was to see whether the densities of the lizards, especially the rainbow lizards, were affected by the soil type, cover of bushes, or presence of other species, and whether the densities of lizards differed between the savanna and the beaches at the edge of the Tapajós River.

The plan was simple, distribute 200 m by 5 m plots uniformly across the savanna and along the beaches, record the density of bushes and soil type, and count the number of lizards of each species. This was much easier said than done. Some of the plots ran through thorny thickets that made it hard to walk, much less maintain a distance of exactly 5 m between observers. It is important to always sample randomly or systematically, so if a plot fell on a steep slope we had to scramble up it, even if that meant torn fingernails and knees, and sometimes risking rolling down a gravelly incline at a speed that could kill.



Photo 10.6 The misnamed Lichtenstein's green racer, *Philodryas olfersii*. Individuals from Alter do Chão are brown rather than green. Some authors consider it a different species. It is a major predator on savanna lizards. Photo by Bill Magnusson.

I had thought that we could rotate between studies and that some of the students would take responsibility for the surveys. However, the students preferred to watch the lizards and it was hard to convince anyone to accompany me for more than two days straight. I ended up surveying all the plots and miraculously my ankle held up.

I also learned a lot about hunting lizards. As we walked along the edge of the virtual plots, we generally didn't see the lizards unless they bolted. This was especially true for the grass anoles, which were virtually invisible until they darted away from our approaching feet. We would sometimes stop and scan the ground in front of us, but we would rarely see a lizard unless it moved. Even the bright-blue male rainbow lizards somehow seemed to disappear into the

background of fallen leaves unless they moved. The lizards obviously had the same problem. If one person circled around, the lizard would often pass between the other person's legs if they remained stationary.

I realized that we and the lizards had a hard time distinguishing objects when we were moving, mainly because everything was changing position relative to our eyes. However, if we remained still, it was easy to detect even the smallest movement against the stationary background. It takes an enormous quantity of calculations to take even slow steps, but our unconscious mind does it all for us and doesn't bother us with the details¹⁴². The problem is that concentrating on where we walk makes us essentially blind to almost everything else around us.

The difficulty of detecting a still object was brought home to me by a thermometer crisis. We could only survey for lizards when the air and ground temperatures were high enough for activity, and whenever we collected a lizard we had to measure its body temperature and the temperature of the air and substrate where we had found it. For this, I had brought along five mercury thermometers of the type used for industrial and scientific applications. The thermometers doctors use to measure our temperature when we are sick cannot be used for the extremely low and high temperatures that occur in the savanna.

At the end of each plot, the student stuck the thermometer into the ground or left it suspended in a bush to measure air temperature. We then moved to another plot. The problem was that the plots were not marked, and the student often moved several meters to one side to take the readings. If they forgot to pick up the thermometer, we would have to go back and look for it. I took to tying colored tape to the thermometers after we lost the first one, but even so we were down to only one by the end of the study. Sometimes, the student remembered about where they had left the thermometer, but stepped on it and broke it before they saw it. I had to spend several hours searching for the last thermometer, often crawling on my hands and knees, so that we could finish the

study. If only those thermometers had moved a little bit when we were near, we wouldn't have had any trouble finding them!



Photo 10.7 Grass anoles, *Anolis auratus*, look like a dead grass blade and are very difficult to detect unless they move, which they only do when they see something that they want to eat or if you are about to tread on them. Photo by Bill Magnusson.

We did find relationships between soil, vegetation and the density of rainbow lizards, but the animals didn't seem to care which other species were in the plots with them¹⁴³. The numbers on the beaches were also similar to the number expected for a savanna plot that was half covered by bushes and half covered by sand, as were the beach plots. Scientists are supposed to be looking for concepts that will change the way we think. However, it is reassuring, and much easier to publish when your results support what most other scientists are saying. These are the so called “Me too!” papers that just corroborate established thinking.

None of the results of our initial studies were particularly startling, but they gave the background I needed to ask more in-depth long-term questions about savanna lizards. Before I could do that, however, I had return to Manaus and dense Amazonian forest.

