Lizzie Peabody: Hey there, Sidedoorables. We are super excited about today's episode! It's the first of three stories we reported from the Smithsonian's Tropical Research Institute in Panama. I had a blast traipsing around the jungle and recording it. I hope you enjoy.

Lizzie: This is Sidedoor, a podcast from the Smithsonian with support from PRX. I'm Lizzie Peabody.

Lizzie: Meg Crofoot has spent her life studying primates—you know, monkeys, apes. But she's especially focused on capuchin monkeys.

Meg Crofoot: I mean, capuchins are—well, I think of them as devil spawn. [laughs]

Lizzie: What? Devil spawn?

Meg Crofoot: Yeah. So I did my PhD on these species. They ran me up and down hills for two years of my life. And while I think that they are deeply interesting, they're also—am I allowed to say this on the radio?

Lizzie: Yes.

Meg Crofoot: They're little [bleeps]

Lizzie: [laughs]

Lizzie: Even if you've never met a capuchin yourself, you'd probably recognize one. In the show *Friends*, Ross had a pet capuchin named Marcel. They're small and black with white faces. Cute—if you didn't know otherwise.

Meg Crofoot: They love to tear things apart. They harass every animal they find in the forest. I mean, when capuchins find a sloth, like, waking it up and, like, pulling its hair. You know, they're like poorly behaved children who are into everything and constantly doing things.

Lizzie: You might say all this mischief just comes with the territory of having a really big brain, which is what makes capuchins fascinating monkeys to study—they're really smart. For instance, not too long ago these monkeys did something that shocked even Meg.

Lizzie: See, Meg is an evolutionary anthropologist at the Max Planck Institute in Germany, and she does research at the Smithsonian's Tropical Research Institute in Panama, known as STRI. One day,

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she was sitting in the cafeteria at STRI having some lunch, when a botanist named Alicia Ibanez planted herself at Meg's table and told her a story.

Lizzie: Alicia had been working on an island off the coast of Panama called Jicaron when she heard something that sounded like rocks being thrown in the distance. When she got closer, she saw some capuchins hoisting stones over their heads and smashing them down on nuts, busting them open to get the tasty food inside. And she was like, "Oh, cool. I should tell Meg. She loves capuchins!" But when the botanist told this story in the cafeteria, Meg did a spit take and was like, "Wait. What?"

Meg Crofoot: Yeah, it was very much like that.

Lizzie: Meg says her colleague seemed to think this was no big deal.

Meg Crofoot: She knew I would be interested. She thought it was kind of a cool thing that she'd seen, but I don't think she realized that it was unique in the way that it was.

Lizzie: See, this was a big deal because very few animals use tools—even something as simple as using a rock to smash open a nut. In fact, we humans used to think only we could use tools. It's how we defined humanity. But here were these capuchins in Panama, like, "Yeah, we use tools. No big deal." Something that had never been seen before with these specific monkeys.

Meg Crofoot: Despite being incredibly well studied. So I knew that it was this unique thing that she had observed.

Lizzie: What led this single group of capuchins on this particular island in the Pacific to enter the stone age? And how could these little devil spawns' decision to pick up tools help us better understand our own evolution? This time on Sidedoor, we go monkeying around in the jungles of Panama to find some answers. That's coming up after the break.

Lizzie: Claudio Monteza knows more about monkeys than he had ever imagined he would.

Claudio Monteza: Nowadays, I say that I speak Spanish, which is my native language, then English, a little bit of Portuguese, and I speak primatologist.

Lizzie: [laughs]]

Claudio Monteza: Intermediate level.

Lizzie: Claudio is a fellow at the Smithsonian's Tropical Research Institute in Panama. And if you're

like, "Wait, I thought the Smithsonian was a bunch of museums in DC?" Well, besides museums, the Smithsonian has research centers all across the globe, like this one in Panama. It's where Meg, Claudio and dozens of other researchers are based. Meg Crofoot is Claudio's PhD advisor, and after the botanist spilled the tea about capuchins using stone tools on Jicaron Island, she came to him and said, "Claudio ..."

Claudio Monteza: "This is a great discovery." [laughs] "Like, this is phenomenal. This is super cool!" And I was like, "Okay, these are monkeys."

Lizzie: Nevertheless, Claudio agreed to help Meg track down these capuchins. See, he'd worked on the island where they'd supposedly been spotted, but studying monkeys comes with some unique challenges. The first of which is finding them.

Lizzie: I'm hiking with Claudio on an island in the middle of the Panama Canal called Barro Colorado Island. It's essentially the heart of the Smithsonian Tropical Research Institute. It's covered in lush tropical forest, but if you look closely, you'll see sensors strapped to trees, cameras for tracking animals, lasers for scanning. Who knows? All sorts of research happening in every direction.

Lizzie: This is an incredible tree. Wow!

Lizzie: And that's why I'm here: to see Smithsonian research with my own microphone. Right now, Claudio and I are searching for capuchins so I can better understand his research. But capuchins aren't the only kind of monkey here on Barro Colorado Island. And before long ...

Lizzie: Oh my gosh, it's a little brown guy right up there. See?

Claudio Monteza: Yes. Quite a few. Those could be the howler monkeys just because of how slow they move. It's a more steady walk through the canopy than the capuchins.

Lizzie: The howler monkeys crawl through the upper branches of trees like a pack of brown cats. The canopy is so dense they don't even have to hop from one tree to the next.

Lizzie: Gosh, they're so small. They make such a big noise.

Claudio Monteza: Yes, it's impressive how far the vocalization of howler monkeys can travel through the forest. Like, you could hear that about a mile away from their location.

Lizzie: Claudio says howlers, just like capuchins, move in groups for safety. And that's essentially how they live their whole lives—clustered together as a community, or in primatologist speak, a colony. And it's not long before we spot another form in the trees, with long, dark gangly limbs.

Claudio Monteza: So now we have the spider monkeys.

Lizzie: [gasps]

Claudio Monteza: Which is very hilarious to see two species in less than 10 minutes of our hike.

Lizzie: Wow!

Lizzie: The spider monkey limbs are almost as long and skinny as their tails, making it look like they've got a bunch of thin legs, just like a spider.

Claudio Monteza: I mean, seeing them every time is super impressive because as you can see, they have, like, very long extremities. Their arms and legs are, like, super long.

Lizzie: Oh, there they go!

Lizzie: So we spotted two different types of monkeys almost immediately, but as we followed the trail deeper into the forest, we still hadn't seen any capuchins.

Lizzie: How important is it to be quiet as we're looking for them?

Claudio Monteza: Not much. [laughs]

Lizzie: Okay. They're not too shy?

Claudio Monteza: Yes. Capuchins are not very shy.

Lizzie: 30 minutes more and we've seen walking ficus trees, amazing roots, tons of cool birds, a gazillion bugs—but no capuchins.

Lizzie: About how big are these monkeys?

Claudio Monteza: Uh, not that big. They could be ...

Lizzie: Like a small dog?

Claudio Monteza: Well, I don't know much about dogs—in English, nor in Spanish or in any other language.

Lizzie: [laughs]

Lizzie: We never saw any capuchins—little [bleep]! But the search gave me a little taste of the challenge Claudio faced when he set off to find the fabled tool-using capuchins on the island of Jicaron.

Lizzie: Jicaron is not like the island I've been walking on with Claudio. It's almost 40 miles off the coast of Panama in the Pacific Ocean. There are no buildings, no electricity, not even trails.

Brendan Barrett: On Jicaron, there is zero human infrastructure, and there's only two places one can reliably land a boat.

Lizzie: This is Brendan Barrett. He's a research scientist at the University of Konstanz and the Max Planck Institute of Animal Behavior, and one of Claudio's colleagues. Now the botanist had told them what side of the island the monkeys were on, but they still had no idea what to expect when they got there.

Brendan Barrett: We didn't know if we could walk there, if the place was going to be shut off by the coast.

Lizzie: So they found a spot where they could anchor the boat close enough to swim to shore. Of course, they'd have to swim through waves crashing on the rocky shoreline, keeping an eye out for sharks, stingrays, maybe even a crocodile.

Brendan Barrett: So we loaded up our cameras and our equipment in dry bags, put on life vests, jumped in the water, did a combination of swimming and crawling to get to land to see if there were things at the site.

Lizzie: Safely ashore, they searched the island—for days. On their last day, they stumbled into what looked like the monkey equivalent of an industrial kitchen.

Brendan Barrett: There was zero doubt in one's mind that that was what was going on.

Lizzie: There was a stone sitting on top of a busted open hermit crab, and this was on top of a well-worn log that the monkeys had used as an anvil—essentially a hard surface where they would place whatever they wanted to smash open. There was also a stone anvil surrounded by husks of thousands of sea almonds, scattered around like peanut shells.

Brendan Barrett: If you've ever had a time machine and went to a bar in the 1800s where they throw

sawdust on the ground ...

Lizzie: Uh-huh?

BBrendan Barrett: There was just, like, littered debris.

Lizzie: Shells everywhere. Hermit crabs, snails, nuts.

Brendan Barrett: And it was one of these things that we saw at these tool sites when there's a lot of activity. There's no way to mistake it for anything else, and it leaves such a clear signature.

Lizzie: Brendan and Claudio clearly had evidence that the capuchins were using stones as tools to smash open these shells. But they needed to catch the monkeys in the act. They only had an hour before high tide made it impossible to get back to the boat, so they quickly set up a bunch of cameras to record videos and pictures. And then they swam back to their boat through crocodile-infested waters and went home. And a few weeks later, when they pulled the footage up on their computers, one thing was clear: capuchins love cameras!

Claudio Monteza: There are a lot of selfies of them on my dataset.

Lizzie: [laughs]

Claudio Monteza: Which is cool, but at some—it's just distracting.

Lizzie: [laughs]

Lizzie: Little fuzzy white faces cheesing on camera are great, but Claudio was more interested in what he saw going on in the background. This is a video captured by Claudio and Brendan. In the center of the frame you see a capuchin monkey. He's facing the camera. The top half of his body is white, the bottom half is brown. He's on the edge of a stream standing on a log, holding a rock bigger than his own head.

Brendan Barrett: This is Spot, actually. You can see this white spot above his left ear.

Lizzie: Oh, he has a name?

Brendan Barrett: Yeah.

Lizzie: Spot hoists this massive rock over his head with both hands, and then brings it smashing down on an almendra nut—also known as a sea almond—using all his monkey power. And he's pretty

jazzed about it.

Brendan Barrett: He's kind of like jumping around. He picks up his left foot.

Lizzie: [laughs]

Brendan Barrett: He's kind of dancing around, like he's jumping up with both legs and lands on one foot.

Lizzie: Uh-huh.

Lizzie: He's doing the Spot Trot. And it's not actually that successful. Sometimes he sends the unsmashed nut flying away, so he grabs it and places it back on the anvil to try smashing it again. Brendan says he's a young capuchin, an "angsty teen," so to speak. And he's still got some technique to learn. But eventually ...

Brendan Barrett: You can hear the pitch of the almendra change as he's hitting it.

Lizzie: Hmm.

Brendan Barrett: And at one point it gets this high pitched thing, which is when the endocarp cracks.

Lizzie: Endocarp means shell.

Lizzie: Oh, I heard it!

Brendan Barrett: And that's when the endocarp cracks, and they can actually access the nut from the inside.

Lizzie: Score one for Spot! He pulls the nut from the busted shell, puts it in his mouth and enjoys— spitting a few shell fragments out as he does. Brendan and Claudio now had documentation that these capuchins were using stones as tools, a groundbreaking—or nut-busting—discovery. And to be clear, there is a cousin of these monkeys called robust capuchins found in South America. And they've been seen using stones as tools, but they're a totally different species than these capuchins in Panama—about as different as humans and monkeys. And so this new discovery in Panama raises a lot of questions.

Lizzie: First of all, why? Why would these capuchins start using tools? After watching the videos, the answer seems pretty simple: food, right? Well that's true, but there's a 'but' here. And it's a big one. Capuchins on mainland Panama aren't using tools for food.

Lizzie: So what's different between mainland Panama and Jicaron Island? Brendan says there's a clue in some of the video footage of capuchins on the island.

Brendan Barrett: I've seen videos of capuchins at 6:00 pm at night laying on the ground near the beach taking naps.

Lizzie: [laughs]

Brendan Barrett: Which is not something that normal monkeys would do because that's not a good place to be.

Lizzie: Right. On the mainland, what might happen to a monkey taking a nap on the beach at 6:00 pm?

Brendan Barrett: They would get eaten.

Lizzie: If you compare mainland Panama with Jicaron, one thing becomes really clear: capuchins on Jicaron have no predators.

Meg Crofoot: There are no ocelots, there are no puma, there are no jaguars to eat them.

Lizzie: On the mainland, capuchins spend almost their entire lives in the trees. If they come down to the ground, there's a good chance they'll get eaten by a big jungle cat. And Claudio would know. He's studied capuchins on the mainland as well.

Claudio Monteza: In terms of the amount of pictures that I will get of the capuchin monkeys on the ground, it will be just like two pictures per month, and maybe two individuals on the ground. But it was really rare to see them on the ground.

Lizzie: Island living appears to be a big factor in this evolution towards stone tool use. There are no predators, so the capuchins can come down from the trees. And Meg says once they're on the ground, a whole new world opens up to these monkeys.

Meg Crofoot: The stones are on the ground, the anvils are on the ground, the fruit is on the ground.

Lizzie: But the monkeys still have to put the pieces together to say, "Hey, maybe I can use this rock to smash open that crab shell." Again, this innovation might come from the fact that the capuchins don't have to worry about being eaten.

Meg Crofoot: Like, if there were ocelots hunting around and you're sitting there doing this loud, super obvious thing that could bring them in?

Lizzie: Right!

Meg Crofoot: It tells them where you are. And then also you're so focused on what you're doing that maybe you don't notice the coming predator. All of that seems terribly risky, but on this island ecosystem, they're on the ground and they don't have to be worried.

Lizzie: Here's the thing though: Meg and her team hadn't found evidence that tool use was spreading to other capuchin groups on the island. And Jicaron is just one of several islands off the coast of Panama with capuchins—many without predators as well. So the question kept coming back: why here? What makes these capuchins special? Well, Claudio stumbled on a discovery—almost literally—that would help them make sense of it all. We'll have more, after the break.

Lizzie: Claudio Monteza and his colleagues had seen and documented one group of capuchins using stone tools on Panama's Jicaron Island, and they thought these were the only capuchins in Central America doing this. That is until Claudio set off on a work trip on a neighboring island.

Lizzie: Coiba Island is the biggest island off the coast of Central America, and is known as The Devil's Island because it was once a penal colony. While Claudio was on Coiba, his colleague forgot something in the boat, ao Claudio sighed and was like, "Fine, I will sit here by this stream and wait for you." And while he was sitting there ...

Claudio Monteza: I saw stones on top of rocks or other stones.

Lizzie: And he thought, "That's weird. It's dry season. Stones shouldn't be stacked like this."

Claudio Monteza: Maybe in rainy season, a floating event could by chance ...

Lizzie: Oh yeah. The water could move the rock.

Claudio Monteza: Yes. But in dry season, very unlikely.

Lizzie: And then he saw another pile of stacked rocks.

Claudio Monteza: And then a third one, and then I keep finding more and more until it was a pattern.

Lizzie: The only other place he'd seen rocks stacked like this was on Jicaron, and he thought, "Wait. Does this mean what I think it means?" So he told Meg and Brendan what he saw.

Brendan Barrett: And we went back there, and we saw what looked like pretty unmistakable evidence that tool use was going on at this other site on Coiba.

Lizzie: Coiba is nearly four miles away from Jicaron, way too far for capuchins to swim.

Brendan Barrett: These islands have been isolated from each other and the mainland for I'd say 12 to 18,000 years. So I think it's very likely that these are independent innovations because of how far apart they are.

Lizzie: All the evidence suggests that these capuchins decided to pick up stone tools completely uninfluenced from their neighbors from Jicaron Island, which makes some amount of sense. The environments on both islands are similar: no predators, lots of coastline and hard-shelled food like crabs and sea almonds. So it looks like these capuchins essentially adapted similarly to their unique environment. But this is where it gets tricky.

Lizzie: Just like on Jicaron, Claudio and Brendan set up video cameras on Coiba to confirm what they suspected. But when they got the footage back, they saw something that left them feeling the way I feel when I eavesdrop on a couple of Gen Zers.

Brendan Barrett: Intrigued, frustrated, puzzled and excited.

Lizzie: On Jicaron, only the male capuchins were using stone tools, but here on Coiba, both male and female were smashing things with rocks. So extra!

Lizzie: So why do we think only the male capuchins are using tools on Jicaron?

Meg Crofoot: Ooh, you got all the good questions.

Lizzie: Meg says this is actually pretty confusing, so she and her team put their thinking caps on, trying to figure out why only the males would be using tools on Jicaron when both sexes were using them on Coiba. They flung every idea they had at the wall, hoping something would stick.

Meg Crofoot: So maybe it's that females don't like to be on the ground. They're more scared, they're more nervous about predators, and so they're not in the place they would need to be to use the stone tools.

Lizzie: Nope. There are plenty of female capuchins on the ground. Who do you think was napping on the beach at 6:00 pm?

Meg Crofoot: It might be that they're not strong enough.

Lizzie: Okay, not a bad theory. Female capuchins are physically smaller than males.

Meg Crofoot: But we see juvenile males, even little juvenile males, who are much smaller than the females doing it.

Lizzie: Maybe it's simply that the females work a little smarter, not harder.

Meg Crofoot: Why would females bother to spend the time bashing open nuts if they can make the males do the work and steal the food from them?

Lizzie: I was really hoping this was the reason, but sadly, no.

Meg Crofoot: Nothing that we've come up with so far has been held up by the data. Like, we still don't know.

Lizzie: Okay, so you might be thinking, who cares if it's males or females using tools? Well, it's a pretty big deal because primate hierarchies are so well established. See, capuchins are what scientists call "matriarchal." That means females hold all the positions of power. Think Barbie Land. The female capuchins stick together, and the male capuchins—aka the Kens—leave the group when they're old enough to start their own families.

Lizzie: Since males are using tools on Jicaron, you'd expect them to spread tool use when they leave the nest, so to speak. But that's not the case. Even though it's the males using this cool new skill, they're not spreading it to the neighboring groups of capuchins on the same islands.

Lizzie: Why wouldn't this spread to other capuchin colonies?

Meg Crofoot: Well, that is the question. It's one of the most exciting and confusing and frustrating things because we don't know yet.

Lizzie: And it's not like capuchins can't teach each other stuff. They're actually really good at learning from each other. Brendan has worked with capuchins in places outside Panama, and he's seen some of the weirder behaviors capuchins learn from each other.

Brendan Barrett: In Costa Rica, they have this wide array of bond-testing rituals and social traditions like hiding things in each other's mouths and trying to pull them out.

Lizzie: It's like a game they play with each other. They also take turns sniffing each other's fingers—kids, just don't try this at home.

Brendan Barrett: Knuckles deep in their noses for hours at a time, doing the same with their fingers in each other's eye sockets.

Lizzie: What? Oh gosh!

Brendan Barrett: Like, two knuckles deep in these trance-like states with fingers in each other's eye sockets.

Lizzie: These are bonding rituals?

Brendan Barrett: They're interpreted as bond-testing rituals, but there's a lot of stuff that capuchins will do that seem to have no clear adaptive purpose. One might say that I'm testing my friend's relationship.

Lizzie: In other words, it's monkey see, monkey do when it comes to really weird and seemingly pointless stuff. But not when it comes to useful skills, like how to get snails out of their shells. Or could it be that this skill isn't actually as useful as we'd think?

Meg Crofoot: It seems counterintuitive that, like, you can access a new food, but maybe you're better off spending your time doing less complex, simpler things to get your food. And this is actually—I mean, it's just sort of a niche fad of this one group, and it doesn't actually help them that much. I mean, we don't know yet, but we will be able to know that.

Lizzie: It's like VR goggles of the capuchin world.

Lizzie: There's also the possibility males on Jicaron aren't leaving the nest anymore when they're sexually active. They're like, "I've got tools. Why would I leave?" Meg thinks that might be causing the females to leave instead, completely flipping the entire social hierarchy on its head. What she calls a clear illustration of how our environment can change and shape our social structure.

Meg Crofoot: I mean, we don't know. It's just a hypothesis at this point, but I'm really excited to find out the answer.

Lizzie: There's still a lot of unanswered questions about what's causing capuchin monkeys on Coiba and Jicaron to pick up stone tools, but Brendan says one thing is clear: the more we learn about these monkeys, the more we can learn about ourselves.

Brendan Barrett: Our earliest window into human evolution is stone tool use. And it's stones because that's what preserves in the archaeological record.

Lizzie: We can find the stone tools left behind by our early human ancestors, but we can't rewind the tape to see why they picked up tools or how they used them. And that's where our genetic cousins, the capuchins, can come in so handy, because we can watch them on their journey into the stone age.

Lizzie: These mischievous little devil spawns are like a window into our own past. If we can figure out why they came down from the trees and picked up tools, we might better understand why we did the same thing hundreds of thousands of years ago.

Claudio Monteza: My gamble goes on predation risk, but there are plenty of researchers that will roast me just for saying that because they also have a lot of evidence that suggests otherwise. But we'll see. [laughs]

Lizzie: You've been listening to Sidedoor, a podcast from the Smithsonian with support from PRX. This is the first episode from our Sidedoor road trip through Panama. In the next two episodes, we'll travel to a coffee plantation in the mountains of Panama to try the world's most expensive coffee.

Lizzie: So you said it gives you more information if you slurp it up and you get it all into your palette? Okay, I see. [coughs]

Lizzie: And literally climb above the trees to learn if those carbon offsets you pay extra for actually mean anything.

Lizzie: Hopefully these helmets will not be useful.

Sergio: If you fall off the tower, no they're not very useful.

Lizzie: [laughs]

Lizzie: To learn more about capuchins using stone tools, and to see some of the videos Claudio and Brendan recorded, check out our newsletter. You can subscribe at <u>SI.edu/Sidedoor</u>. We'll also share some photos of our monkey chasing in Panama.

Lizzie: For help with this episode, we want to thank Claudio Monteza, Brendan Barrett and Meg

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Lizzie: Our podcast is produced by James Morrison and me, Lizzie Peabody. Our associate producer is Nathalie Boyd. Executive producer is Ann Conanan. Our editorial team is Jess Sadeq and Sharon Bryant. Tami O'Neill writes our newsletter. Episode artwork is by Dave Leonard.

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Lizzie: If you have a pitch for us, send us an email at Sidedoor(@)si.edu! And if you want to sponsor our show, please email sponsorship(@)prx.org.

Lizzie: I'm your host, Lizzie Peabody. Thanks for listening.

Meg Crofoot: There are groups that train them to be aid animals to paraplegics, for example, which has always seemed like a bit of a bad idea to me, given their penchant for troublemaking, but ...

Lizzie: That would not be your assistance animal of choice?

Meg Crofoot: It would not be my assistance animal of choice. No.