

# Smologies #3: TOADS with Priya Nanjappa

## Ologies Podcast

### August 4, 2021

Oh hey, it's the dog in the backseat of the car next to you, Alie Ward, back with Episode 3 of *Smologies*, bite-sized, classroom-friendly versions of our deep dive *Ologies* classics. And this one makes me so *hoppy*, because toads. Get it? Hoppy.

Are toads the unsung underdogs? Are they warty friends, yet to be made? Do they belong in a heap of canceled beasts who don't deserve our admiration? You'll find out.

Okay. Bufology. Let's go down a toad hole. Let's get the hell into it. So bufology is a word that I did not make up; although it's seldom cited, to be fair. A 2011 *Reptile Magazine* article titled "Ode to a Toad" uses the term 'Bufology 101', so I'm going with it. There's also herpetology, which is reptiles and amphibians, there's batrachology, which is the subfield that is just amphibians and which I may have pronounced wrong. But what if I want to do a frog episode down the line? Or one on newts?

So, I'm going with Bufology, because it exists, people use it sometimes, also its root is *bufo*, the Latin for 'toad', which may come from a word meaning slimy plant, or it may also come from *bufare*, meaning to puff up, and 'buffoonery' is a related word. It's debatable, like toads, for some people.

Speaking of people, get ready to hear a scientist passionately describe a love of toads. She's so human. I cherish her. She was once the program manager for the Association of Fish and Wildlife Agencies where she also served as a national coordinator for Partners in Amphibian and Reptile Conservation. She worked as a biological science technician for the US Geological Survey, and now works in the non-profit ecology sector at Conservation Science Partners. But is still in the field a bit, out toading, and salamandering, and frogging, and newting. So hop on in to a conversation with amphibian enthusiast and Bufologist, Priya Nanjappa.

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**Aside:** Okay but what makes a toad a toad?

**Alie:** Straight away, what is the difference between a frog and a toad?

**Priya:** So, generally speaking, most frogs have smooth skin, they tend to need a closer association with water or aquatic environments. Then the toads that we traditionally know, with the big stout, fat bodies, and the warts, and everything, they typically can be away from water longer, and they don't need as much of that, sort of, direct moisture the way that frogs do. And then they also secrete these toxins from their skin. That's the biggest thing. There are some frogs that do that as well. But pretty much all toads have some sort of gland and they secrete some sort of bufotoxin.

**Alie:** Bufotoxin! Sounds like such a good punk band. "We're Bufotoxin!"

**Priya:** Right? Yeah.

**Alie:** Is their skin thicker? And what exactly are the warts? Are they "warts"?

**Priya:** That's a good question. These warts on toads are associated with mucous glands and granular glands. But the granular glands are the ones that are responsible for the toxic secretions. It's for anti-predator defense so that when anything grabs it, it just tastes bad, and they spit it out, or sometimes they'll get sick. Some of the toads produce some pretty strong toxins. So, all toads are frogs, but not all frogs are toads.

**Alie:** Oh, I love those. It's the old "All cactus are succulents, not all succulents are cacti."

**Priya:** Yes, exactly. Or like in the amphibian world, there's newts, all newts are salamanders but not all salamanders are newts. Newts are to salamanders like toads are to frogs. Early lineages of toads, they look more froglike, and over time, those different features, the more stout bodies, and the bigger warts and glands, appear later in evolutionary history. They came after frogs, so somewhere in that Cretaceous-Cenozoic period. They've been around.

**Aside:** To recap: toads are frogs, and toads have no teeth, yes for warts, they've got a poison gland behind their eye called a parotid gland, thought to have been an adrenal gland just gone bonkers. Oh, and another souped-up special feature not available on the standard frog model:

**Priya:** And the other really weird thing is that toads have this thing called the Bidder's organ, which sits kind of between the kidneys and the gonads. And I think both males and females have them, but they're thought to be like a primitive ovary.

**Alie:** What!?! [slowed down: "Whaaat?"]

**Priya:** Kind of like a spare set of follicles, but the males have it too. So in experiments in the lab, they've removed the testes, and all of a sudden this Bidder's organ is like, "Oh! Okay! Time for me to come into play!" and it starts forming eggs.

**Aside:** How long have toads had a place in her life and her heart?

**Priya:** I remember my first toad sighting, which was in my mom's garden, in Iowa. It just would hop along the tomato plants and eat things, and eventually we figured out we could build a little toad hut, like out of a pot, and put that in there and it would just go and hang out. I was so sad on the days when I didn't see it, like I'm sure it was all seasonal but I don't remember the specifics of it. But I do remember other people's houses where there'd be one sitting under the gutter, eating the flies and stuff like that. And I liked other critters too, but there was something about the toads that I just kept coming back to, that I just kept... I don't know. I just love them. They just have that face, you know? It's just that face.

**Alie:** I love that you had a toad friend! Like, that toad was your friend.

**Priya:** [laughs] It kind of was my friend.

**Alie:** Are the males bigger than the females?

**Priya:** The females are bigger than the males.

**Alie:** By a lot?

**Priya:** Yeah, by a lot. Usually by quite a bit.

**Aside:** Oh, and both have tympanums to hear sound, such as for example, the romantic screamy love ballads man-toads make by inflating an air sac like a big extra chin, kind of like having a subwoofer on your face.

**Priya:** So, another thing that's really cool about toads is they have a lot more bony material in their skull. Their skulls are highly ossified, and those crests and the shape of those crests are what you can use to distinguish species when they are in the same area and you have a lot of similar-looking little brown toads with warts. Other than the warts-per-spot. In the dark brown spot, there'll be two or three warts if it's an American toad, and then if it's a Fowler's toad or a Woodhouse's toad it'll have more in each dark spot.

And then there's the shape of the parotid glands, which are the things behind their eyes that produce more of the toxic secretion, and then those little crests and bosses and ridges and everything. That's how they differentiate themselves. So yeah, they have these really cool skulls. Frogs don't have that.

**Aside:** So, next time you see a toad, it's absolutely okay to say, "Hey, what's up? Your skull looks *toadally* cool. But where can you see a toad?"

**Alie:** Are toads on all continents?

**Priya:** Everywhere except Australia, which right now is being overrun by the invasive cane toad.

**Alie:** Oh really?? Australia got a little bit ripped off on the toad card and then they got payback.

**Priya:** Yeah, kind of. And they didn't used to be on Madagascar either but now there's a different toad that is found on Madagascar that's also super invasive and wreaking havoc. Unfortunately, the toads that are finding their way to places where they never were are the ones you just don't want to be there.

**Aside:** Okay let's loop around back real quick and talk about cane toads, shall we? Okay, great. So, these are these huge toads. They're also called marine toads, even though they're terrestrial. But the largest recorded one measured over 9 inches long.

They look like holding a big leathery pretzel roll but with legs. They eat everything from live bats, sometimes plants, to bugs, to dead animals, to just straight-up garbage. Sometimes just literal, actual garbage.

Another reason we love toads? They're not too picky. Can you ever have too many toads? In some places, perhaps, like those so-called marine-but-actually-terrestrial toads in Australia, the cane toads. Why are they there?

**Priya:** So, it was like where they were growing sugar cane, they had brought them there to control the bugs that were eating the sugar cane. And then of course, anytime you bring a thing to control the thing that you don't want, then that thing goes crazy. So, they're these big, beefy marine toads, so they can tolerate saltwater environments, but they also apparently can live all over the place.

**Aside:** Does Priya have a favorite toad? Yes. She has a soft spot. She has a soft, warty spot for American toads because they were the first she saw in the Midwest, but she did clarify that they no longer belong to the *Bufo* genus. North American toads are now classified *Anaxyrus*, which sounds like a very cool rebrand, if you ask me. *Bufo* versus *Anaxyrus*? Reminds me of the time my goth friend Ben wanted us to call him Sebastiane. But unlike *Anaxyrus*, it didn't stick. I'm sorry Sebastiane.

**Priya:** They're a little bit fatter and their eyes are just a little bit more, like, bulbous. So, I really kind of fell in love with them, but there's some really pretty toads, too. In the Southwestern US there are these green toads, and then these red-spotted toads. Especially in South America. I haven't really seen all the bufonid species that are down there, it would take millions of years; there's so many species of toads all over the world. They are really diverse and interesting.

**Aside:** PS, how many species of toad are out there, hoppin' around and frowning? It's over 600! And some look like dead leaves with a face, and some are beautiful rainbow colors, some we haven't even discovered yet, right now, just kickin' it in a hollow, I think.

**Alie:** Is that where toads live? Do they live in toad hollows? Do they live in little carved-out spots in trees and stuff?

**Priya:** Pretty much in burrows of different sorts; some of them can do a little bit of digging but a lot of times they'll live in other mammal burrows and things like that.

**Aside:** Do toads ever get chilly?

**Priya:** They don't freeze like some frog species can totally freeze in the winter. They produce this antifreeze, but toads don't do that. They just go underground below the frost line where it's just warm enough that they can survive through the winter. They hibernate, but they don't freeze; they just live underground.

**Aside:** Don't freeze? That's handy. Speaking of hands:

**Alie:** True or false: Toads have arms?

**Priya:** [*gasps in delight*] Yes, they do! [*laughs*]

**Alie:** Thank you! I don't feel like toads have four legs! I feel like they have two legs and two arms.

**Priya:** They do!

**Alie:** Toads have arms!

**Priya:** They do have arms! I mean, they're like little Popeye arms, right? Couldn't you just see a little tattoo on those little forearms? They're sooo fat. And the males have fatter forearms on purpose, to clutch on the ladies. Yeah, they have arms.

**Alie:** Okay *thank* you!

**Priya:** You will see it in different places and references, about their arms.

**Alie:** Really? So, is that official?

**Priya:** [*pauses*] I'm going to say it is. [*DJ airhorn*]

**Aside:** Priya has done a lot of work with a lot of amphibians, namely salamanders, but her fieldwork helping collect toad data made her love them even more.

**Priya:** Just a little ways into the season, the toads would come in and they could just be *everywhere*, and they were just so fun to watch. The eggs were everywhere, the tadpoles would be everywhere. There's probably at least a couple of sites where there was probably close to a hundred toads. We definitely saw a lot of them, just out and about, and just hoppin' along.

**Alie:** Are they solitary, or do they burrow with friends, do you think? I wonder if they have girlfriends, boyfriends...?

**Priya:** I think there are some records of them sharing burrows with other toads. We actually found a multiple species hibernaculum. But I do think that there are toads that will share the same types of burrows, and then there's some places where the soil is really sandy and they can just shimmy down under the sand, especially in the hotter environments. In a lot of places in the southern US, both east and west, they're active pretty much year-round, they don't really have much of a hibernation. But in the northern areas they do.

**Alie:** Do they sleep?

**Priya:** They do sleep. I've never seen a sleeping toad. Yeah, I haven't seen a sleeping toad.

**Alie:** Are they nocturnal or are they out in the day?

**Priya:** When they first come out, it's usually during the day and they will just be singing their little hearts out, like all during the day. And then they kind of shift to just calling at night, so you don't really hear them during the day, but you'll see them out there sometimes. We definitely... when we go out in the field to our sites during the daytime, we would see the toads, just everywhere, and they weren't always calling by that point. But then if you came to the same pond that night they would just be singing like crazy. So that was cool.

**Aside:** Ugh, listen to these beautiful sounds! [*high trilling toad noise*] So relaxing and soothing. Now let's hear something both cute and horrifying: Toads oozing out of your skin. Well, their mom's skin.

**Alie:** Okay. Is there a type of toad where the baby toads are birthed from holes in the back or was that on *American Horror Story*?

**Priya:** No, no, those are a different family, so they're not bufonids, they're not true toads. They're called the Surinam toad, and that's the craziest reproductive strategy. They'll lay the eggs, and they'll be fertilized, and then they scoop them up with their legs onto their back. And then the chemistry of the skin changes, and it basically absorbs the eggs into their back, and then the skin grows back over the top of it. [*Alie groans*] And then, when they get ready to hatch, they hatch out as little, live... it's not even tadpoles, it's little live baby toads, and they just start cracking out of the mom's back. It's so crazy.

**Aside:** What is the state of the toad these days? How are toads? Do they need us? Do they hate us?

**Alie:** I know that cane toads are having a heyday. It is the Era of the Cane Toad, but how in general are toads faring these days?

**Priya:** It depends. So, some of the species of toads have been hit pretty hard by the chytrid fungus, the amphibian chytrid fungus *Batrachochytrium dendrobatidis*, [*"That's quite a mouthful."*] or BD for short. In Central America especially, there's a couple of the *Atelopus* genus species that are thought to be extinct. There's a golden toad that's in the *Incilius* genus from Costa Rica that was their iconic toad species, and they think that that's extinct. [*slowed down, sad, "Oh noooooo."*] I think they've found maybe a couple of individuals here and there of all these different species, but they've gone extinct and it's because of this fungal pathogen.

So, have you heard of white-nose in bats? This actually came before and the people in the white-nose world learned from that, but it took the BD world, the amphibian world, a really long time to figure out that it was this fungal pathogen. It was described as a new species once they figured out that that's what it was. It's been responsible for... well, it's questionable. But there's a recent paper that says there's like 500 species that have declined throughout the world because of BD. But there's some question about that. Most people say around 200 or so species have declined or gone extinct specifically because of the impacts of BD. And in the US in particular, some of our toad species have been the ones that have been most impacted.

**Alie:** What are the predators of toads?

**Priya:** Oh, there are various birds and snakes that will eat toads. Hognose snakes are kind of toad specialists. The toxin doesn't seem to bother them, so they're able to manage with them. But crows, which are super smart as you know, will eviscerate toads and then just eat their gooey insides.

**Alie:** That's what I do with airport sandwiches. I just eat the middle.

**Aside:** But before I ask the questions that you submitted, patrons, a few sponsors of the show who make it possible for us to make a donation each week to a cause of the ologist's choosing. And this week, Priya requested a donation be made to Amphibian and Reptile Conservancy to support inclusivity and diversity initiatives in amphibian and reptile conservations. So thank you, Priya. Okay, sponsors.

[Ad Break]

All right. We're back. Your questions.

**Alie:** Jack Kelleher asks: Life cycle of a toad; same as, similar to a frog? Or do they live longer or shorter than a frog, do you think?

**Priya:** Well, I think it depends on the species. Some frogs live pretty long, some toads live pretty long, but on average sort of 5ish, 7ish, 10ish range of years. But life cycle, fairly similar to a frog, because, you know, they are frogs.

**Alie:** They are a frog.

**Priya:** So, they will mostly be on land until it's breeding season, or they'll be hibernating or whatever, and then they'll come to the ponds for that breeding season, and they'll call, attract their mate. There are some toads that don't call and... Oh! There are some toads that will do that leg-waving thing? Have you ever seen that?

**Alie:** What?!

**Priya:** In these stream environments where it's so loud because of all the stream noise, they have evolved this... They literally take their back leg and they just go like this.

**Aside:** Priya, by the way, is laying on the hotel room bed, doing a move that looks like part synchronized swimming but also part shipwreck victim.

**Priya:** And I think in some of them it's their front leg too, or their... arm. And they're like, "Hey! I'm over here!" [laughs]

**Alie:** Oh my god. Like hailing a cab!

**Priya:** Yes! And then some chick toad is walking by and she's like, "Oh. OH! I see you."

**Alie:** [laughs] I never knew that they did that!

**Priya:** Anyway, I digress there. So, generally speaking, they attract their mate, the female comes over and they, you know, they lay their eggs. And most of the species lay a lot of eggs. Maybe you'll have a pretty decent amount of the eggs that'll hatch into tadpoles but then the tadpoles are food for all sorts of stuff. ["Mmmm. Delicious!"] Have you ever *seen* all the little toadlets popping out of...

**Alie:** Are they really called toadlets?

**Priya:** Yes! Toadlets!

**Alie:** Oh god! Heather Albrecht says: What are toad communities like? I always see toads on the ground, blazing their own trails, but then there's always another little guy not too far away. Do they reconvene at the end of the day in communal housing if they survive my lawnmower? Or do they battle it out for prime resources? Do they have friends, do you think?

**Priya:** They all come together for the breeding season, but they're not really, like, friendly. They're all competing during that time. And it is true that you do tend to see them together, and I

think that is probably because they must hang out together wherever they're overwintering or hanging out during the hot months or something.

**Alie:** Laura Kinney wants to know: Do toads travel far from their burrow, or whatever a toad home is called, to forage or find a mate? How's their commute? What's a toad commute like?

**Priya:** You know, generally speaking, it's thought they don't move that far. But there was recently... one of my colleagues in Utah was tracking these Western toads, and found that they moved like 5 or 6 miles, which, for a toad that hops? That's a long way! Between where their breeding site was and where they were hanging out in the winter... because they'll go back to the same ponds where they emerged to go breed.

And so, when those habitats got fewer and farther between, if they went back and their pond that they know was not there, they'll usually go just a little bit further until they find the next thing. So probably over time, these animals have developed the ability to go that far. And especially the ones in these montane habitats, there are a lot fewer areas, and a lot more ground to traverse between ponds.

That was one that I remember was pretty striking. I just learned that a couple of years ago, that those particular ones were able to do that. I'm pretty sure that there's nothing in the literature that suggests that they go that far.

**Alie:** Do they have a homing device? How are they finding the same ponds?

**Priya:** I think they believe it's a little bit both astrological as well as chemo-sensory, and they're able to smell their home ponds, basically, and go back. That's true of a lot of amphibians in general, they tend to go back to the same sites, and actually a lot of reptiles as well. They have site-fidelity.

**Alie:** Do you have a favorite thing? The one thing about a toad that you love the most? Or about your job as a herper?

**Priya:** Oh, what is my favorite thing about a toad? I don't know? I just love their little bodies, that little classic toad shape, and the little hop, and the face, just that little classic toad face.

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So there you have it. Toads have cute faces, and little arms, and they are our friends. Thank you for being my friend, smologite, and listening. New *Smologies* episodes are out every other Thursday and you can find them all together at [AlieWard.com/Smologies](http://AlieWard.com/Smologies). That will be linked in the show notes, along with the credits because we keep these short.

But before I go, I share a tidbit of advice from a lady who calls herself DadWard. That's me. My advice is to make stuff. The best way to get good at something is to do it. So if you want to be a poet, or a painter, or a paleontologist. Write, and build, and draw, and dance, and read, and do experiments, and just get in the game. Don't be afraid to mess up because as long as you're doing, you're learning, and that is not messing up.

Okay smologites, berbye.

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