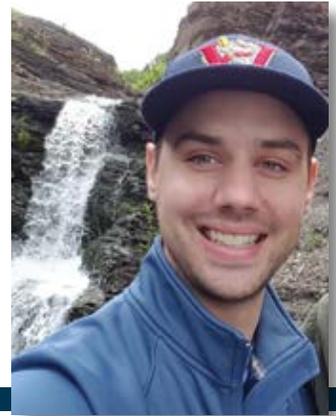


# The Ribbet Hypothesis



By Nick Pink, AWA Conservation Specialist

**L**ea Randall is a population ecologist with the Calgary Zoo. Lea leads the Northern Leopard Frog Research Program at the Zoo and is a part of the British Columbia Northern Leopard Frog Recovery Team.

**Nick Pink: Tell me a little bit about yourself, how did you end up at the Calgary Zoo?**

**Lea Randall:** I am originally from the Yukon; I loved wildlife and outdoors so that's part of what led me to wildlife biology. I did my undergrad at the University of Victoria and then I came to the University of Calgary to do my Masters. I was studying forest ecology, looking at little brown bat habitat use in the Yukon, and looking at how different forms of forest disturbance affected their habitat use: infestation, logging, and forest fires. Which seems kind of far off from studying frogs in Alberta but it's funny how the sets of skills you gain in one job can transfer to another – a lot of the skills that I gained doing my Master's degree and working with the Yukon government for their wildlife department. The Zoo was looking for someone who had an ecology background, but they wanted someone who had experience working in remote field settings who could back up a trailer and was comfortable driving trucks on back roads and all of those skills I had pretty much gained, either growing up in the Yukon or doing my Masters.

**NP: So northern leopard frogs – they were pretty abundant until about the 1970s when they just crashed. Why is that thought to have happened?**

LR: There's a few different things. Somewhere around the 1970s/1980s, naturalists and biologists who were working in the field noticed that they weren't seeing leopard frogs in the numbers that they used to and in the places that they used to be found. That was primarily happening in western Canada and the United States. They're still fairly abundant and doing fairly well in Eastern Canada and parts of Eastern U.S., although not as well as they used to be either. Here in Alberta we had a drought that was fairly severe. We've also lost an estimated 60 percent of our wetlands in the white zone of Alberta – the settled areas of Alberta. Just that loss of wetlands in itself could have led to those declines.

Leopard frogs and many other species of frogs are assumed to act like a metapopulation – the idea being that you might have a pond occupied but maybe it's not occupied every year and maybe the population goes extinct there one year but next year it gets recolonized from adjacent ponds. As you start to lose wetlands on the landscape, you lose that connectivity and metapopulation structure, and the populations can collapse. Or you may end up with really isolated populations – the problem there being that you can end up with genetic isolation.

Not just habitat loss but also habitat degradation; things like increased agriculture – with pesticides and herbicides leaching into the water, increased development, and the effects of a higher density of roads. If frogs have to cross roads

they can act like barriers to migration. Chytrid fungus may also have been a major player (this fungus causes a potentially lethal skin disease called chytridiomycosis. It has caused global declines in many amphibian populations – NP). The problem is that we didn't know that chytrid fungus even existed then. But there have been some studies that have looked at going back through museum specimens and swabbing them and then discovering that chytrid fungus has probably been around for a lot longer than we knew about. Certainly there are some anecdotal reports from primarily Manitoba – Manitoba used to have huge populations of leopard frogs. They seem to have recovered somewhat but there used to be quite an industry of people collecting leopard frogs for sale.

**NP: Would that be to eat?**

LR: Probably some of it was for eating, but a lot of it was for schools – they were commonly used for dissection and a common laboratory animal. It's amazing if you go through the literature, there's a huge body of literature that uses leopard frogs.

**NP: Right, they were a model organism for neuroscience.**

LR: Yes and for toxicology as well, so there's been lots of work done with them. But we know from looking at these collection records that somewhere back in the 1970s the numbers that they collected crashed. And there are descriptions of people trying to collect the frogs – they would collect them in their

hibernacula – and they would find a metre deep of dead and dying frogs. To me that suggests that there was probably a disease agent.

**NP: So there were a number of environmental factors that increased susceptibility to disease and then something bad struck?**

LR: Yeah I think it was partly synergistic and a lot of factors played into it, primarily habitat loss.

**NP: And they are dealing with many of these same threats today – habitat loss, fragmentation, and degradation. Are you presently finding chytrid fungus in your surveys?**

LR: There have been a couple studies done in Alberta. One of them found that approximately 40 percent of the wetlands that they surveyed, where they found and swabbed frogs, there was chytrid fungus present. We know it's out there on the landscape; the only thing that we can hope is that the frogs that have survived have a genetic resistance to it.

We only have a single extant population of leopard frogs in B.C. and that's in the Creston valley area, and we know that there is chytrid fungus throughout that system and the frogs seem to be persisting. It's not that you find a lot of dead and dying frogs but that doesn't mean that it can't be having sublethal effects that might be impacting their ability to breed or overwinter, among other things.

**NP: Part of the reason why these threats to habitat are such a big problem is that leopard frogs require a mix of habitats: in a given year, they go from wintering in a stream with moving water, to breeding in a shallow pond, to foraging anywhere from riparian habitat to prairie landscape to a forest. Why do they need these different habitats and what happens to a population if they can't reach one of those three required habitats?**

LR: They are probably toast. That is one of



*A northern leopard frog foraging in the grass PHOTO: © L. RANDALL*

the big challenges because their habitat requirements are so diverse. It is possible that they find a single spot that meets all of those habitats but that's fairly rare. They overwinter in streams and rivers that have flowing water so that it does not freeze to the bottom and there is sufficient dissolved oxygen. There is some research that they can overwinter in some lakes and springs that don't freeze to the bottom and have a high enough dissolved oxygen content, so there are some locations that will meet the overwintering requirements and also function as a breeding pond.

**NP: What is their current protected status of northern leopard frogs and does this vary amongst the different populations?**

LR: Yes, so in British Columbia the Rocky Mountain population is listed under COSEWIC as endangered and provincially they are red-listed. In Alberta, the prairie and boreal forest populations are considered threatened under the Wildlife Act and a species of special concern under COSEWIC.

**NP: I was kind of surprised to see that they are listed as “Least Concern” on Wikipedia.**

LR: That's IUCN [International Union for Conservation of Nature]. If you go through the IUCN, part of their criteria is “what is the chance that this entire species is likely to go extinct within a certain number of generations or years,” so given how widespread the leopard frogs are and how many populations there are still in existence that is highly unlikely to happen. But what's far more likely to happen is that we'll lose them in specific parts of their range.

**NP: Which of course is proving to be more and more important in conservation as local extinction reduces the species genetic diversity. For the everyday person, amphibians seem to be pretty rarely thought about, why are they important to conserve?**

LR: There's different reasons. One is the Rivet Hypothesis, where the idea is that if you're flying along in an airplane, you can lose a few of the rivets in the airplane and it will continue to fly along,

but if you start to lose too many rivets, the whole thing comes apart at the seams. And you never know which rivets are important. I like to think of it as the “Ribbet” Hypothesis as it pertains to frogs.

From a biodiversity standpoint amphibians are important. A lot of the time when we think of importance we think of what is important to us as human beings. Frogs are important to us because they can eat a lot of pest species and the tadpoles can be primary consumers of algae in ponds. If you don't have them you can get huge overgrowths of algae which can lead to fish die-offs and all sorts of other things. They're used as study animals and research animals, leopard frogs in particular, and there's been substances that they've found on their skin that have been useful for human use. For example, they've found something they've isolated from the leopard frog's skin that's useful for treating genital warts. So I laugh, because amphibians are sometimes blamed for giving warts but actually they could cure you. There are lots of other examples but that one makes me laugh.

**NP: Going back to your Rivet Hypothesis, I suppose losing one rivet is also probably an indicator that you're about to lose a lot more.**

LR: Yes, people often use frogs as a “canary in a coal mine;” they can be indicators of wetland and ecosystem health because they are so sensitive. Frogs spend a lot of their lifecycle in the water and they have very permeable skin and that's so that they can maintain their moisture balance and absorb oxygen. Anything that's in the water, such as toxins and runoffs, they can also absorb into their skin. So when you start losing amphibians, that can be an indicator that there is something else going on that could wipe out the whole ecosystem which could have run-on effects that can affect human health.

**NP: Something I've been interested in of late is the value of a healthy wetland. Research is finding that wetlands have large economic benefits, such as improved water quality, just by existing, and it functions better than anything we can create using “grey infrastructure.”**

LR: Yeah, wetlands have these spin-off benefits for humans as well. They are amazing for filtering things, anything that flows into the wetland they can help settle things to improve water quality. Algae will start to degrade toxins. Wetlands in themselves are really important for human health.

**NP: And they reduce costs for water treatment.**

LR: Absolutely, and they reduce flooding. Here in Calgary, we've lost an estimated 90 percent of our wetlands and now we're putting lots of effort into making these storm water ponds.

**NP: We're trying to make wetlands.**

LR: But these aren't necessarily functional wetlands that are good habitat for other species – they're just basically to prevent flooding.

**NP: In terms of what the Calgary Zoo is doing for the northern leopard frogs, what has the scope of your project been to date?**

LR: Here at the Zoo we've been involved in northern leopard frog research since 2003. As part of that we lead a massive surveying effort – which you were a part of (I worked with Lea in 2013 – NP). We surveyed 68 wetlands over 60,000 km<sup>2</sup> of southern Alberta to look at leopard frog population dynamics. We knew that the populations had crashed at some point, but we didn't know if they were actually starting to recover. The results of that work showed that they didn't seem to be declining but they also didn't seem to be recovering. If our goal was to make a difference, we needed to be doing a little bit more. So in addition

to that we also do recovery work in B.C. where we help with doing leopard frog reintroductions in the Columbia Basin.

**NP: Is that with the Vancouver Aquarium?**

LR: I'm on the B.C. Northern Leopard Frog Recovery Team, as is Vancouver Aquarium. We use the one extant population in Creston as the source for all of the re-introduction efforts, so we'll move tadpoles to two reintroduction sites, hoping to re-establish populations to other parts of their range where populations have gone extinct. Each year, the Aquarium brings in wild tadpoles for their captive breeding program and the idea is that, if successful, they will also supply tadpoles for reintroduction. And there has been some success with that.

**NP: Has there been success in establishing viable populations at the reintroduction sites?**

LR: We have two sites, one is in the Upper Kootenay Floodplain and we've had ongoing reintroductions there for years. We didn't introduce any frogs there last year and yet we detected breeding and successful metamorphs, so as far as being an indicator of success, wild breeding is one of the major milestones. We'll see if that is self-sustaining, we may still have to further augment the population but right now we are just monitoring it. We are putting more of our efforts into reintroduction into the Columbia Basin. One of the major concerns in B.C. is that we have all of our frogs in one basket – we only had a single population and there are all the same threats that we talked about as being in Alberta. There's habitat loss, we lose frogs on a road that runs through it – they get smushed by cars every year – and we know we have chytrid fungus present. One of the other major concerns is that there are invasive bullfrogs that are starting to move up into the area, literally a few kilometres from our breeding grounds. In other places where that has happened, often



*Hanging out.* PHOTO: © L. RANDALL

the bullfrogs win – they’re just so big and they’re such excellent predators. We’re really concerned about that and it’s another reason we want to try and establish them in different locations.

**NP: To hedge your bets, essentially.**

LR: Yes, and the B.C. Leopard Frog Recovery Team approached us here at the Calgary Zoo to see if we’d be willing to host a captive assurance and captive breeding colony for B.C. northern leopard frogs. If something catastrophic happened in the wild or at the Aquarium, having two different populations increases your probability of being able to maintain the frogs. It mitigates the risk of a single event wiping them all out.

**NP: How far along is the captive breeding program at the Calgary Zoo?**

LR: We’ll actually be bringing in our first eggs or tadpoles this spring. The plan is to build an age structured population for captive breeding so we’ll bring in say, 75 tadpoles each year to build up to this captive breeding population and we’re not anticipating that those frogs will breed for at least a couple of years. Vancouver Aquarium will hopefully give us some of their frogs as well, so that’ll give us a bit of a jumpstart on our population here.

**NP: You’ll be breeding the B.C. strain of leopard frogs; will they be released back into B.C.?**

LR: We’ll be getting eggs from B.C., they’ll grow into frogs, they will lay eggs themselves, and we’ll take those eggs back to B.C.

**NP: Captive breeding sometimes makes people in the conservation community nervous as it does not address the issues that contributed to the species decline. From your point of view, where does it lie on the hierarchy of preferred recovery options?**

LR: The best way to sustain a species at risk is to protect their habitat in the first place because, invariably, habitat loss is the one thing that’s driving most species to extinction. Ideally, if you can protect their habitat then you never really need to do anything more than that. After that, there are other methods for recovery.

If you’ve lost certain populations but still have healthy populations elsewhere, you can use translocation. Ideally, the closer the source population is to the release population the better. That’s

for a couple of reasons: genetic diversity – it's better to take individuals from habitats that are more similar to where you're going to put them because they are likely adapted to local conditions; disease concerns – if you take a frog from far outside of its range, it could have different diseases that maybe it's resistant to but other populations, or even different species of amphibians, might not have any resistance to. If a nearby population is not feasible, and in many cases it is not, then you have to look further afield.

Captive breeding is pretty much a last case resort. It's often very expensive and labor intensive and it's not guaranteed to work.

**NP: Do you worry, about any unintended consequences of your captive breeding and translocation programs?**

LR: We are working on a risk assessment right now and there are ways to minimize risks. One thing we are looking at doing is either bringing in eggs or freshly hatched tadpoles, and the reason for that is that those life stages are less likely to harbor disease. Chytrid fungus, for example, isn't really found in eggs because they lack cretanous structures that chytrid feeds on. So you can minimize disease risk at that point. We also have excellent vets and zoo keepers, so if we did end up bringing in disease we have the ability to treat it here, which gives us a head start over wild populations because you can't really do that in-situ.

The other potential risk is escape. We have ways to prevent that, we'll have enclosures and the frogs will be isolated.

**NP: What could the average person who's concerned about the decline in leopard**

**and frogs or other amphibians do to help ensure their survival?**

LR: Well, the average person can't necessarily do this but... saving wetlands. There are lots of organizations that are committed to preserving wetlands, in the prairies for example. You could buy property and make sure that those wetlands last in perpetuity, organizations like Nature Conservancy of Canada are good with those kinds of things. If you want to help amphibians in general, a lot of it comes down to: don't drain wetlands. And also there's ways to improve water quality – don't use pesticides and herbicides because all of that ends up flushing into the river and ends up in our wetlands. 🐸

*Thank you to Lea and the Calgary Zoo for facilitating this interview.*



*Individual leopard frogs can be identified by their spots as no two are the same, much like our fingerprints.*  
PHOTO: © L. RANDALL