

TRANSCRIPT

INTERVIEWEE: Lee Mackenzie

INTERVIEWER: David Todd

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Google Voice [00:00:00] This call is now being recorded.

David Todd [00:00:04] Good afternoon, Lee.

Lee Mackenzie [00:00:07] Hello, David. How are you?

David Todd [00:00:09] I'm fine, I'm fine. Thank you for asking. And thanks for taking some time, to have a little conversation about your interest and work of many previous years and many years to come, I hope.

Lee Mackenzie [00:00:25] Yes, I hope so, too. So, thank you for your interest. And we are always happy to talk about bats. So glad you reached out.

David Todd [00:00:37] Yeah, sure. Well, you know, our intention here is to build an archive of interviews with people who work with animals and towards doing that we do try to record all these materials and create transcripts. And so I wanted to just recite a little preface, if you don't mind, to explain what we're doing, to make sure that, you know, you feel comfortable with it.

Lee Mackenzie [00:01:07] OK, sure.

David Todd [00:01:07] If you can give me a moment here, the idea is that we would plan on recording this interview for research and educational work on behalf of the Conservation History Association of Texas for a book and a Web site for Texas A&M University Press, and for an archive at the Briscoe Center for American History, which is at the University of Texas here in Austin. And you would have all equal rights to use the recording and the materials as well. But that's, that's our goal. And I want to make sure that was OK with you.

Lee Mackenzie [00:01:44] Oh, sure. Absolutely. We were honored that you considered us for this and we'd be happy to participate. We feel like it's a valuable and noble goal, so we'd love to participate.

David Todd [00:01:59] Well, that's wonderful. Thank you so much. We appreciate it a lot.

David Todd [00:02:04] Well let me give a little introduction to when, where and what we're doing here. It is August 30th, 2020 and my name is David Todd. I'm here for the Conservation History Association of Texas. I'm in Austin and we're conducting a phone interview with Lee Mackenzie, who I believe is also in Austin. He is a carpenter, a design-build remodeler, and a wildlife worker who is the co-founder and a director of Austin Bat Refuge.

David Todd [00:02:41] And today, we'll focus on discussing the Mexican free-tailed bat, and Mr. Mackenzie's own history and his contributions to the bats' protection and restoration.

David Todd [00:02:56] So, I have a question I'd like to begin with, with everybody, and that is, how did you first become interested in the outdoors and wildlife, and in this case, bats?

Lee Mackenzie [00:03:11] Oh, yeah. We're going way back. Well, I've been a carpenter all my life, as you, as you mentioned earlier. I did not pursue a college degree. Back in the early '70s when I was in college, there was a lot of competing interests. And so the world seemed like a huge and vitally interesting place, and I wanted to go see it.

Lee Mackenzie [00:03:47] So I was a, I actually became a fruit picker for a number of years just to be able to travel around and experience a little bit different view of the world. And during the off season, I became a carpenter while we were waiting for fruit to ripen or after trees had been pruned. So when I started doing carpentry work, I started doing remodeling and realized quickly that we were constantly running into wildlife in people's houses. And we, you have to take care of them somehow. You know, if you are opening a roof and there's a family of raccoons in there, you have to, you have to do something to care for them. You can't just evict them and put him out on the street and we'd find squirrels in the eaves of people's houses and just a wide variety of animals.

Lee Mackenzie [00:04:51] And we would bring them down to the Hyde Park Vet Clinic. There was a doctor there, a vet called Dr. Dave and his sidekick, Pam Wilson, was, they were two of the most interesting people I'd ever met. And I thought, wow, those are, they became, you know, I thought they were incredibly interesting. And I just said, "they'd be great role models. I hope to be more like them someday." And so, slowly but surely, I've always looked for ways to, to, to balance my life in the construction world to, to maybe mitigate some of the damage that construction causes, the development that we see, that we become a part of, whether we like it or not. And when, and so I was always looking for a way to give back to the natural world.

Lee Mackenzie [00:05:58] So consequently, when I met my wife for the first time, I met Dianne, who would become my wife, she was already doing wildlife work. And I thought, well, this is an interesting girl. And she was, it was fascinating to me. And we teamed up and became, and became what was known as the Raccoon Squad back in those days, at first.

Lee Mackenzie [00:06:33] She then moved over into doing bat work, and I became fascinated by what I was seeing in her world and we teamed up and became partners in Austin Bat Refuge.

David Todd [00:06:51] Well, this might be a good segue to ask about the origins of Austin Bat Rescue and what its goals are and the raison d'etre of your nonprofit.

Lee Mackenzie [00:07:10] Well, so it is Austin Bat Refuge.

David Todd [00:07:16] "Refuge", I apologize. I'm sorry.

Lee Mackenzie [00:07:18] That's OK. But we don't want to, you know, since there's few of us, we don't want to give the impression that we'll come running if there's a bat hanging on somebody's building. So as a refuge, we will be happy to care for a bat if it needs to, if it gets

sideways with humans. We feel like our job is to level the playing field. We feel like it's only fair to try to repair some of the damage that bats, are incurred on bats just from, from living around humans who may be a little fearful of them and maybe not understand them as well as they, as they could. Bats are difficult to study. And since they fly at night and we don't see them very often, except when they suddenly appear on or in , or even in our house, we're naturally fearful of them. People are afraid of what they don't understand. So we feel like that our role is to educate people to understand the value of bats, how they are highly beneficial, completely harmless, if simply left alone, and fascinating and vital to the balance of nature, and try to mitigate some of that fear.

Lee Mackenzie [00:08:53] And so, if we encounter a bat that's gotten sideways with humans, maybe it was simply hit by a car or maybe just fell, became grounded from natural causes in the city, we feel like it's a good way to look out for nature, to try to give back to the world, to try to care for them and to and we feel honored to have found a way to do that, to give back to the natural world in this particular way. Everybody's looking for that opportunity. Everybody knows the impact that humans are having on the planet. And we feel that we are lucky simply to have found a way to give back.

Lee Mackenzie [00:09:45] So we care for orphans and injured bats as they are, as the public makes us aware of them. We also do conflict resolution. If people have bats living in their building, in their home, we try to explain to them that bats are beneficial and harmless neighbors who've been, we've been sharing our homes with bats since the days of the caveman, and they've always been great neighbors and allies to humans. They have a great safety record around humans and a way better safety record than our beloved household pets, but yet we fear them. And so we want to take the opportunity, that every rescue presents and leverage that through social media and outreach to simply use it as an educational tool and to promote the idea of peaceful coexistence with these beneficial mammal allies.

David Todd [00:11:04] Well said. Well, you know, I just I should kind of speak up here just for a moment, a little housekeeping: I'm getting a little bit of a sort of a knock-knock on the line here. Yeah, there it goes. Is there something maybe in the background that's moving around, making sound?

Lee Mackenzie [00:11:29] I can't imagine what it might be.

David Todd [00:11:32] OK. It may be just the connection. We always like to make sure that we get as clear a signal as we can.

David Todd [00:11:41] So maybe you can give us a little bit of the background about Mexican free-tail, I guess sometimes called Brazilian free-tail bats.

Lee Mackenzie [00:11:51] That's correct. So the...

David Todd [00:11:55] You know, just some sort of sense of their natural history, just a basic outline of their features.

Lee Mackenzie [00:12:02] OK. Well, they are, their scientific name is *Tadarida brasiliensis*, "Tadarida" meaning "wrinkled lip", which is very descriptive of their overbite. Their wrinkled lips allow them to open their mouth very wide and and catch, capture a large moth when they're hunting up to 10,000 feet in altitude, up to two miles high, foraging on crop pests. *Brasiliensis* describes the location where they were first discovered, I believe first described.

But, we don't call them Brazilian free-tailed bats here in Texas because we don't want to give people the impression that they migrate to Brazil every winter. Our bats do migrate to Mexico. So we here in central Texas call them Mexican free-tailed bats simply to avoid the misperception that they migrate all the way to South America. Some of our purple martins do fly all the way to Argentina. But we want to make sure that we don't misrepresent where these bats are going in the winter when they leave our, our bridges and caves.

David Todd [00:13:24] And so, I think that the Mexican free-tailed bats are kind of most famous, at least around Austin and central Texas, for being found under the Congress Avenue, Ann Richards, Bridge. And I was hoping that you could help us understand that maternal colony and you know, how it first developed and some of the reception to it.

Lee Mackenzie [00:13:54] Yeah, well, bats have been coming to central Texas for tens of thousands of years, at least, in the early spring, to form maternity colonies in, and traditionally those colonies were in the the karst limestone caves in the Hill Country. Karst limestone erodes readily with rainfall and forms large caves that were perfect for maternity colonies, for the bats. They could pack up to millions of bats under a dome, a maternity dome, in those caves, which held the heat and provided the naked pups with the warmth that they need to thrive. So without a warm maternity roost, the pups would shiver and burn calories that should go toward development simply to stay warm. So they've always used the Hill Country caves for maternity roosts and they flew out over Austin to go feed in the blackland prairie where most of the insects are.

Lee Mackenzie [00:15:07] So when we remodeled the Congress Avenue Bridge in 1980 and used a concrete box beam construction, the engineers that built that bridge specified an expansion gap of three quarters of an inch so that the heat wouldn't destroy the bridge. But they didn't realize it at the time, but they were specifying the world's largest urban bat roost. So bats said, "ooh, three quarter inch crevice that only I can fit in and I can fly up in there. And and let's see, it's also heated by the sun." So it's basically a solar powered incubator. They thought that was perfect. So bats have been, they took to it readily. I think within the first year there was a colony about half the size of what we have now. And by the second year, there were as many bats there, and two years after it was built, as there are now. So we commonly reference one and a half million bats. I'm not sure anybody really knows for sure, but it's a huge colony, the largest urban bat colony in the world as far as we know.

Lee Mackenzie [00:16:24] So but it is the perfect roost. So the, the crevices in that roost being warm, well-protected and they're they're protected from ground predators that, that congregate around the mouth of caves in the Hill Country because they're elevated. So there are no raccoons. There are no snakes, no possums, skunks, or ring-tailed cats or anything like that, that congregate at the mouths of caves in, in the Hill Country.

Lee Mackenzie [00:17:01] So they've simply had to learn how to put up with humans in order to take advantage of it. So they've become accustomed to our road noise. The traffic on Congress Avenue bridge does not bother them. They, a certain amount of white noise from the city is fine with them; they've accommodated, they've learned to become accustomed to it. And it's only unusual noises that cause them to interrupt their pattern. I think certainly Fourth of July is kind of a big deal when the fireworks go off, but usually they're flown, long gone by then and have flown out to feed by the time the fireworks happen. But unusual noises, like people under the bridge flapping paddles on the water or clapping to try to make them come out are certainly not acceptable. And they will interrupt the bats' peace of mind. But for the most part, they've learned to accommodate and accept us as beneficial in that we scare

away the predators and they're willing to put up with a certain amount of our, you know, shenanigans, basically, to take advantage of our predator or just our predator scare, our scaring of the predators for them. But interesting tradeoff.

David Todd [00:18:37] Well, I guess these days there are crowds and crowds of people who come to see them. And I would like to hear about those, those tourists and other visitors. But I understand that when the bats were first covered, there was was real worry and concern, and even an effort I think to eradicate the colony. Is that right?

Lee Mackenzie [00:19:03] Yes, there was. So there was great fear among the citizens of the city when the bats moved into the bridge. I believe the headlines said, "Rabid flying rodents infest the city". People were convinced that they were all rabid, that all bats carry rabies. And that they were just another infestation of rodents, only this time they flew. And petitions were circulated to eradicate the bats and to modify the bridge to make it inaccessible to them where they could not, where they could no longer roost there.

Lee Mackenzie [00:19:42] And that was, that's an interesting story, because Dr. Merlin Tuttle moved here when news of the city's fear of the bats made headlines. And he started a campaign. He met with an education campaign. He met with the City Council and the Chamber of Commerce and explained to them that this was this, this was a blessing, not a curse. That, that simply left alone, they would be a beneficial force for the city. And he spoke to, in schools also, he went to the local schools and to convey that message to children, and the children convinced their parents to bring them to go see the bats. And now when we have an information table set up on the weekends, those children from back in the '80s are now bringing their children and grandchildren to come see the bats during the viewing season, and passing that love of Austin's bats on to the next generation. So that, very heartwarming to have them approach the table and tell us that they remember those conversations that Dr. Tuttle had and his speeches and, and that they are passing it on to their, their kids. We just love that.

David Todd [00:21:12] Well, you mentioned this information table that you often have when the maternal colony's full and there are visitors there. Can you talk a little bit about the kind of, you know, level of interest and the kind of questions, kind of comments that you get from people who've come to see the bats?

Lee Mackenzie [00:21:34] Yeah. Yeah, it's really interesting. We've been manning a table down there for, we've had the information table for at least seven years, I believe, before this current year when it was interrupted by the current events. But we originally started out going four nights a week from Thursday through Sunday, but it got to be a little grueling. We cut it back to two nights a week, on Friday and Saturday. And it was, it's so interesting to see the people arrive and and sit on the lawn. And many people are reluctant to approach us because they think we're selling something or you know, people are just, some people just are naturally reluctant to engage in conversation. But the children are not. They come and storm the table and they go and the parents are happy to let them go for the most part: "you go take care of them for a while." It's fun when they come up, full of excitement, and so fired up to see the bats. And they have a million questions.

Lee Mackenzie [00:22:45] And it's, it's interesting to to field them. And to hear the the questions they have. Most of them are really, really well educated about bats and have very insightful questions. And soon their, their parents come down to kind of, you know, some parents, most parents do after awhile come down and try to say, "okay." Make sure they're not

getting in trouble or wearing out their welcome. Often the grandparents are way in the back and sometimes they're giving us, kind of, funny looks. So it's really remarkable to see the difference in the generations. The kids are so excited and have a great love of bats and it's not so much the case with some of the older generations. So we're excited for the future to see the, to know that those kids have that love of bats that they'll be spreading far and wide in the future.

David Todd [00:23:58] So I guess all these visitors that come to see the bats represent you know, educational opportunity about bats, and their biology and their role. But I guess it's also about dollars for the community. Can you talk a little bit about the economic impact of the Richards bridge or other places that are accessible to see bats?

Lee Mackenzie [00:24:25] Sure. Yeah. And as you said, a lot of people are, some people are just casually interested in the bats. They may have come to town for business, or for a convention, or to visit the Stevie Ray Vaughan statue, or make a pilgrimage of one kind or another. And they look and see on Yelp that, oh, going to see the bats as the number one thing to do for free on Yelp. So we really value the interaction with those people. They're here bringing their tourist dollars to the city. But they're also not necessarily huge bat fans or, or very much aware. Many, many of them never thought twice about bats. So to be able to get in front of a crowd like that is really valuable to us. We're not just preaching to the choir. We're not just talking to people who already love bats. Some of them are actually quite fearful and have been dragged there for one reason or another or are going actually going for therapy, I think. You know, I think sometimes people are going just to get over it. You know, maybe if I go see one and a half million bats come out, you know, it will be aversion therapy, you know, learn to, to not be so scared of them. We can usually tell those people because they hang back a little further from everybody else and stay longer and don't go down to the river when the bats come out and still keep asking questions. So they're, we recognize the type now.

Lee Mackenzie [00:26:12] But the overall effect of all those people cumulatively is really a huge economic engine for the city of Austin. And, you know, they're, it's fascinating to see them come. Many do come specifically for the bats and they come from all over the world and they write in our bat journal to say how special their experience was. And say, "keep up the good work." And we just love to hear that kind of feedback in many different languages. We always ask them to write something in your language, you know, and then we have to go home and try to translate it later. It's just really fun. We can't afford to travel the world, but we can, we love interacting with people from all over the world when they come to see the bats.

Lee Mackenzie [00:27:01] But, you know, the locals, we only see them when people come from out of town and they have, if they have out-of-town guests. And they, they'll bring them down to show them at least one thing, one, one of the things that makes Austin unique. And cumulatively, I think the effect is gauged at, I think the Chamber of Commerce estimates about 12 million dollars' economic impact for the city.

Lee Mackenzie [00:27:29] But, I think there is more than just the economic value. I think there's, it gives Austin something that you just can't put a value on, that, that being known as the city that embraces bats and gets along with them, that knows how to take care of them. I think that's something that that is immensely more valuable than just the economic value.

David Todd [00:28:02] You mentioned the economic value for tourism to the city. But I guess another aspect to these bat's value to people is, is the pest control I've heard of. And maybe you can fill me in a little bit on, on what sort of impact they have on on pests.

Lee Mackenzie [00:28:27] Yeah. You know, bats are the the primary predator of night-flying insects. Most of the birds go to roost when it gets dark. There are some night-feeding insects [birds], but the vast majority of birds go to roost and most of the crop pests fly at night. So without bats to control night-flying insects, we, we would be overrun with them and we would have to use more pesticides in order to protect crops. And those pesticides would run off into the watershed and cause even more health problems than we already have. So bats contribute immensely to the health of the ecosystem out here. We think they consume, the bats in Congress Avenue Bridge, are estimated to consume 10 tons of insects on a nightly basis. And I think, overall, the US, they estimate their economic value to be between 3 billion and 21 billion dollars. That's the value that all bats over the US give to agriculture annually. I don't know why it's such a huge swing in estimates from low to high. But that's, I guess that just talks about how difficult they are to track and and to, and to visualize.

David Todd [00:30:12] I think it's interesting that, you know, this really famous colony for bats is in an artificial structure and not in a cave or a hollow where bats might have more commonly stayed, you know, in years past. And so I was wondering if you would talk a little about the pluses and minuses to the fact that they are finding shelter under the bridge rather than in a cave out in the Hill Country.

Lee Mackenzie [00:30:50] Well, I think one of the big advantages is that the bridges are often closer to water supplies than the Hill Country roosts. So we see, we see bats leave the Hill Country roosts, or at least the numbers diminish quite a bit, especially at this time of year as it gets drier, as bats move toward the I-35 corridor and the bridge roosts and artificial roosts that we provide. And I personally believe that it's because, one of the reasons is, that we're closer to water supplies than, than out in the Hill Country. So, and I think that there may be more insects, insect prey, here than drier areas of the Hill Country when we get into the time of year when all those babies are flying. So at this time of year, traditionally, there's more bats flying because all the pups have joined the mothers and there's less food. So they, we seem to see the the numbers of bats in the bridges increase at this time of year, and the number of bats in caves decrease.

Lee Mackenzie [00:32:18] And that's just anecdotal observations on my part. I'm not sure it's been quantified, but I'd love to undertake that someday. But when I say we see that, it's because we're tracking them on radar. So that's, that affords the opportunity to quantify it at sometime in the future. But that's, that's in the, in progress right now. It's in the works.

Lee Mackenzie [00:32:50] But let's see, so I think some of the natural [artificial] shelters, in addition to being close to water and close to food, as I said, they're, they are a solar-powered incubator, they are heated by the sun and the concrete used to build them holds and stores that, that heat from the sun. The solar gain is captured by the concrete and it's radiated out in a flywheel effect all night long. So the bats, the bat pups herd, are nice and warm when they're born in the bridge. The bats like warm temperatures, so on a 68 degree night or 70 degree night, they would enjoy a nice warm roost.

Lee Mackenzie [00:33:40] So other than that, they take advantage of human, our scaring of the predators. There are very, a lot fewer predators in the city. And so I think those are

probably the big, those would come to mind, at the top of my mind. There may be other very important advantages, too. But those are the first ones that popped to mind.

David Todd [00:34:13] Fascinating. Well, as you were talking about the shift of bats that you observe or heard of from Hill Country caves to downtown bridges, you mentioned that, you know you've been able to see some of this from radar signals. And I was wondering if you would talk a little bit about your work with NEXRAD radar and understanding better bat flights?

Lee Mackenzie [00:34:44] Yeah. Well, I attended, when we first started getting interested in bats, or in the first few years of our work, there was an ESA conference here in Austin and one of the (I believe that's Environmental Science Association), the conference had many workshops. One of the workshops was an aeroecology workshop about the emerging, the emerging discipline of aeroecology, blending of different disciplines of physics, meteorology and biology, and study of the atmosphere. So it was headed by Tom Kunz from Boston University and one of the giants in that research. And I felt so blessed to hear him moderate the workshop and to get to know him a little bit. Not long after, maybe a few months after that workshop, he had a terrible accident, he was hit by a car and never fully regained his, his capabilities, his full mental faculties. And in fact, he passed away earlier this year. But he was a giant in the field. And it was wonderful to see him moderate this group of people who were just starting to study radar and its effect on, or its ability to track, biological entities in the, in the atmosphere. And it was just fascinating to me, I saw some of the videos that people were compiling from NEXRAD radar. And I was just hooked.

Lee Mackenzie [00:36:36] One of the presenters was Philip Chilson from the University of Oklahoma, from well, actually from, with NOAA, the National Oceanographic and Atmospheric Administration, based in Norman, Oklahoma. And he kind of got me started, saying, if you want to see some of the stuff we were looking at, you could look at this date. Here's the place you could go look. And I've been fascinated ever since. I got hooked. And I've been doing it on a nightly basis since about 2011.

Lee Mackenzie [00:37:09] So, we've got a huge database full of our observations and, and nightly data collected - meteorological data, astronomical data, and what we glean off the radar. So we're doing it the hard way, we we do it because we love it and we want to keep our finger on the pulse of the Mexican free-tailed bats in the central Texas area. We call it the Significant Bat Area of central Texas. And there are four radar stations which surround the Hill Country. And we look at all of them every night, and just so we get a feel for the bats coming out and what they're doing every night.

Lee Mackenzie [00:38:04] Basically, this arose because the people at Congress Avenue Bridge would always ask us, well, where do they go and what are they doing? And how many are there? And where do they, you know, when, when do they come? When do they leave? So we wanted to be able to better inform the visitors. And so it was all part and parcel to our education work. So but it's also been just fascinating. And we are doing it the hard way. We're doing it, and just looking at each roost every night. And just, basically we're just writing down emergence times at this point. We always hope to have somebody follow up and to try to quantify the number of bats coming out of each cave each night. But that soon became overwhelming, and we have a lot of other work to do. So maybe someday if we can get funded to do that, we'd love to pursue that.

Lee Mackenzie [00:39:01] But right now, the trend is going toward artificial intelligence and machine learning. And that's truly the future of aeroecology. They can rapidly analyze decades of data stored on the Amazon Web servers. This is all NEXRAD radar data from, going back to 1988. They can analyze decades of that data, and turn them into 15 seconds GIFs, so that you can look at it go, "Oh, that's what happened in the last 30 years." So it's really remarkable. Pushing 40 now, I guess. So anyway, it's just remarkable what they can do. But they have to teach those machine-learning and the artificial intelligence programs how to, how to differentiate between weather and biological scatters and what's a bat and what's a bird. The new dual-pol radar that they've used since 2013 can distinguish between those two, between, they can tell weather from biological, and even somewhat between birds and bats.

Lee Mackenzie [00:40:16] But the data is available way back to 1988, and so when, when the people making the algorithms go back and try to get data before dual-pol radar, back in 2013, they have to describe what areas to tell the program not to look in, or they have to describe where where they're going to find the bats. So that's where we come in. They come to us. And so our data has been used to inform testing and data selection of some algorithms developed recently. And we were really pleased to find that out, that, that our work is not going to be for naught and that it will be used to inform these machine-learning programs in the future, and give us even better insight into what these bats have been doing all these years.

David Todd [00:41:19] So if I can understand this, it sounds like you mentioned that when you're using these NOAA radar data, you're looking for astronomical, meteorological clues. Can you give examples of each of those, how that might be valuable to learn more about bats?

Lee Mackenzie [00:41:50] Well, we, what we've loved to look at just is how the bats interact with the weather, with the fronts. So as the weather comes in, we can see how they, if a, if a storm is approaching a bat roost, bats seem to sense that, and they seem to leave earlier to go meet the front because they know from millions of years and knowledge that's been passed down from one generation to the next, that that weather front is going to be pushing insects along in front of it. It's like a big giant broom that just sweeps bugs and and prey and their food along with it. So if the storm is not too close to the roost, they will fly toward it. There's been evidence that they have tornadic hearing, that they can hear storms from far away and maybe feel it. But they go toward, they seem to go toward storms if they're not too close.

Lee Mackenzie [00:42:57] If they're too close to the roost, they will hunker down and they will not want to venture out. If they go out and leave the roost and become, and get hammered by the storm, they can get hit by a hailstone and break a wing. We take bats in, in our rehab facility after a storm passes, we will frequently get bats with broken broken wings. We can track the location to coincide with a severe storm cell full of hail. So we are convinced that they that's what's happening there. So bats are known to avoid that. They don't like high winds. They don't fly well in high winds. So, so they will avoid that.

Lee Mackenzie [00:43:45] But once the storm has passed, a lot of times they will emerge once they see the coast is clear and follow that storm and try to pick up, pick off whatever bugs or have been blown along by the storm. So all of that is just fascinating to watch the weather move across the screen, to watch the bats emerge and their reaction and interaction with the storm fronts. Sometimes you can just picture yourself up there flying with them as they surf along this big wave. It looks almost like they're surfing a big wave of a north front as they move out across the Hill Country at night.

David Todd [00:44:27] It's amazing. So I guess you've highlighted some of the meteorological kind of interactions you're seeing with with bats. Did you also mention that there's some astronomical aspects to bat behavior that you're starting to see?

Lee Mackenzie [00:44:48] Yeah, there there are aspects to it, certainly. But honestly, we don't, we're having trouble gleaning the real effects out of the data. So, I'm not a data scientist, but we do have tons of data regarding phase of the moon, of sundown, sunrise and sunset, moonrise and moonset. Different times of years have an effect seasonally. But nothing really jumps out of the data to my eye. But that's where data scientists come in. So, I don't know if it's too late for me to learn how to program, how to write script in Python or in R. We, we've hired a few data analysts to try to develop a bat emergence predictor so we could predict the flight time, but it's kind of fun. It's more of a, it's more just a fun exercise than anything else. We can pretty much predict when they're going to come out just by looking at their, what they've been doing the last week or so, and what the, what the weather is going to, predicted to do. But it's always fun to talk about that and to meet with data scientists and see what they are able to tell us about the data. We do have a treasure trove of data and we would love to delve into it more deeply.

David Todd [00:46:28] You seem blessed with curiosity. So one thing that I feel like we ought to circle back to is just how the design of the Richards Bridge, and particularly the girders, has been really conducive for the bats to use. And I heard that there is kind of an interesting story about how the Texas Department of Transportation picked up that design that was used at the Richards Bridge and deployed it to other bridge sites around Texas. And I was curious if you might know more about how that came about.

Lee Mackenzie [00:47:11] You know, I'm not, I'm not, I'm not extremely knowledgeable about how they came together, how they came to do that. But I think it was an engineer named Mark Bloschok, that was working for TXDOT that spearheaded the, the deployment of that design. You know, I'm not sure what their motive was, if they were truly intending to create more roosts for bats or the cynic in me wants to say, oh, it must be the the most cost-effective design, you know. But for whatever reason, we're extremely proud of them, or we are just very grateful that they took that design and have since built hundreds more bridges of that same design all across the state. So whether they're doing it for economic reasons or to actually help the bats or both, we're just very grateful that they're doing that. And we're and we're certainly happy that they didn't spend more money to build a bridge the bats could not use, as might have been the case had Merlin not come to town and and quelled the fears.

David Todd [00:48:39] When you were talking earlier, you mentioned that if the weather is not good, you know, for instance, if there's a hailstorm, some of these bats may get injured, they may break a wing. And so I was hoping that you could talk a little bit about the rehabilitation and release work that you do at the Refuge.

Lee Mackenzie [00:49:02] Well, sure. So, when bats are discovered by the public, they start Googling what to do. We used to be way down on the 27th page of returns when people Googled, "I found a bat what do I do in Austin?" Now we're right at the top or right on the first page, anyway. So people are easily able to find us and we're happy to guide them in what to do to try to care for the bat. Oftentimes the bats don't need to be brought into our facility. We ask people to send us a photograph. We look at the bat the best we can from, from photos. And if there's no obvious injury and they don't seem to be emaciated, we may ask them to follow one branch of our instructions, which is to simply get a twig, a 2-foot long twig and wiggle it under the bat to the point where it grabs on with its back feet and just lift it up in a tree. And that

way, hopefully under a branch where it will be protected from birds for the day until it can gather its wits and and strength and then fly out when it gets dark. Oftentimes all they need is to be elevated so that they can drop into flight. Some of the young ones don't fly well off the ground and none of them do if there's something in front of them that prevents their forward progress, like even tall grass. So that's our first option. We don't want to take bats in if all they need is a helping hand just to get up. And I don't want, say, a helping hand, because the major, the only rule you need to know about bats is just don't never barehand a bat. And you're completely, you can peacefully coexist with them completely safely, forever. So there are, anyway, but they can be assisted.

Lee Mackenzie [00:51:29] So if they have obvious injuries, we will ask people to bring them into us. We have a Web site it's austinbatrefugee.org. It has a page called Found a Bat?, and there is a video on the top of the page that shows how to safely contain a bat, and with no risk to yourself or to humans or to the bat. So that's the next option. We can't just go running around the town looking for bats, that are on a wall or on the ground and not contained, because frequently by the time we get there, they've crawled away and are hiding somewhere we can't find them, where we can't find them, or else a bird is flown down and picked him up and flown off, eaten them. So containing a bat that needs assistance is a first step. Then we're happy to take him in and care for him. We're happy to try to level the playing field a little bit. Sometimes all they need is to be rehydrated, rehydrated with an injection of electrolyte solution under the skin that frequently will tell us whether they're going to, whether they were, whether they're going to be quickly releasable or not. After that, if they look like they're getting more perky and bright-eyed, we might check their flight skills. And if they look good, we'll just simply release them.

Lee Mackenzie [00:53:08] So that's a one, the best-case scenario. The worst is if they have a severe injury that makes them non-releasable, in which case we will care for them, will care for them for the duration of their lives. We've had some bats that have been with us since the start. And, and they're, they're wonderful. They're like family to us. They're hilarious. They come out every night and want to interact when you go to feed them in the cage. And I say we, but in truth, my wife does most of the free-tail work with the, with those bats, both in new intakes and the captive colonies. And I do more of the flight cage work with some of the foliar roosting bats, the Eastern Reds, the Seminoles, the northern and yellow, northern and southern yellow bats.

Lee Mackenzie [00:54:08] So that's kind of our division of labor here in the Refuge. But we take them in for all kinds of reasons. And, and they have all kinds, all different, we have all different degrees of success. Some don't make it at all, and there's nothing we can do to help them, in which case we simply give them a quiet place to pass to the, to pass. And so, I think that's a valuable lesson or not lesson, but just a, it's valuable to show kindness to, in that kind of situation. It beats being, baking to death on a hot sidewalk, or being trampled by a crowd. So we feel like those are little ripples of kindness that won't do the world any harm and just might do a little good in the world.

David Todd [00:55:07] That's very sweet. So with your skills as a carpenter, I was hoping you might be able to talk a little bit about the (I think you've also worked with permaculture), if you could talk about the design and construction of some of these rehab structures that you've got - flight cage, the watering ponds and so on.

Lee Mackenzie [00:55:33] Yeah, OK. Well, we've always been, we've always had a garden that's always been, just, you know, gardening is a fascinating way to interact with nature, and

we've always been interested in permaculture, which was like something that was started in Australia long ago by a guy named Don Molson, but it gained traction in the US twenty years ago, maybe. And it refers to permanent agriculture in a way that you don't have to plow the prairie and reseed it every year and go to Monsanto for your new seed supply that has a built-in Roundup immunity, which will never, which will never be able to pass, they will never be a viable seed supply in the future. You have to keep on buying your seeds from the people that make them when you go that route. But permanent agriculture is one aspect, but also permanent culture is the other meaning of permaculture. And so that's just a way of being, of making this this life sustainable or a life sustainable. Maybe not this current one, but so we've always been fascinated by that.

Lee Mackenzie [00:57:03] And one thing about permaculture is that sometimes they do look at wildlife as being the enemies. They may wildlife may come in, and foxes may come in or coyotes will come in and kill your chickens. Raccoons will come in and raid your chicken coop. We tend to look at a more wildlife-friendly version of permaculture in that we're there to assist the wildlife, too. So our garden soon became a flight cage. We simply put netting over the garden. So this was a shade structure that we bought from a seed catalog or one of the farm supply catalogs. And we bought the, the inexpensive version and bought a bunch of fence posts and simply lifted it up to the point where it had enough headroom to accommodate bats, but still allowed us to reach them with the help of a 12-foot ladder. Oh, I'm sorry, an 8-foot ladder.

Lee Mackenzie [00:58:08] So, basically, we're stacking and packing a lot of different elements in the same tiny space and that really helps when you're, when you're in the middle of a city. There's a lot of value to us being here because this is where most of the calls come from. We don't want to be way out in the country, but I like doing a lot of elements in a small space, allows us to take advantage of what little land we can afford here in the city where the property values being what they are. So it's a organic vegetable garden that, the garden attracts the crop pests that the bats like to hunt and it gives them their joie de vivre, their reason for living. They, the netting is designed where the moths can wiggle through and lay their eggs on the collard greens and kale or whatever it is we may be growing at the time. Moths can smell brassicas a quarter mile away and they come to lay their eggs because they know their larvae will have good food to nourish them and develop into more moths. So we simply allow them to do that.

Lee Mackenzie [00:59:27] When we first had our garden, before we had bats, we used to spend all our time picking bugs off on them, and tossing them over to chickens next door. Now we just let them stay and they, they, the larvae hatch out into moths and they fly around a blacklight that we hang from the ceiling and provide the bats with incredibly valuable hunting practice. So they get to practice their hunting skills.

Lee Mackenzie [00:59:59] And we've had researchers come to film our bats in slow motion, and in 3-D. And it's phenomenal what they do. Even a bat that's only been flying for a few weeks is capable of incredible acrobatics that we never saw. They were so fast that we never even saw them doing this. But when we look at it in slow motion. Oh, my Lord. It's just unbelievable what they're doing. They're little juvenile bats are coming up to the moths doing backflips, catching them off in their tail. The moths have evolved to evade bats, and so they're already trying to escape. The bat is like batting, if you will, the moth back over toward them where they can catch it on their tail and in their mouth, completing that flip and then flying the backflip while controlling the moth and then flying away. So this research is going to be super valuable. It's going to, we're so pleased to participate in that, this is going to be this will

be turned into three dimensional models that will be studied by bat labs for many years to come. And they'll be using these models to describe the biomechanics of bat flight. So who knows what the implications may, you know, where that may lead over the years? I mean, it's just super exciting to be able to to see the bats in such incredible detail and to know that we're contributing to bat research at the same time.

Lee Mackenzie [01:01:41] Sorry, I, I lost track of our, your thread there, but feel free.

David Todd [01:01:46] This is great. I was just asking about these rehab programs, and then, you know, what you've done with these flight cages and permaculture programs at your place. And so this is really helpful.

David Todd [01:01:59] Let me let me ask a couple more questions. I don't want to hog your whole day, so I'll try to make it as quick as I can. So I understand that white nose syndrome has come to Texas and has been found in a number of caves. And I'm wondering if if you are seeing that in the Hill Country or any of the bats that are coming into your Refuge.

Lee Mackenzie [01:02:32] Well, I'm sorry to say we are. So the first ... we've known that the fungus was here in the area for a couple of years now. And the disease generally follows the discovery of the fungus by a few years. And sure enough, this winter the head chief mammalogist for Texas Parks and Wildlife was hiking at an Enchanted Rock with his family and discovered a bat on the ground, a cave myotis that looked to be in really bad shape. And he bundled it off and sent it up to the wildlife lab up in Madison, Wildlife. Oh, I can't remember it. The name escapes right now, but the main lab up in Madison, Wisconsin. And it came back positive for white nose. So that was the first confirmation that we had the disease here in central Texas.

Lee Mackenzie [01:03:40] Even what we had been seeing, the same species arriving at our refuge in unheard of numbers, so we've never seen cave myotis brought to us in the winter or late winter, early spring. And we got 24 in a row and they were all in horrible condition and they were all positive for the disease. We swabbed them, kept them in quarantine, made sure we followed all the right protocols and sent the swabs off for analysis. And they all were positive for the fungus. We didn't bother doing the histology because if the bat dies and it's confirmed for the fungus, they just assume that it's positive for the disease. So those are different things. But so basically they were all positive. And so I think actually we probably had the first instance of a bat with the disease.

Lee Mackenzie [01:04:43] So that's just part of how rehab can take, keep, keep its finger on the pulse of the health of bat species in, in an area. And we were devastated. We thought, our heart just goes out to them, even the same as if a bat has rabies. We just go, "Oh you poor thing. What got into you?" The same with a bat with WNS. You know, it's like, "Oh, my God, you poor thing." It's just. It's just, it's heart rendering, heart rending. So. Anyway, we, none of them survived. They were in terrible condition and not one survived. And that was surprising to us. We thought we could simply rehydrate them and feed them and care for them. We've been, we've heard you can clear the disease simply with supportive care. That was not the case with these bats. So we were disturbed and we know it's going to happen again, unfortunately, next year. So we're prepared to do better and to make sure we don't spread the disease or make it any worse.

Lee Mackenzie [01:05:55] But we have not seen that evidence in Mexican free-tail bats. But since they roost in caves with cave myotis, we have to assume that they're all positive for the

fungus. The fungus has been found in Bracken Cave, one of the largest roosts in central Texas, in the world. So we know that many free-tails actually have the spores and are likely spreading it far and wide. Now, what effect it's going to have on the huge bat colonies of central Texas? We don't know. We're cautiously optimistic that it won't affect them, that they'll be, because they migrate and don't hibernate with the fungus all winter that they will somehow avoid the, avoid the disease and avoid catastrophic declines in the, in the colonies.

Lee Mackenzie [01:06:53] But that would be catastrophic for us because of the ecosystem services they perform and those and the slow increase in population. They have a very low reproductive rate. They only have one baby per year. And if they suffer catastrophic declines, it'll take many of our lifetimes for them to rebuild their numbers if they ever do. So there's been some thought that this passed through Europe thousands of years ago and that that's the reason why Europe does not have huge colonies as we do here. So we can only hope that they'll avoid that, and that we'll continue to enjoy the benefits of living safely with bats.

David Todd [01:07:42] Well, you know, you mentioned this fungus and the disease that they suffer from. I've been reading and I'm sure you have, about a lot of finger-pointing and, and concerns about bats, not so much Mexican free-tails, of course, but bats elsewhere conveying COVID. What do you say to people who, who have these worries?

Lee Mackenzie [01:08:16] That repeat the stories?

David Todd [01:08:19] Well, we have heard that some folks point to bats as vectors for COVID and then others say, oh, that's probably not a valid kind of concern. I'm wondering what is your response?

Lee Mackenzie [01:08:34] OK, well, we spent much of the early, much of March and April, getting our thoughts together on that. And so we have a blog that has many, much of our, much of our thoughts on the process, on the, on the subject. But basically, it boils down to that bats are not responsible for COVID-19. And they are not spreading it. So all that, they've been vilified as being the cause of the pandemic, when in reality all that's known is that a relative of this current virus, seem to run through bats long ago. But it's not the same virus. It's possibly, it's related, apparently. But this pandemic is a human disease and it's spread by humans and it can't be transmitted by bats.

Lee Mackenzie [01:09:47] We've seen a lot, a huge increase in snarky comments on our social media. And whenever that comes up, we respond quickly and emphatically to make sure that people are aware that bats are not to blame for this pandemic. We just feel like we have to respond. And even a joke, we don't even tolerate jokes about it. So, and even though, there's been a lot of concern for us and from wildlife officials in the U.S., about reverse zoonosis, of people giving COVID-9 to bats. So that's caused the, the, caused since then, cessation of bat research for most of the spring, a lot of valuable research was put on hold and it's just now being released.

Lee Mackenzie [01:10:49] But that's smart. You know, they were exercising, exercising an abundance of caution to make sure that we didn't transmit this human disease to bats. That's the last thing we need on top of all the other things we're doing to them.

Lee Mackenzie [01:11:07] So basically, there's been, a new study came out just last week that showed the likelihood of different animal species or kinds of animals contracting COVID from humans. And it was a genomic study where they looked at the bat genome and the ACE2

receptors in various animals to see which ones would likely be a fit for the spike on the coronavirus. And they found that bats were very low on the, all bat species involved in the study were low or very low in likelihood to contract COVID-19 from humans. And, but they're very worried because lowland gorillas and most of the primates and a whole lot of other animals that are endangered and, and indeed in danger of extinction are, are high on the likelihood that they may be able to contract COVID from humans.

Lee Mackenzie [01:12:16] It's not the same as a study done in a lab. And they are conducting studies along those lines right now and until. But it is a good overall, overall framework for what to study and where to put the research dollars and so on.

Lee Mackenzie [01:12:41] But it also really makes us realize that we've got to, got a lot of work to do to protect these endangered populations of animals. You know, bats are low on the list. Even the Chinese horseshoe bats, which were vilified for being the start of all this, are also low on the list of being, of contracting COVID from humans. So that helps us. That makes it easier. We hope that U.S. Fish and Wildlife will relax some of the restrictions they've placed on us. We had to furlough, we had to lay off, well not lay off - that implies paying our volunteers - we had to tell all our volunteers to no longer come to the Refuge back in March, according to protocols from Texas Parks and Wildlife. We were glad that they allowed us to continue to rehabilitate at all. Rehabilitation was shut down in many states. But we worked with the state mammalogist, and the Texas bat specialist, to look for ways where we could have, instigate protocols, protocols where we could continue to, to rehab bats. So they see the value in it. And we're very grateful for them for working with us on that. And we are, we have our class of 2020 is about ready for release. We're just trying to hold them back through the worst of the heat and waiting for a break in the heat and a little more rainfall on the landscape, so there's water to drink and insects to eat before we release them.

Lee Mackenzie [01:14:17] So we're thrilled to see that, that the science seems to be trending in our favor as far as being able to rehab back and release them and care for them, as we always have.

David Todd [01:14:32] This is this is really interesting and is very helpful, thank you. Well, one last question about sort of this interaction between people and bats. I've read a little bit, and I'm sure you know more about it than I do, the impacts of climate change that seem to be affecting the migration of Mexican free-tails. Are you seeing evidence of that or any suspicions that's a factor in bat life?

Lee Mackenzie [01:15:03] Yeah, we are. We had hoped that our. You know, our, our, I mean, when we look back on our data just in the last 10 years, we can see that the Congress bats are returning a couple of weeks earlier than they did when we first started doing this work. That is, that seems to coincide with some of the artificial learning I was referring to earlier. Some of the research that certain ecologists have been doing, looking at huge swaths of data. I think they have seen, they tracked Bracken cave bats for the last 20 years and decided that they were coming back a couple weeks earlier, over the course of 20 years.

Lee Mackenzie [01:15:57] That's something that's absolutely remarkable to see, the distillation of all that data into that tiny little GIF that we were talking about earlier, the 15 second GIF, where you can see the effect of climate change or what we've assume to be the effect of climate change on the bats. All we, all it really says that they're coming back earlier, but...

David Todd [01:16:22] Does that make the bats be out of sync with the hatches of their prey or...?

Lee Mackenzie [01:16:33] A major concern is that that there will be a, that the insects, they may come back too soon, that the insects may not emerge from diapause, from being larvae, larval forms of their insect in the soil, that they may not emerge in time to feed the bats. That there may be huge disruptions if this continues, if this trend increases. And it's quite concerning, very alarming. It's all the, and we're we're concerned about it. But we're, that's the kind of thing that needs to be looked at on a meso scale over long temporal periods, where there's, where there's a, where people, we can really witness the effect. I mean our Congress Avenue bridge stuff is more anecdotal, when it's looked at, when you look at it in the grand scheme of things. So there are people hard at work on this and you know, I think, of course, you know, anything we can do to mitigate the effects of climate change has got to be beneficial, if it's not too late, we can always just try our best. Might as well go down swinging, if it is too late.

David Todd [01:18:02] Yes.

Lee Mackenzie [01:18:03] We need wind energy. And that's a big concern for bats. There's been a lot of work done on that. There are acoustic... bats being killed by the millions, by wind turbines, by wind farms, both Mexican free-tails and hoary bats, yellow bats, many different species, especially the migratory bats, are being killed by wind farms. And we need that clean energy, but we can't afford to lose our bats. So there's, there's been a lot of, some of the, there's been wind energy companies funding some of the studies. They've had success with acoustic deterrents, reducing mortality of some species around the wind farms, Mexican free-tails and hoaries, in particular. But those same acoustic deterrents seem to actually increase the number of yellow bats being killed.

Lee Mackenzie [01:19:04] So there are ongoing studies to figure out why that's the case. We've contributed our bats, or we have bats participate in those studies and we take them down there every chance we get to a facility that's studying that issue right now down at Texas State. So we're not sure about the overall effect. I mean, I guess they're going to build these wind farms regardless because of the huge demand for energy. If they reduce the mortality by 50 percent, but then build 10 times more wind farms, I think it's pretty clear what the trend is going to be overall, for overall bat survivability of these species that are getting hammered. But, so we have our reservations, but seems like they're going to be building those wind farms anyway, and we better figure out a way to kill fewer bats and try to allow them to continue, their species to exist and not kill them in our time.

Lee Mackenzie [01:20:10] Bats have intrinsic value, and have been here for for millions of years, you know, almost, you know, billions of years of existence of the earth. They've been for millions of years of life on earth, certainly. And so they have intrinsic value. And we don't have, it's not up to us, we don't have the right to wipe them out in our lifetime.

David Todd [01:20:38] I hear you. Well, you've spoken so well about all these things, and thank you for answering all my questions. Is there anything you'd like to add as we wrap up?

Lee Mackenzie [01:20:51] Oh, man. Sure. How much more time do you have?

David Todd [01:20:57] Well, maybe you can just tell us why you're studying and caring for bats, and educating about them, is meaningful for you. Is that a question you might be able to answer?

Lee Mackenzie [01:21:11] Well, I think I touched on it earlier, saying that, you know, I think every, all of us realize the impact that humans are having on the planet, and I think all of us are looking for ways to mitigate the damage and to try, to try to give back to the natural world, and we feel really lucky to have found one way we can do that. That's not enough. We all need to be working on, on every front, as hard as we can, if we're going to allow this planet to keep going and not irreparably harm it. So there's that.

Lee Mackenzie [01:21:57] But it's also been a real honor to do this work and to to get to know these bats as individuals. Just, it's just the fact that each bat has his own personality and his own life story as well, life history to tell, is something that we really feel deeply, you know, after working so long with these, with these wonderful animals, you know, and to see, to work with them like that really adds a lot of depth to the experience of seeing a huge emergence of bats. If you see a million bats coming out of a roost, but you just had one in your hand a few minutes before, and you, it has a huge, it adds so much depth to the experience because you just say, oh, my God, there's more unique ones than snowflakes, by far. They all are their own little individual persons. And you know, we find ourselves going out. There goes Kyra. And there goes Study. There goes Peach. Until we're almost dizzy, you know.

Lee Mackenzie [01:23:14] So this just feels like a real honor to to work with them and to experience that. And, and to know that, you know, they're the unique product of millions of years of life on this planet and they belong here.

David Todd [01:23:37] Well, you say it so well. And thank you very much for all your time. I look forward to seeing you down at the bridge really soon. And thank you again for taking time out today to talk to me and put your thoughts down for the future.

Lee Mackenzie [01:23:57] Thanks so much, David. I'm really, I'm really glad, grateful that you reached out to us. And we love talking about bats. So thank you so much for the opportunity. And we hope we get to see you in person. And without a mask and without any worries, up close. And soon.

David Todd [01:24:18] Yes, please. I look forward to it. Well, thank you, Lee. Take care yourself and I look forward to seeing you around. All right?

Lee Mackenzie [01:24:28] Thank you so much. Say hi to the family.

David Todd [01:24:33] You bet.