Dr. Sandra Rideout-Hanzak: *[00:00:21]* Hello, welcome to a Talk on the Wild Side, your biweekly tour of All Things Wild in Texas. I'm your host, Dr. Sandra Rideout-Hanzak. *[00:00:29][8.1]*

Rebecca Zerlin: *[00:00:30]* And I am your co-host, not a doctor. Rebecca Zerlin. *[00:00:34][3.6]*

Dr. Sandra Rideout-Hanzak: *[00:00:36]* Folks, if you aren't fascinated by this episode, you need to check your pulse. We've got a marine mammals expert with us today to talk about dolphins, dolphin genitalia more specifically, and dolphin populations in the Corpus Christi region of the Gulf of Mexico. And she is fantastic! *[00:00:54][17.9]*

Rebecca Zerlin: *[00:00:55]* Yes, I want to be her when I grow up. *[00:00:57][2.3]*

Dr. Sandra Rideout-Hanzak: *[00:00:59]* Yeah, so cool. We all got girl crushes now. But anyway, first we're going to go to our What's Wild and New segment. And we have Mr. Andrew Lowery with us today for what's wild and new. *[00:01:11][12.1]*

Andrew Lowery: *[00:01:11]* Howdy. Howdy. *[00:01:12][0.6]*

Rebecca Zerlin: *[00:01:13]* So what's wild and new? *[00:01:14][1.4]*

Andrew Lowery: *[00:01:15]* Well, guys, there's an invasive moth that could potentially decimate the prickly pear cactus population in Texas. This moth, the cactus moth, or Cactoblastis cactorum, for the Latin nerds, is native to Argentina, but came to the United States first in Florida, where it has hit the prickly pear population very hard. It was first noticed in the Texas Gulf Coast in 2017, and it may have possibly hitched a ride here on Hurricane Harvey, the gift that keeps on giving, as we call it. Researchers at UT Austin's Invasive Species Project have been studying the moth since it arrived here. *[00:01:47][31.8]*

Dr. Sandra Rideout-Hanzak: *[00:01:48]* OK, what have they figured out? Is their hope for stopping this before it's widespread? *[00:01:52][4.3]*

Andrew Lowery: *[00:01:53]* Well, Dr. Rideout, they've studied the moth, the cacti, and the cacti nutritional value. So far, all indications are that the moth could easily make a living here in Texas on our prickly pears, and it could become a widespread

problem throughout the state before long and eventually the entire Southwest. Ironically, the only known possible solution at the moment is bringing another insect over from Argentina, a parasitic wasp that feeds on the moth. But that has obvious implications and has not been studied well. Time is of the essence here, and UT lab is continuing to work on it. This work at UT is being conducted by Robert Plowes, Nathan Jones, Lawrence Gilbert and Collin Morrison. *[00:02:31][37.7]*

Dr. Sandra Rideout-Hanzak: *[00:02:32]* This seems like something we should revisit in depth sometime soon. I can't even imagine Texas without prickly pear. It's such a huge component of so many ecosystems and it's an important part of the habitat for many wildlife species, too. Plus, I don't want to live without nopalitos enchiladas. Well, now it's time for Rebecca to break it down for us as an introduction to today's guest experts. So here's Becca's breakdown. *[00:03:03][30.9]*

Rebecca Zerlin: *[00:03:08]* Have you ever met someone who didn't like dolphins? It seems we all have a bit of a mammal crush on these playful, intelligent creatures that inhabit the oceans, but other than our ideas that they're playful and smart, what do we really know about them? Well, today we'll be getting pretty intimate with dolphins, their anatomy and their behavior, so we can all understand them a little better. But let's start with the basics. Dolphins are a part of a group of entirely aquatic animals called Cetaceans, which also includes whales and porpoises. Cetaceans are aquatic mammals, and like land mammals, they share some of the same characteristics. They give birth to live young, they produce milk, breathe oxygen, and even have hair. Cetaceans evolved from land animals. But Michael Phelps aside, most land animals are not very fast in the water. So over time, these animals made some modifications to their bodies to allow them to be successful in the marine world. Hind-legs were largely lost, four legs became cute flippers, and they developed a breathing spout on the tops of their bodies. Hair just slows you down in the water. I mean, have you ever seen a hairy fish? So they drastically reduced the amount of hair that they have so that all that's left for the most part are some adorable chin whiskers. Kind of like mine. Now, let's dive a little deeper into dolphin anatomy, shall we? See what I did there? In most mammals, the male of the species has external genitalia. In other words, the penis and testicles are on the outside of the male's body. But when you're trying to be as streamlined as possible for fast movement in the water, that arrangement is not ideal. So cetaceans evolved to have internal male genitalia. The male can extend the penis and introduce it to the female during

mating. Now, consider the difficulties that might arise from trying to mate while swimming. Cetacean males and females have dealt with these difficulties by coevolving very specialized and complex morphology of their penises and vaginas. OK, definition time "morphology" is just a fancy term for shape, and coevolution just means that they influence each other as they evolved and made changes together. So why do scientists care about how penises and vaginas are shaped and dolphins and other cetaceans? We're not perverts, OK? Often in order to help a species that's threatened or endangered, understand their behavior or manage their habitat, we first have to understand how that species is built. How do all the parts fit together? It may seem like a simple or unimportant question, but it can help lead us to a greater understanding overall of the species we're studying or managing. So in today's discussion with a marine mammal scientist, we are going to get a little personal with dolphins, their genitalia and their mating behavior. And she's going to tell us all about the 'porpoise' of dolphin conservation. *[00:05:56][168.3]*

Dr. Sandra Rideout-Hanzak: *[00:06:03]* I'm really excited today, this is our second official podcast and we are talking to Dr. Dara Orbach. She is an assistant professor of marine biology. She's in the Department of Life Sciences at Texas A&M, Corpus Christi. So, Dr. Orbach, please tell us a little bit about yourself and what you do as an assistant professor of marine biology. *[00:06:24][21.0]*

Dr. Dara Orbach: *[00:06:27]* Absolutely. So I can I guess one of the questions I get asked very often is how I got into the field, and the answer is really that I am Canadian and I was born in Toronto, which is on the lakes, but not on the ocean. And so I moved to the ocean for my undergrad degree to the West Coast and just fell in love with being by the water, and decided that I needed a lifestyle which always had that that balance of ocean and breeze and salt water. And it just seemed to bring out the best of me. So that's sort of how my career took off. And I've been very fortunate that I've got to work with several different animals, including waterfowl, bats, fish and marine mammals. So, I come from a comparative background where I can look at concepts across different species and see what techniques have been used in one taxa, and apply it to a different system as well. So I am relatively new to Texas A&M, Corpus Christi. I've been here just under two years, so I'm starting at my lab here. And my research really is a balance of anatomy and behavior and ecology of animals. So I have several different projects which try to look at different facets of how

our marine mammals are adapted to their environment. And so from the anatomy perspective, I do a lot of work on their genitalia, which is, I think, fascinating, and also a very understudied area that for the most part, when animals die and they are dissected to understand the cause of death, people look at the gonads because you can tell from looking at testes of an animal that's actually sexually mature and you can look at ovaries and you can tell from that how many times the female has ovulated before. But very rarely do people doing dissection of marine animals look at the actual penis and vagina. So I have this very unique aspect to my research while I'm documenting diversity and understanding more about the relationship between form and function. So, for example, we know that when dolphins are swimming in the ocean and they're meeting that their penis is outside their body when they're trying to mate with the female, but we don't know much about how that penis is built to withstand the drag forces acting on the penis, the hydrogen drag forces. We also know that the vagina, for the most part, don't have much diversity. But I have documented that in cetaceans, which includes dolphins, whales and porpoises, they have extreme diversity to the point that when people send me dissect the reproductive tracks, I can tell you what species it is just by looking at their genitalia. So this amazing level of diversity that we didn't know existed before. So that's one aspect of my research. I'm really looking at genitalia, reproductive anatomy, and how we can use that to understand more about basic biology with conservation applications. And then the other aspect is behavioral ecology, which in my past research has largely focused on mating behavior and understanding the relationship between how animals are meeting and the idea of female choice in choosing a mate. We've been using drones to document mating behavior and look at very specific, subtle behaviors which you usually cannot do from a boat, to getting really deep into video analysis. But locally, the water is quite murky, and so our interest has largely been understanding more about the local population, which haven't been there hasn't been a study published on them in over 30 years. So we know almost nothing about these dolphins. We don't even know how many there are. If they have preferred habitat, who spent time with whom, if the areas where they spent time or areas of high risk from different human-made disturbances? So there's so many different questions that can be answered. And it's a really unique opportunity because so little has been published on these dolphins that it's the sky's the limit opportunity in terms of both anatomy and in terms of the habitat distribution and local ecology.
[00:10:30][243.5]

Dr. Sandra Rideout-Hanzak: *[00:10:31]* Well, that's exciting! I'm surprised it's been over 30 years since somebody studied them. I always think of dolphins as one of the most studied, most interesting creatures. So I'm kind of shocked to hear that. *[00:10:44][13.1]*

Dr. Dara Orbach: *[00:10:46]* I think a lot of it has to do with dolphins and other marine mammals, well, let me retract that. Most marine mammals, not all, are covered or they're protected under the Marine Mammal Species Act. I did not say that right. They are protected, though under the federal government under the National Oceanic and Atmospheric Administration, National Marine Fisheries Services. And so you need a permit. But locally, we don't have as much federal representation. We have a lot more state. So we have Texas Parks and Wildlife locally, but we don't have as many NOAA researchers, which may be part of the reason why they have not been studied here. *[00:11:23][36.5]*

Dr. Sandra Rideout-Hanzak: *[00:11:23]* Oh, I got ya. OK, you mentioned your lab earlier. Tell us what the name of your lab is. *[00:11:29][5.8]*

Dr. Dara Orbach: *[00:11:31]* Sure, it's FABEMM! With an exclamation point. So it's the Functional Anatomy and Behavioral Ecology of Marine Mammals! Lab. *[00:11:38][7.4]*

Rebecca Zerlin: *[00:11:39]* We didn't have that written down correctly. No exclamation. (Laughter). *[00:11:41][2.5]*

Dr. Sandra Rideout-Hanzak: *[00:11:41]* I did forget the exclamation mark. I apologize. That's a cool name. *[00:11:45][4.1]*

Dr. Dara Orbach: *[00:11:46]* I remember seeing the movie Shazam! And I was like, I like that. I want to call my lab FABEMM!, with an exclamation point. (Laughter). *[00:11:53][6.2]*

Dr. Sandra Rideout-Hanzak: *[00:11:54]* I like that. *[00:11:54][0.5]*

Rebecca Zerlin: *[00:11:56]* So you study both behavioral ecology and marine mammals and reproductive anatomy, we'd like to talk a little bit about both today, but let's start with the reproductive anatomy. Why is it even important to study reproductive anatomy and marine mammals? Like, I don't mean to sound harsh with this, but why do we care? Why should we care? *[00:12:15][18.6]*

Dr. Dara Orbach: *[00:12:17]* And this is a question I get asked all the time and...a lot of times when we think about research from our human perspective, we're interested in applied research, but how is this going to help humans in terms of biomedical or in terms of engineering? And a lot of the research I do is basic science, just trying to understand the way animals are adapted over evolutionary time without a applied approach in there. So simply understanding how animals are built is something that intrigues me as well. And I also like the idea of making science more accessible, something you can talk about, hopefully after hearing this podcast, something that might come up over the dinner table, something you heard that day. So let's apply more just general understanding. But that said, there also are some applied aspects. So one of my current main projects right now is actually building biomimetic artificial vaginas to simulate the natural shape and elasticity of dolphin vaginas. And we're very fortunate to have some different aquariums in the U.S. that have agreed to train their dolphin to use our artificial vaginas. And the hope is to see if we get a better quality ejaculate. And most research on artificial insemination really focuses on ways to inseminate the female deeper or to have that to preserve the sperm. But there's very little research on how to improve the quality of the sperm at ejaculation. So, this has the potential to be applied towards any animals in captive breeding programs, with the goal of ultimately conservation. So that's just one applied aspect to it. Also, potentially way down the line over here, if we can come up with a way to...improve the quality of ejaculate, this will help a lot with artificial insemination of livestock like pigs and cows that can be used for human consumption. There's a lot of potential benefits in that way. But my interest is largely basic science with conservation and also potentially application towards agriculture and livestock. I was going to say so we found some really amazing things in looking at reproductive anatomy. So for one thing, I have been very fortunate that have the 90 plus species of cetaceans, which again are dolphins and porpoises, I have dissected reproductive tracts of more than half of those species, which is extraordinarily rare since most people have never seen a reproductive tract of any cetacean species. And what I have found in terms of vaginal morphology, is there is more diversity in cetacean vaginal morphology than in any other vertebrate clade that exists out there. So the question really becomes, why in the world do you need such distinct shapes across different species? And the working hypothesis is that these these animals, these dolphins, whales and porpoises, they have weird structures called vaginal folds, which are protrusions of the vaginal wall

into vaginal lumen. So imagine you have a water bottle, for example, with something protruding into the middle of it. And that's what these shapes are, these vaginal folds. And the question is, why do these animals have them in the first place? And a lot of researchers in the 18-&-1900s thought that - and I shouldn't say a lot...there has not been very much research on vaginal folds at all - but those who have studied them suggested that they were an adaptation to living in the aquatic environment, that maybe these were a way to keep saltwater out of the reproductive tract. But that doesn't really make sense, because they are found very cranial (towards the cervix, not towards the clitoris), but are found very deep in the reproductive tract. And also we find that dolphins that live in rivers have these vaginal folds. But there are other marine mammals like sea otters and seals and walruses, they don't have vaginal folds. So these are not something ubiquitous across all marine mammals. So my hypothesis has been that they play an important role in sexual selection and wait for females to control paternity potentially. And what we've found is that male penises have very unusual shapes as well, and they're the exact same shape as vaginal lumen, which actually makes sense, since they all probably coevolved together. And if you think about it, copulation is the most direct possible interaction between males and females. So their penises and vaginas should overlap and shape. But what we've found is that the way that sperm would have to travel through the vagina to bypass all these barriers that the vaginal folds present, and actually reach close to the cervix (where presumably the penis or the sperm would then travel to fertilize the eggs), the penis shape is the exact same in terms of all these bends that bypass these vaginal folds. So we see this amazing level of coevolution of male and female reproductive tracks. And something else we found, which was fascinating, was that in harbor porpoises, they have extremely unusual, highly convoluted reproductive tracks of all kinds of spirals in there. And we found that in San Francisco, males only approached the female on her left hand side. And this laterality - this one-sidedness - in sexually approaching a female has not been documented in any mammal ever before. And it turns out that the reason the males approach on the left hand side is because that is the angle they need to use for their penis to bypass all these vaginal folds. So we see this amazing evidence of coevolution, both between the anatomy of males and females and also between their behavior, which I think is absolutely fascinating and tells us something really special about long term evolutionary history. *[00:17:49][332.2]*

Rebecca Zerlin: *[00:17:51]* Yeah, that is really, that's kind of crazy to think about because, I mean, just thinking about...dolphins, you don't really necessarily think that they would be that different. So since you've seen, can you describe maybe some differences you might see in these these structures, especially with the females? That kind of sounds interesting, like how if you were to receive a female reproductive track, how would you be able to determine who it belongs to? *[00:18:19][27.7]*

Dr. Dara Orbach: *[00:18:21]* Yeah, so the first thing we do, we get them is we make casts of made out of silicone of the lumen so we can look at the actual shape of it and compare it to penis shape. And then we actually make an incision right down to the belly side of it, so right down the ventral side, we make a single incision, and then I can count things like the number of folds they have, their distance between each other, how thick they are, the shape of them. Some are very lifelike, almost like flower petals, where some are very, very thick, like kind of thicker than your thumb sometimes. So all kinds of differences in the number, shape, size and positioning of them. And it tends to be very conserved within a species, so there is some individual variation where you have 10 bottlenose dolphins, they all might look slightly different, but they're all just going to have one large leaf-like fold with a certain distance between the cervix and and where that fold is. So it's pretty consistent within a species, compared to across species. I actually had a situation once where I was sent a specimen, and I was told it was a bottlenose dolphin, and I opened it up and I wrote back to the stranding network and said, "I think you've mislabeled it." And they checked their notes, and they said, "It looks like you're correct. We actually did mislabel it." So it's at a point where they're that distinctive that you can tell what species it is. It's a weird skills that I've acquired over this life. So I think it largely is a form of antagonism between the sexes that we often think that females are cooperative in mating, that the goal of life is to have more babies. But if you think about it from a female dolphin's perspective, pregnancy is 12 months long. So she'll be lactating for at least two to three years depending on the species. Some species can be up to seven years. That is a huge investment in one single offspring and they never have twins. So she's investing up to, let's say, seven years of her life and one offspring. You better be sure that's a desirable male you're meeting with. And when dolphins are mating, first of all, they're mating all year round, not just seasonally, although they do tend to have a peak period where they can conceive, mating can serve several purposes beyond

conception. It can also be for play. It can be for social learning. It can be for working out dominance relationships. So dolphins are mating all year round. And oftentimes you'll see multiple males trying to mate with one female consecutively without her getting a break in there. So it paid for her to be very picky. But if she's resistant to males, there's a possibility that they will be aggressive towards her or potentially kill her offspring or engage it, which is infanticide, which we know does occur in dolphins. So it pays for the female to mate with these males rather than incur physical violence or cost of her potential offspring. But she the a way to control paternity so that she's not going to conceive by any potential male she's meeting with. So we think these might be a way for her to subtly control which males are going to inseminate her (sire her offspring), just by shifting her body slightly, she can offset that penis inside her reproductive tract so the penis doesn't penetrate as deep. It can't bypass those folds. And then the sperm would have a longer distance to travel, to fertilize the eggs. And the longer the distance, the more likely the sperm won't make it because there's so many chemical barriers inside the vagina. *[00:21:44][203.1]*

Dr. Sandra Rideout-Hanzak: *[00:21:46]* That's really interesting and but it makes a lot of sense when you think about, I mean, how how intelligent dolphins are. It makes a lot of sense that she would have some some control, some say in the matter, I suppose. *[00:21:59][12.8]*

Dr. Dara Orbach: *[00:22:01]* And I guess a lot of females, if males can tell the female is an estrus, (if she's if she's able to conceive), and the answer is actually, we have no idea. We think so, because there are periods where dolphins will be mated with frequently, and then 12 months later, they'll have an offspring. So we do know that it turns out the timing corresponded, but we have no idea how males know when a female is in estrus. Personally, I think it has something to do with pheromones, probably released in the urine. But this is a really exciting area for future research as well, to understand how males even detect when a female could conceive. And if certain females are more desirable than other females. It's really amazing how little has been studied on cetacean mating. And if we think about it, we're talking about a group of animals that are found oftentimes offshore, they spend most of their life beneath the surface of the water, they're not meeting just because we happen to be there waiting to watch them. So it's not necessarily an opportunistic, we're going to make because we

have an audience thing, and we think that most species also mate deep beneath the surface of the water where we wouldn't be able to see it anyhow. So if I mention humpback whales, for example, or one of the best-studied species. They've been studied on their breeding grounds for over 40 years. We know they go towards certain places in Hawaii, in the tropics where they produce the males produce vocalizations which are thought to be calls to attract females or competition between males. We know this is where the females have the calfs, and yet no one has ever observed a copulation among these humpback whales on their breeding grounds. Similarly, one of our best-studied populations of bottlenose dolphins is in Shark Bay, in Western Australia. There's a lot known about males. They form alliances where the males work together to coerce females away from other dolphins, and they basically force her to stick with them and to copulate with them and don't let her get away. And then they form these bigger alliances, which steal females from other alliances. It's amazingly complex social hierarchies and they've been studied for 30+ years. Yet no one has ever observed a copulation between an adult male and an adult female. So there's very few places in the world where we actually can observe cetaceans mating under natural conditions. And I do want to mention that natural conditions, because I imagine that if you were to take a population of 400 animals and put five into a human care facility, the interactions and dynamics are going to change between those animals. And what you see might be more about a hierarchy, as opposed to natural copulation. So I am very fortunate that I have spent much of the past decade plus looking for places around the world, which there's something about the local ecology where you can see these dolphins mating. So, I mentioned the harbor porpoises in San Francisco, and we actually stand on the Golden Gate Bridge and look down, and it turns out that the Golden Gate area, the San Francisco Bay, is hourglass shape and the narrowest point is right underneath the bridge. And so every single day, the tide moves in and out of the bay, and food is going to move with the tide, (all of the small fish are going to move with the tide), and the females are going to follow the food in. The males are going to follow the females. And because of that hourglass shape, the males are waiting underneath the bridge or near that bridge, which is the narrowest point, to intercept the females when they're following their prey. And so if you go to San Francisco Bay and stand on the bridge and look down at high tide, you're very likely to see a copulation event. But it's less than two seconds; so, all you'll see is a splash and you blink and you miss it kind of thing. *[00:25:42][221.8]*

Dr. Sandra Rideout-Hanzak: *[00:25:44]* Wow. So, this is so fascinating. I'm starting to, uh, starting to question my career choice. Do you have room for another grad student in your lab? (Laughter). *[00:25:52][8.5]*

Dr. Dara Orbach: *[00:25:55]* For you? Absolutely. (Laughter) You already have a PhD, are you going for a second PhD, or another master's? *[00:25:59][3.6]*

Dr. Sandra Rideout-Hanzak: *[00:26:00]* Yeah, I don't know. I'm just, like, so fascinated. I could listen to this forever. (Laughter). *[00:26:05][6.0]*

Rebecca Zerlin: *[00:26:06]* You've given lots of examples of different marine mammals. So do you have a favorite marine mammal? *[00:26:13][6.6]*

Dr. Dara Orbach: *[00:26:16]* I actually do, and it's not one that I've been fortunate to study as much alive...it actually...there's Kogia, which are the pygmy dwarf sperm whale. And they look so similar, it's hard to tell them apart unless you dissect them. And they're actually found in the Gulf of Mexico. So they're probably the second or third most likely species to strand on the beaches here. But they are a deep offshore species. So you almost never just see them from a boat. And what's really special about them is they have so many weird adaptations, and as a functional anatomist, I'm fascinated by adaptation. So they have what I would like to call an overbite, they're kind of like a sperm whale; so, they look a lot like a shark in that capacity. And they also have soft gill slits. So we know that dolphins are mammals, they breathe air from their blowholes at the top of their heads; so, why would you possibly have a superficial structure that does not go very deep, that looks like a gill slit? So they look a lot like sharks and they're about the same size of sharks. But it's unclear why they look like sharks. And then my favorite aspect about them, is that they actually can ink like a squid when they are startled. And that makes the water really, really murky so they can escape from predators. And it turns out that ink is actually poop produced in their colon, but it makes the water murky. So it's a really unusual adaptation that we don't see in very many species, like it seems to be unique to the cuttlefish and to Kogias, for the most part. *[00:27:44][88.6]*

Dr. Sandra Rideout-Hanzak: *[00:27:45]* That's pretty fascinating! *[00:27:46][0.6]*

Rebecca Zerlin: *[00:27:47]* I don't think I've ever heard of them before, so I have a new species to look up. *[00:27:50][2.8]*

Dr. Dara Orbach: *[00:27:50]* Yeah, the pygmy and the dwarf sperm whale. *[00:27:53][2.1]*

Dr. Sandra Rideout-Hanzak: *[00:27:53]* Okay, we'll have to look into those, and you'll have to come back if you start studying those and talk to us about those. *[00:28:01][8.1]*

Dr. Dara Orbach: *[00:28:03]* Sounds like a good idea! I'd love to sometime. *[00:28:05][1.7]*

Dr. Sandra Rideout-Hanzak: *[00:28:08]* That's terrific. Recently you began studying the local bottlenose dolphins population in the Corpus Christi region. Tell us what you've learned about this. Are there a lot of dolphins in this area? Are they year-round residents? Do they migrate? What's going on with them? *[00:28:24][16.7]*

Dr. Dara Orbach: *[00:28:26]* These are the exact questions we're trying to figure out, and I will mention that although I'm new to the area, my collaborator Will McGowan at a Texas Sealife Center, has been collecting videos, or photos rather, for the past decade or so on these dolphins. So he has been collecting not quite...we're getting close to a decade, I believe...since 2014. So he goes out four times a year and collects photos of dolphins in Corpus Christi Bay and in Redfish Bay. So slowly, we're using his photos, plus the photos that I've been collecting the past couple of years, to understand more about if these dolphins are residents, and how long they live and stay in the area. And the way we do this with photos is actually pretty amazing. It's noninvasive. And so dolphins have unique markings on their dorsal fin. So when...(the dorsal fin is the fin on their back), and when dolphins are born, they have beautiful fins with no markings on them. And then over time, they acquire all these nicks and notches and scars, which come from a variety of sources. And most of these markings come from other dolphins - others of the same species - will bite each other during play. We also know they can get them from sharks and from orcas, killer whales are their two main predators. We also know that a lot of a lot of these markings are coming from humans, either from fishing gear, or boat propellers, or nets left in the water. So they leave all these markings on the dolphins, which persist over time. And so we can take a photo of a dolphin then when it comes to the air to surface and then we come back a subsequent day or a month or year. And if we take a photo of the

same dolphin, that gives us an idea of the population size. So every time we photograph a new distinctive fin, that's another animal that we're adding to the population. One really special thing that that my undergrad student actually has found, is that she's been understanding or she's been trying to understand more about how these scars heal. So we know that these nicks and notches are persistent, those are missing pieces of tissue, those are not going to heal. But scars might heal quickly. And what's really special about our area is that Laguna Madre, which extends from North Padre Island all the way down to Mexico, is the only hypersaline bay in the U.S. It's the only place and the only bay in the U.S. where the water is more salty than ocean water. And we know that if you were to cut your mouth, for example, and get a canker sore or you might be told to rinse your mouth with salt water, because salt helps heal wounds. And so she's been looking at photographs of these dolphins moving up and down the coast of the Laguna Madre and taking photos of them or using Will McGowan's photos of them and looking at how fast these scars heal. And then comparing that to Corpus Christi Bay, where because there's freshwater inflow, the water tends to be lower than seawater. So we have these two extreme salinities: one which is hyper (high), and then in Corpus Christi Bay, hypo (or low salinity), where we would expect scars to heal much slower. And that's exactly the pattern that she's been finding. So, again, just really amazing things we can find just by taking photos that are actually disturbing these animals. *[00:31:36][190.5]*

Dr. Sandra Rideout-Hanzak: *[00:31:38]* That's terrific. With with these photos, do you have an idea of how many there are in this area? *[00:31:43][5.9]*

Dr. Dara Orbach: *[00:31:46]* So the last paper from three years ago said that there were 300 dolphins, give or take. My guess is over a thousand dolphins. I think that in the past two years they've probably collected well over 600-700 different individuals, but we don't know how long term they stay in the area. So, for example, one of my other field sites in New Zealand, we know there's about 2000 dolphins present at any time of a national population of 10,000 dolphins, but they don't stay as residents are constantly moving in or out. So I'm not sure if the dolphins we're photographing here the same ones who stay here, or if it's just a constant flow of dolphins moving around. And what's amazing is the federal government has set up a database called GOMDIS, the Gulf of Mexico Dolphin Identification Study. I think that's what the acronym stands for. And they are matching bottlenose dolphins down in the Gulf

of Mexico across institutions. So they're looking at the dolphins found in Corpus Christi area are the same ones found in Galveston, the same ones found in Alabama, the same ones found in Florida. And looking at how these animals might be moving. *[00:32:51][65.6]*

Dr. Sandra Rideout-Hanzak: *[00:32:54]* Wow! So speaking of how they're moving, what areas do you see them the most in? Are there certain places that they prefer and certain places that they congregate in, or are they just moving all throughout the bay? *[00:33:09][15.6]*

Dr. Dara Orbach: *[00:33:10]* Yeah. It turns out that there there are. So, my current Masters student Samantha Sheeran has been looking at site fidelity and Habitat use and trying to understand if there are certain areas where dolphins typically are found and they very much so spend a lot of time right by the ferry terminal at Port Aransas/Aransas Pass, seems to be a main hub. And what Samantha has been doing is plotting where dolphins have been sighted over the past 10 years, and then looking at where potential threats to them are, including power plants, chemical plants and other potential sources of chemical pollution. So really interesting to see how their habitat preferences overlap with potential threats to them. *[00:33:55][44.9]*

Rebecca Zerlin: *[00:33:56]* What are some other threats or concerns for them? *[00:33:58][2.2]*

Dr. Dara Orbach: *[00:33:59]* This area, their main threat, I would say, are largely locally, they're largely humans, so they're predators or sharks and killer whales, but we don't see too many markings of that. But I think their main local threats are going to be humans, either people feeding fish, feeding fish to them, (which is extremely dangerous), because dolphins become reliant on them and stop being able to collect or find fish on their own if humans are feeding them. So feeding the animals. We know that our waters are highly polluted. I'm sad to say...so, pollution is a big deal. We also know that salinity is important. So, whenever we have a hurricane or a major storm like we had just the other day, there's a lot of freshwater inflow, and low salinity causes skin lesions on these dolphins, which can lead to long-term compromisation of their skin, or their epidermal integrity, and eventually to death and some of these animals. So, for example, I know there's plans to build a desalination plant and that could have major impacts on the health of these animals. *[00:35:01][61.7]*

Rebecca Zerlin: *[00:35:02]* What are some of those expected impacts, you would say, with these plants being built? *[00:35:05][3.6]*

Dr. Dara Orbach: *[00:35:07]* I think the largest one would have to be in terms of their their skin and having any skin lesions which can compromise their entire immune system and ultimately lead to death. So one thing we're hoping to do and we have permits to do is to fly drones over the dolphins. And even though our water is murky, we can use drones to take photos of their overall body condition and look at skin lesions and see what the health of the population is in terms of the skin lesions, both before, and after, construction of various desalination plant. *[00:35:37][29.3]*

Rebecca Zerlin: *[00:35:39]* So with all of these potential threats, would you say that the Texas coast is well suited for bottlenose dolphin populations? *[00:35:46][6.8]*

Dr. Dara Orbach: *[00:35:49]* That's a tricky question to answer, because it's good fishing. We know that the Texas the south Texas coastline attracts people from all around the world for fishing and dolphins like fish, too. So in terms of the resources available to the dolphins, few predators in terms of natural predators, like sharks and killer whales, and in terms of lots of fish available, then, yes, the Texas coastline is very conducive to them. In terms of our anthropogenic human-caused disturbances, which are increasing substantially with more industrialization. It's becoming substantially dangerous, which I think is part of the reason that the research I'm doing is so important to understand more about what are the threats to these dolphins, how at risk are they and how can we inform management to better protect them? Dredging is another big issue. We know that the entire channels are being dredged out as part of the Panamerican dredging project. And we know almost nothing about how dredging influences dolphins. We know that dolphins tend to prefer dredging sites because they can catch fish there. But we don't know if the sound from the dredging is disturbing them. We don't know if it's changing the habitat substantially. So it's just a really interesting area to be positioned in terms of understanding more about how human threats are changing. Dolphin distribution habitat use. *[00:37:10][81.6]*

Rebecca Zerlin: *[00:37:11]* OK, so we're going to I think we're going to lighten up a little bit to just learn some fun things. So, do you have something that's really surprised you? What

would be the most surprising thing you've learned in your research? *[00:37:23][11.9]*

Dr. Dara Orbach: *[00:37:26]* I think learning about the diversity of genitalia has just shocked me in terms...for the most part, it was thought that males have very diverse genitalia and females don't. It was sort of like a statement that was published. And I read an article that reviewed the history of studying penises and vaginas in the past two decades and found that we still have this bias in science, that we study penises more than vagina. And the reasoning was firstly that there was a paper or book published which said that females have largely invariable reproductive tract for that sort of set the precedent. Also, researchers used to predominantly males who are more interested in penises and vaginas. And then we also know that a penis might be easier to study because it's external as opposed to a vagina, which is internal and a little bit harder to access. So just learning how much variability there is in vaginal morphology has been really surprising to me, and kind of changed the way we think about some fundamental principles in sexual selection. We often take things which have been discovered 20, 30, 40 years ago as fact, but I'm finding them more and more you research and delve into things and question some basic principles, the more you're finding that there is a lot more to be discovered and room for interpretation. *[00:38:44][77.8]*

Dr. Sandra Rideout-Hanzak: *[00:38:46]* The more you learn, the more you realize you don't know, right? *[00:38:49][2.8]*

Dr. Dara Orbach: *[00:38:52]* Exactly! For every question I answer, I feel like I have 40 new questions, which is a very exciting time to be in the field of marine mammal reproductive biology, where I'm also very fortunate that there's not very many other people in the world doing these questions. So I definitely have a monopoly, in terms of being fortunate that I get sent a lot of specimens. And really the sky's the limit thing. Also, since there's been so little research done in this field that any question, no matter how wacky it is that I can conceive, seems to be - and if it's possible to do it - I can answer these fundamental biology questions. So, I feel really fortunate that I'm not just doing things which have been done a million times before in a new location or new species. But I can ask is really novel questions which change your understanding of sexual selection and also help conserve the local animals? *[00:39:43][51.0]*

Dr. Sandra Rideout-Hanzak: *[00:39:44]* That is really exciting when you when you're in a new science, and the doors are just wide open for you to follow your curiosity. That's, that's great that you have that opportunity. *[00:39:55][11.5]*

Dr. Dara Orbach: *[00:39:57]* I count my blessings every day - more funding would be nice - but I count my blessings on the research opportunities every day. (Laughter). *[00:40:04][6.1]*

Dr. Sandra Rideout-Hanzak: *[00:40:04]* Absolutely. So, for young people out there or, you know, folks like me who are now questioning their career choices, what would somebody do if they want to get into a career with marine mammals? *[00:40:16][12.3]*

Dr. Dara Orbach: *[00:40:19]* So my pathway was quite unusual, and I didn't realize how competitive it was to study marine mammals, and so I finished my undergrad, I have two bachelor degrees, and near the end of my second one, I was having my early life crisis trying to figure out what career to go in. And it was really living by the ocean that inspired me that I wanted to study marine mammals, but I didn't think I would be competitive enough to get into a master's degree studying dolphins since I hadn't been interning and volunteering. And so I took a very unusual route, and I actually studied acoustics in bats, and I looked at the alcohol tolerance of bats (fruit-eating bats). If fruit ripens, it ferments. And I wanted to see if bats fed alcohol in tropical latitudes had a higher tolerance than those in temperate latitudes. And so it was a lot of fun, that's for sure. But I became a bit of an expert in, but I wouldn't say an expert, but I became much more knowledgeable in bioacoustics, with the ultimate goal of that being a transferable skills set. So I guess the point of my story is I have a bachelor's degree in classic Middle Eastern and religious studies and studying bat bioacoustics, and that got me into my career avenue. So I think the real message is that it's never too late and you have to capitalize and think outside the box on the skill-sets and the training and experiences you do have and how those make you valuable. So, if you study fire ecology, just to call you out over here, have some of the circumstances you might have encountered in some of your research experiences would be transferable towards studying Dolphins? Mm hmm. And then I also highly recommend getting involved in different projects. So if you can intern somewhere, or volunteer in an aquarium which has dolphins, any actual experience would certainly be helpful. *[00:42:02][103.4]*

Dr. Sandra Rideout-Hanzak: *[00:42:03]* Yeah, well, I noticed that bachelor's degree on your on your CV, and you reminded me a little bit of myself because I, I was a Latin teacher before I decided to come back to school and get a master's and then eventually a Ph.D. in natural resources. So it's kind of fun to be a little bit of a jack of all trades and know a little bit about some other things, too. *[00:42:26][23.1]*

Dr. Dara Orbach: *[00:42:28]* And even with your example, I took Latin in university and it probably was one of the most valuable courses I took, because I can understand so much more of the scientific literature and the nomenclature, the naming system, because I understand a little bit more about the roots of Latin words. So super! *[00:42:43][15.1]*

Dr. Sandra Rideout-Hanzak: *[00:42:44]* Thank you for that. You know, I love to hear that! *[00:42:47][2.7]*

Dr. Dara Orbach: *[00:42:49]* It really was one of the most valuable courses I took. *[00:42:51][2.8]*

Dr. Sandra Rideout-Hanzak: *[00:42:52]* Absolutely. People will call it a dead language. And why would you study that? And I'm like, oh, my goodness, it's at the root of almost, you know, half the words that come out of our mouths. So, that's terrific to hear a scientist like you say that, too. *[00:43:05][13.5]*

Dr. Dara Orbach: *[00:43:07]* So I think that's exactly what you need to think about--your experiences and how they make you unique. I think that conformity has benefits, but it's the things that make us different, which are a real strength that need to be used towards your advantage to help you achieve your career goals. *[00:43:26][18.8]*

Dr. Sandra Rideout-Hanzak: *[00:43:26]* Oh, absolutely. Absolutely. I would agree with that 100 percent. I've got another, one last question for you in biology fields, we sometimes find ourselves in sticky situations just because we're studying live animals out in the wild. And we're just wondering if you wouldn't mind sharing with our listeners any biology blunders that you might have made yourself. *[00:43:48][21.8]*

Dr. Dara Orbach: *[00:43:50]* Oh, my gosh, pick a date and why, I feel like I constantly having them. One example that comes to mind...actually happened early, it happened...last semester, and I was asked to give a seminar talk for a different university, a different state, and initially I was going to go in person and

then COVID happened; so, we scheduled it to be online, and the day I was going to do it online, it was going to be at noon. And it was a really rare, wonderful weather day where the way our surveys are designed is we have to do several consecutive days on the water... To assume it's a closed population with our dolphins leaving or coming or birth or death, we have to do several days within a short period of time. And it was a good weather window. So we decided to go for it. And the plan was I wouldn't be on the boat in the morning, we find a way to - there's no dock on campus - find a way to drop me off somewhere near campus. I would run over to my office, and my seminar talk, running back somehow to a bridge, jump on a boat, and we continue that afternoon...I'd only be gone for an hour-and-a-half. And the morning was going great. We saw lots of dolphins, and we were heading back towards the campus. We had like 30 minutes to go until my talk, when the motor cut out and completely died on us. And luckily it was not my boat, but we were stranded there, and it took almost five hours to get towed back to the place where the boat was launched from. And so I completely missed my talk over there and had to reschedule for a third time. So equipment malfunctions happen a lot. And that's sort of what you come to expect that something is going to go wrong. I can say that many, many times I have lost my datasheet to the ocean. (Laughter) I now print them, or write on rain paper, so that they float. But luckily, one boat in my whole clipboard flew into the ocean. So that didn't help me very much either. Oh, no. So we just be prepared for things to go wrong, and to think outside the box. Once I lost my clipboard, I just pulled up my phone and started dictating the coordinates and all the water quality parameters that we needed. You do the best you can, but definitely the dolphins don't read the protocol, and they tend not to cooperate, as you would hope. (Laughter). *[00:46:10][139.9]*

Dr. Sandra Rideout-Hanzak: *[00:46:11]* Oh, absolutely. I often, I often doubt why, why didn't I just go on with the classical languages? Why did I have to go into something with so much equipment? Because it's always the equipment. The equipment is like, oh, my gosh, it's the biggest blessing to have all the equipment, and it's the biggest curse at the same time! (Laughter). *[00:46:33][21.9]*

Dr. Dara Orbach: *[00:46:34]* I would say that a lot of my issues come down to things like equipment. Yes. So I would say if you have a mechanical background that's, or are good at fixing things, that is a huge asset. I know that my PhD advisor learned how to take apart cameras and computers and rebuild them, just

because that's a skill-set that you would need, or bootloader motors, huge asset in terms of being able to fix stuff. I'm not as good at fixing things, but I'm very good at calling people to fix things. (Laughter). *[00:47:06][31.9]*

Dr. Sandra Rideout-Hanzak: *[00:47:08]* Yes, I have a similar skillset there, too. Well, is there anything else you'd like to share with us today? *[00:47:15][6.5]*

Dr. Dara Orbach: *[00:47:17]* I think really just a message that we're lucky to have these dolphins locally, there's not that many places in the world where you can see dolphins from shore in your backyard like you can in the coastal bend area. But, we also need to be careful not to take advantage of this and to respect our animals, to be really wary about throwing out our used fishing gear and nets, to recycle our plastic bags end up in the oceans, and to not feed the animals. And hopefully, we can have a sustained population that will last for a long time for the benefit of all. *[00:47:50][33.2]*

Dr. Sandra Rideout-Hanzak: *[00:47:51]* Oh, absolutely. Thank you so much for that message. And it has been a real pleasure to talk to you today. I've thoroughly enjoyed myself. *[00:47:59][7.7]*

Dr. Dara Orbach: *[00:48:00]* I always am happy to chat about my research, and to hopefully educate the public more, and again...I get phone calls all the time, just asking questions, I'm happy to entertain anyone who hears this podcast can shoot me an email and I'm happy to talk more about the dolphins locally. *[00:48:18][18.0]*

Dr. Sandra Rideout-Hanzak: *[00:48:19]* Absolutely. And we'll make sure to put contact information up with the podcast information as well. Thank you so much. *[00:48:26][6.8]*

Dr. Dara Orbach: *[00:48:27]* Thank you. *[00:48:27][0.2]*

Dr. Sandra Rideout-Hanzak: *[00:48:27]* Thank you so much, I really. My pleasure. *[00:48:29][1.5]*

Dr. Sandra Rideout-Hanzak: *[00:48:29]* Wow, that was so interesting! Now I want to go to the beach and look for dolphins. *[00:48:42][13.2]*

Rebecca Zerlin: *[00:48:43]* I learned way more about dolphin genitalia than I ever expected to learn, but it was really cool and really interesting. *[00:48:52][8.6]*

Dr. Sandra Rideout-Hanzak: *[00:48:52]* Right. I never even gave dolphin genitalia much thought, to be honest. *[00:48:57][4.2]*

Rebecca Zerlin: *[00:48:57]* But now you do! *[00:48:57][0.0]*

Dr. Sandra Rideout-Hanzak: *[00:48:58]* I know. Now I do. And now I want to know more. *[00:49:00][1.8]*

Rebecca Zerlin: *[00:49:01]* Yeah. You have some interesting dinner conversations to have. *[00:49:03][2.4]*

Dr. Sandra Rideout-Hanzak: *[00:49:04]* I do. But that's a wrap for today. *[00:49:07][3.0]*

Rebecca Zerlin: *[00:49:08]* Yep, so we will see you all on the flip side. And remember, don't feed the wildlife. *[00:49:14][6.0]*

Dr. Sandra Rideout-Hanzak: *[00:49:16]* A Talk on the Wild Side is a production of the Caesar Kleberg Wildlife Research Institute of Texas A&M University - Kingsville. Funding for this project is provided by the Harvey Weil Sportsmen Conservationists Award, by the Rotary Club of Corpus Christi. Editing was completed by the talented Gabby Olivas, Andrew Lowery and Tre' Kendall. We thank the TAMUK Distance Learning Lab for all their help and cooperation. *[00:49:16][0.0]*

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