Now comes the good part...

10.5, 10.6 we're O.K. here. Tie this... tie this here.

Well, what we just did was install one of the recorders that we use to record the acoustic landscape of Dolphin Bay...

Now comes the interesting part. What we did was tie this rope, but we raised it a bit, so that the buoy would be at least three meters underwater.

It does not remain on the surface because if a boat comes by it will take it or steal it.

Leila Nilipour: Welcome to Biodiversa, the podcast of the Smithsonian Tropical Research Institute in Panama, also known as STRI. My name is Leila Nilipour and I am a science communicator. In this episode, we will travel to the Panamanian Caribbean, specifically to the Bocas del Toro archipelago, to try to understand if the dolphins are stressed out due to the presence of tour boats. And this is critical, because it gives us clues about what these marine mammals need to survive.

Betzi Pérez-Ortega: My name is Betzi Pérez-Ortega, I am a marine biologist graduated from the University of Panama and currently finishing a PhD at McGill University in Montreal, Canada.

LN: Betzi is the one you heard at the beginning installing a hydrophone, that is, a recorder that works underwater.

BPO: It records all kinds of sounds from the boats, which is one of the main activities that take place here in the bay, as well as the dolphins, the fish.

LN: In other words, a whole new world of sounds for those of us who are, well, terrestrial. But for this Panamanian scientist, her main interest is the dolphins' sounds. The hydrophone would stay underwater for two weeks, recording sound for 10 minutes every hour.

BPO: And the data that is collected here during the next 15 days is going to be used to understand how the sound of boat engines affects the communication of dolphins.

LN: But before continuing, let's go back a bit, to talk about Dolphin Bay and why it is so special... starting with the origin of its dolphins.

Dalia Barragán Barrera: My name is Dalia Barragán Barrera, I am a marine biologist from the Jorge Tadeo Lozano University in Colombia and I have a PhD in Biological Sciences from the Universidad de los Andes, also in Colombia.

LN: Dalia was on the boat that day with Betzi, as were University of Vermont students Emma and Manali, and René, the captain. During her university training, Dalia studied the genetic relationship between dolphins.

DBB: And what we found is that, well, at the genetic level the population here in Bocas del Toro, the 25 individuals that I was able to collect that time, all the individuals shared the same haplotype. It is a unique haplotype, new to the Caribbean.

LN: In other words, they all appear to be related, at least through the maternal line. It could be said that they all descend from the same great-great-grandmother.

DBB: They are all the same thing, at the level of, that is, that is what you want to show is that eventually thousands of years ago a mother one day arrived with her babies, she liked this bay, they stayed and made a family. We can say it's a very exclusive family group from here in Bocas del Toro.

LN: For these scientists, the fact that a group of dolphins are fond of this bay in Bocas del Toro means that they can study them year after year. They are already so familiar with them, from the photos they take on each visit, that they can even identify them by name when they see them. They distinguish them by the dorsal fin, which is like a dolphin's fingerprint.

BPO: All the dolphins we have in the catalog have names. Some of the most common, that you can see here, Bitey, Messi, super Messi, Popa.

LN: The fact that there is a group of dolphins faithful to this bay benefits tour operators dedicated to dolphin watching, because they have an infallible place to take tourists. And it is precisely because of this large number of tourist boats in Dolphin Bay that Betzi installed the hydrophone here.

BPO: Since these dolphins are quite faithful to the area and they come here every day, well, the boatmen, tourism knows that they can find dolphins here, so there are interactions between tourist boats and dolphins almost daily and for that reason it is that we chose this site to do the study.

LN: Since before the pandemic, and as part of her doctorate, Betzi has been recording the sounds of the dolphins, trying to understand if the presence of the tour boats and the noise of the engines affects them. The thing is that to orient themselves in the sea, dolphins generate sounds that travel in the water and bounce off objects. That bounce returns to them in the form of vibrations and allows them to understand what is in their surroundings. And of course, when there are many external noises, it could be more difficult for them to orient themselves or communicate with other dolphins. But when Betzi was in the middle of studying this phenomenon, the pandemic struck.

BPO: Yes, this... this field work was really scheduled for 2020, but precisely the day that everything in Panama closed down due to the pandemic, that day was the day we had scheduled to fly to Bocas.

LN: However, Betzi quickly turned what appeared to be an obstacle into an opportunity. If she couldn't go to Bocas del Toro at that time because of the pandemic, neither could tourists go for the same reason. It was a golden opportunity for science. So, she managed to make it to Bocas del Toro despite the restrictions.

BPO: And well, the logistics were quite complicated. But we managed to come and put one of the recorders here in Bocatorito and...

LN: And for the first time they managed to film the dolphins without tour boats around.

BPO: I mean, we've never had data without boats present in the area. But in reality, there was traffic of boats, because boat traffic was really allowed to transport personnel and obviously to buy food, but tourist boats were totally prohibited, so, yes, you can hear boats, but mostly these transport boats.

LN: With the recordings from recent years and those from 2022, Betzi will be able to compare the sounds of the dolphins before the pandemic, during the pandemic, and after the pandemic.

BPO: And well, what we want to know is how dolphin communication really changed in the absence of boats and now that the boats are back in the bay.

LN: Preliminarily, Betzi found that dolphins communicated more during the pandemic. Or well, at least more vocalizations were detected in those recordings. What she doesn't know yet is if the dolphins really vocalized more or if more of them were detected because there was no masking...

BPO: Masking is when an external noise is over the vocalizations. It is like having a conversation and having the radio at full volume. Well, the conversation that we may have between the two of us is not going to be heard because we have that external noise that is affecting our communication, and that is what we want to try to determine: if the boats are really masking the vocalizations of the dolphins or if the dolphins are simply changing their way of communicating.

LN: A few years ago, Betzi did a similar study, comparing a bay with plenty of tourism with another that only had passing boats. What she found was that dolphins modulate their communication more when there are tour boats around than when there aren't. And this is important because modulation is believed to be a potential indicator of emotions, such as a sense of danger or stress.

BPO: Our idea or our hypothesis is that the dolphins in Bocas Del Toro may be experiencing high levels of stress due to constant interactions with the noise of the boat engines.

LN: And to determine if the dolphins could really be stressed, Betzi also measures the levels of hormones such as cortisol, which is the stress hormone.

BPO: Well, to test this what we did was try to take biopsies from the animals...

LN: I imagine you are wondering how a moving dolphin is biopsied from a boat. It is done with a veterinary rifle, a tool that shoots a dart with which a small sample of skin and fat is collected, without hurting the animal.

BPO: Let's see, what is complicated here, if the dolphin is... is not parallel to the boat, what the dart is going to do is hit the animal at an angle that is not 90 degrees and then the dart bounces, slips and does not collect samples.

LN: As complicated as it sounds, it is. There are many factors that go into the decision to shoot or not. Not only whether the dolphin is parallel to the boat, but also that there are no babies around, and no tourists. A veterinary rifle, even though it is a scientific tool that will not harm the animal, could well be confused with a hunting rifle for those who do not know the difference. And, well, Betzi prefers not to become famous on social networks due to a misunderstood viral video.

BPO: Turn off the engine, while the tourist boat doesn't leave, we can't take a biopsy. Let's just not lose sight of them...

René: They separated in two...

BPO: Yes, one group here and the other is over here, right?

LN: That day we had to wait patiently for the tourist boats to leave to try to take the biopsies. The other hurdle is that time is quite limited. When she wants to collect samples, Betzi only has an hour to follow the dolphins with the boat and achieve a successful shot. And this has to do with how cortisol, the stress hormone, is stored in fat.

BPO: Cortisol is released directly into the blood, into the bloodstream, but it lasts a very, very short time. It's also not easy to take a blood sample from a dolphin, which is why we use the fat. Fat stores hormones, all kinds of hormones and cortisol is stored in it. When we are going to take a sample, we try not to chase the dolphins or follow them for more than an hour to take the sample, because after an hour the cortisol passes from the blood to the fat. So we don't want the possible stress that we are causing by following them to affect our results.

LN: So, when the tourists left, Betzi took out the veterinary rifle and started the countdown.

BPO: Now we can go follow them. The group split up and there are several individuals who have already left.

DBB: Let's continue slowly to see

BPO: Here come two of them...

LN: Preliminarily, Betzi already has some data and a general idea of what she could find.

BPO: Preliminarily yes, the dolphins of the Bocas Del Toro archipelago have levels of cortisol hormones, which is the indicator of stress, a little higher than dolphins outside, who live outside the archipelago.

LN: In addition, they were not only looking to measure cortisol, but other hormones whose levels are also indirectly associated with stress, such as reproductive hormones.

BPO: When an animal is stressed, including humans, the body goes into a state of alert and when it goes into that state of alert due to stress, or excess stress, it stops producing reproductive hormones or the production of reproductive hormones is very low.

LN: So, if you find lower levels of reproductive hormones and find a relationship with cortisol levels, it would mean that the constant presence of tourist boats in Dolphin Bay could be causing the dolphins to reproduce less and that little by little they begin disappearing. Previous studies in the area, such as those by Laura-May Collado, a Costa Rican researcher based at the University of Vermont and associated with STRI, have found other clues.

BPO: Dolphin Bay. Well, it has been monitored for the last 16 years practically by Dr. Laura May-Collado who began her studies here in Bocas del Toro.

LN: For example, Laura found that dolphins socialize and feed less when there are tour boats around. And socialization, well, is essential for them, because it is also linked to reproduction. This is how Dalia explains it.

DBB: It is very important because you have to have babies, right, if you don't have babies, you don't guarantee the survival of the population. They change their important behaviors by displacement and by diving which are in fact evasive techniques that dolphins have been reported to use to evade predators.

LN: In other words, instead of using their time to procreate, the dolphins are often using it to escape the tour boats. And well, according to Dalia, due to the fact that they are genetically isolated, not only could they be more vulnerable to rare diseases or harmful effects associated with pollutants, but also, if they were to eventually become extinct, a unique lineage -the Bocatoreño lineage- of the Caribbean would disappear.

Did you spot them?

BPO: Yes, the group is over here

DBB: But they hid.

BPO: They hid quickly, as soon as we arrived. Here they are jumping, see?

BPO: The perfect behavior is sometimes when they swim near the bow, but when they need to breathe, they move away a little and emerge parallel, right here next to it.

LN: Another study found that many of the tour operators do not comply with existing regulations for dolphin watching, such as the minimum distance allowed or the maximum number of boats that can be seen at one time. And in a survey of tourists in Bocas del Toro, many expressed dissatisfaction with the whale watching tours, given the large presence of boats in the area. But the human impact on these animals is not limited to tourism.

DBB: And could it be that they are also exposed to contaminants, because here we have banana crops where fertilizers are irrigated, this can also contaminate the water in some way, the boat traffic and also mercury. At first, mercury occurred to me because mercury here has also a natural origin. That is, let's remember that mercury comes from, let's say, volcanic eruptions, soil erosion, through the river that transports all these metal materials to the water.

LN: Although it is of natural origin, mercury has increased due to human activities. And to analyze the risk in dolphins, Dalia carried out a study that allowed her to find out which fish were the most consumed by dolphins and what their mercury levels were. And she found that you don't really have to worry about dolphins, at least not for now, but maybe about humans.

DBB: A marginal risk for dolphins, which, extrapolated to humans, may also imply a risk, because basically dolphins and humans here are eating the same diet. We collect fish, the ones that fishermen fish and consume.

LN: In other words, the results found in dolphins also suggest that there could be a potential risk to people, which could be greater for young children and pregnant or lactating women.

DBB: Let's say as an adult to be affected by pollutants or mercury in particular, well you have to be exposed to high levels. Instead, a developing baby, well it is clearly going to be affected. So, let's say that the work is always done mostly with pregnant and lactating mothers, because mercury is also transferred through the placenta and breast milk.

LN: However, only by doing more studies we could determine what the real risk is in humans.

BPO: When they emerge, René try to do this and follow them... to see if they get closer and emerge.

BPO: They are very close... They don't want to.

LN: That first day in Dolphin Bay, the researchers were unable to shoot any dolphins. However, during the following two weeks they would, gathering the samples they needed to continue their investigations. And don't worry, although the word "shot" sounds a bit strong, for dolphins it is something like a mosquito bite, a very small wound that heals quickly. And it's not just me saying it, science does.

BPO: Generally, they heal quite well and quickly.

DBB: It is standardized, at least three articles have been published that follow up on the wound and it heals well, without any problems.

LN: On the last day of work, they removed the hydrophone from Dolphin Bay. During those two weeks under the sea, it recorded 60 hours of audio that must now be analyzed. So sooner rather than later we will have a better idea of how the pandemic – and the absence of tour boats – may or may not have influenced the dolphins' communications and stress levels.

LN: The Biodiversa team includes me, Leila Nilipour, as well as Ana Endara, Linette Dutari, Elisabeth King, Lina González, Johann González, Juan Pérez, Jess Sadeq and Sharon Bryant. The arts of the episodes are by Paulette Guardia. We have additional support from PRX. Our show is edited and mixed by Melissa Pinel. The music in our episodes is by Epidemic Sound. If you liked this episode, please share it with more people. And thanks for listening.