

It's small...

The boat is small, and I don't think the lens can capture it, let's see...

No way, I mean I can try to take a picture and enlarge it, but it looks like a dot on the horizon...

And the drone?

The drone, if it goes, it won't come back... too much wind.

Do we need to raise some stabilizers or something? Are we going to the roof to fly that drone?

Yeah? Will you bring it back?

Sacrifice a drone or not, for the sake of science? I'm nervous, I'm going to get some batteries.

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'm a science journalist. In this episode, we're hopping on the Argo and going on a two-week expedition to the Cordillera de Coiba seamounts in the Panamanian Pacific. And well... during two weeks at sea, a lot can happen.

Héctor Guzmán: It's 11:40 and we have officially set sail. This is expedition number one to the Cordillera de Coiba ...

LN: This is Hector Guzman, a marine ecologist at STRI. Hector is the main responsible for a group of six scientists from Panama, Costa Rica, Ecuador and Colombia spending two weeks at sea. They were Candy Real, Erick Ross Salazar, Marta Cambra, César Peñaherrera and Felipe Ladino. Together they would explore the Cordillera de Coiba for the first time. As STRI communicators and to document the expedition, videographer Ana Endara and myself, as writer and audio producer, joined them.

HG: We are here, in Panama City and we are going out like this. This is the place where I tell you there is going to be some turbulence because you have two currents, the one that comes from the Gulf of Panama and the one that comes here collides with that turbulence, but that's where we begin going in this direction. And well, I have some news for you, we are going to reach the border with Colombia, at this point, we have already decided it.

LN: Now, when we talk about the Cordillera de Coiba, the concepts could be confused. First there is the marine protected area.

HG: The Cordillera de Coiba was created in 2015 with 17,000 square kilometers. Then it was expanded in 2021 to 68,000 square kilometers.

LN: When Hector says it was created, he is referring to the marine protected area. Then came the expansion in 2021, which is important because it led Panama to protect 30% of its oceans by 2030, a commitment it made as part of the United Nations Convention on Biological Diversity.

HG: And that obviously led to the development of a management plan and within this management plan, the important thing was to create a... one of the six programs was scientific research, and this is then the first... the first project, so to speak, where scientific research is carried out in the Cordillera de Coiba.

LN: Then there is the submarine mountain range known as Cordillera de Coiba, which coincides in part with the marine protected area. But what is exactly a submarine mountain range?

César Peñaherrera: Just as on the surface of the earth, where there are mountains that are the product of volcanoes or are products of the force that exists between the tectonic plates folding upwards, the same thing happens on the seabed. So that is how these submarine mountain ranges are created, and there are some that go over very long distances.

LN: This was the Ecuadorian marine ecologist César Peñaherrera, who was part of the expedition. And as César says, some submarine mountain ranges travel great distances. Coiba's is no exception. This is how Héctor sums it up.

HG: Let's say, this set of mountain ranges or chains link together Costa Rica, Panama, Costa Rica, Colombia and Ecuador in some way. Actually, uh, geologically we are practically linked to these four countries at the submarine level.

LN: As an ecologist, one of Hector's interests is to understand the behavior of marine species and why they behave as they do. This data is indispensable for working on their conservation. But in the case of an area unexplored by scientists, such as the Cordillera de Coiba, they must start with the basics: what species live there? The expectation was to find a lot of biodiversity. This is Cesar, again.

CP: A seamount, a mountain, plays a fundamental role for food webs, for all marine webs. Some use these seamounts as breeding areas, others use them as nursery areas because they are more protected from the predators that they might encounter out there, yes? Others come to feed here in this area.

LN: And to explore these seamounts you had to, well, go under the sea. But deep. Much deeper than you can go with a scuba tank. On the stern of the Argo was the perfect vehicle for the mission: a submarine capable of descending more than 350 meters, ten times deeper than would be possible with a scuba tank. After two days of navigation, near the Panamanian border with Colombian waters, the first mountain with the ideal depth to descend by submarine was detected. So, on the third day at sea, the first trip took place.

Submarine pilot: We arrived to the dropping point, we arrived to the dropping point, diver in the water.

Ok, permission granted.

LN: Hector started to go down twice a day in the submarine, to explore the mountains. It was not one of those big black machines we see in war movies. It was a small yellow submarine used mainly for recreational and tourist dives in Costa Rica. It had three seats, for the pilot and two passengers, which were surrounded by a kind of glass bubble with a panoramic view. Hector

always went down with one of the two pilots -Yuval or Fede- and someone else, usually one of the scientists of the expedition.

HG: I'm confirming because I just received information from the chief pilot... he just gave me the information of what we worked on yesterday, the four sites, the two we collected samples from and the two we were exploring. He was verifying the depths and the deepest we got was, according to this, 287 meters deep. And the shallowest was 130 meters, around 128...

HG: All this was collected between 220 meters to about 140 meters when we started going up. These are sea urchins, we have brittle stars, starfish, sea cucumbers. On this side we have corals, a black coral. This one here would be like a coral of, I think, the scleractinian group, which is a hermatypic hard coral. We have certain sponges, which would be these.

LN: On the seventh day of the expedition, I got up the courage to go with him. I was terrified at the idea of being locked for 3 hours in a bubble under the sea. But I had psyched myself up. Besides, it would be a special trip. We were going to visit a new mountain for the first time, a mountain that had never been explored before.

Submarine pilot: Top See Top See looking good... we're going down. Copy copy, have a nice dive. Copy copy.

HG: We went through the thermocline... today we found it shallower, started at about 10 meters deep and we are still in the thermocline.

HG: The thermocline is an initial layer where there is very very cold water and it separates the deep water, it goes up or down vertically depending on the time of the year, depending on the time of the day.

HG: And this would be, by the way, mission 7 and it would be the 3411th dive that the submarine has done.

LN: But it's the first one on this mount.

HG: It's the first one on this mount. We definitely have no idea what we're going to see down there. So everything we see today is new to us and to science.

LN: Every so often, the pilot had to communicate with the surface, where the descent was monitored from a little boat called the Top See. As he descended, he would report on the status of the different indicators inside the submarine, such as oxygen, carbon dioxide, temperature, humidity...

Submarine pilot: Our depth is at 5-3, 5-3, O2 is 21.2 21.2, CO2 is at 0.21 0.21, cabin temperature is at 2-8, 2-8, humidity 6-6, 6-6, cabin pressure is at -1, -1, 24 is at 25.4, 25.4, 108 is at 116.4, 116.4...

HG: We arrived at 8:47, we reached 304 meters in depth. We have an almost vertical wall in front of us, solid rock, we are already starting to see the first octocorals or yellow soft corals that we had seen yesterday. This is definitely a new mountain and I would like to tell you that we are going to name it and dedicate it to our great friend Kevan Mantell.

LN: Kevan Mantell was a marine explorer and diver at Coiba National Park who supported Hector and other marine scientists for years in their field work at Coiba. Sadly, Kevan passed away in March 2022, shortly before the expedition.

HG: That's a nice octo, see? Those are the famous deep soft corals. It's excellent because it's a solid wall as you can see and it's consolidated, it's not rocks that have come rolling off the mountain below, which sometimes we've found that on the slopes. That makes me think that this solid mountain goes even deeper...

LN: The trip I accompanied Hector on was the first one to go down that deep.

HG: We were at a maximum depth of 340 meters and there was a certain change in the composition of the habitat. The rocks were a little looser, some sand, however, this mustard-colored octocoral was still dominating. And as we go upwards it is interesting because you see the verticality of the wall and what looks like there was some volcanic activity because in some places you see columns...

LN: 340 meters deep. As a point of comparison, the Eiffel Tower is about 330 meters from the base to the tip. But unlike other dives, where sharks were seen, I didn't see a single one during the three hours I was underwater. What I did see were lots of corals, starfish, lobsters and some small eels.

LN: That night the crew of the Argo prepared a special dinner for us on the ship's deck. And here it is worth noting that the logistical support and care of the crew during those two weeks were indispensable for a successful scientific expedition. But let's go back to dinner. It was a nice surprise at the midpoint of the expedition and considering that bad weather was forecast for the next day. After dinner, we saw the light of a fishing boat in the distance, even though we were located in a marine protected area and specifically in a part where fishing was prohibited.

And then, as predicted, the following day things got complicated.

LN: Then we realized that the fishing boat we had seen the night before was still nearby. So, we tried to find out what they were doing. First, with a long-range lens.

No way, I mean I can try to take a picture and enlarge it, but it looks like a dot on the horizon...

And the drone?

The drone, if it goes, it won't come back... too much wind.

Do we need to raise some stabilizers or something? Are we going to the roof to fly that drone?

LN: Since it wasn't close enough to take clear pictures of it, we decided to take the risk and send the drone. Not only was it complicated to do it from a moving ship, since the point from which it takes off is not the same point to which it would return, as it is done on land, but also the wind was strong that day due to the bad weather.

There it is, but it needs to be zoomed in....

Is it covered? No. You have to zoom in. Take the photo.

High wind velocity...

Neither the back nor the front has the name? It can't be, mae, they're so clever.

No, it does have a name, but I have to go further down and if I go down a wave will hit it.

LN: The drone returned safe and sound, but what we saw afterwards was not what we expected.

How barbaric, how barbaric, do you see?

Look at the fins there. No way, drying fins and all in the front, can't you see? What a pity.

LN: In the photos and videos we could see two things: that the vessel is called Santa Barbara 2 and that they were drying shark fins on the deck. This meant that they were finning sharks, a very cruel practice. This is how Felipe Ladino, a Colombian marine ecologist from Fundación Malpelo who was part of the expedition, describes it.

Felipe Ladino: Shark finning is a very barbaric practice because they remove the shark's fins and return it to the sea dying. The shark needs to move in order to breathe, so it dies by drowning.

LN: In addition to being cruel and illegal, the boat was fishing in a zone of the marine protected area where fishing was prohibited.

So, not only are they fishing in an area where it is not allowed, but possibly species...

Not possibly. They are 30 miles north of the fifth parallel, that is already well into the waters... they are fishing illegally in Panamanian waters, and also you are inside a protected area that is "no take", of no extraction.

LN: What this refers to is that, when the 68,000 square kilometers of the marine protected area of the Cordillera de Coiba were delimited, two zonings were also established: in two thirds of the protected area any type of fishing is prohibited, this is the "no take" zone, while in one third of it, sport fishing and angling are allowed. The boat was in the area where no fishing of any kind is allowed.

And quite possibly these are hammerheads, right? Hard to say...yes, hard to say.

It's that big fin, it looks like a hammerhead...

Look, they have fins drying in this compartment and in the second compartment they also have fins on the lid.

How sad... see what a pile of shark fins, but still, these people are not to blame... what can they do?

Let's say this man, the grandpa that he is, where is he going to find a job? Who is going to give him a job? So, *diay* what's left for them? To do this.

LN: And the fin business is very lucrative. It sells well in the Asian market. This is Felipe, again.

FL: What is striking is that I have a friend who did a genetic study of the fins that arrive in China, where they are consumed, and most of the fins of hammerhead sharks, thresher sharks and silky sharks, which are species from this region, most of the fins come from here.

LN: They are CITES species, that is, they are part of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, and their international trade must be regulated to avoid putting their population at risk.

And do we want to approach them and, by radio, tell them...?

No, it is dangerous. No, no. We don't know if these people are armed and nobody here has weapons on board.

It is better to let them continue with what they are doing, and everyone can continue doing their own thing. We have the evidence.

LN: The decision taken was to report the fishing boat to the local authorities, who then flew over the area requesting the coordinates.

Radio exchange: 51 minutes point six four seven, whiskey. Information received; information received. Correct. That was the last position where we saw them and, in these days, these last days we have not seen the boat. And if you have the characteristics, confirm the characteristics of the boat... The characteristics of the boat, it is blue. It has a wide bow, it is blue in color and it is called Santa Barbara 2 if I'm not mistaken. Received, pending...

LN: Despite not being able to use the submarine during the days of bad weather, monitoring continued with a system called BRUVS, which records videos at 10 meters depth to detect species moving near the surface, such as certain sharks. And precisely on the days that the fishing boat was nearby, not a single one appeared in the recordings.

But how does this system work and what is it used for? This is Marta Cambra, a marine biologist from the University of Costa Rica, who was leading that arm of the expedition.

Marta Cambra: The technique we use is called baited remote underwater video stations. In English it is called baited remote underwater video stations or BRUVS. And basically, how it works is that we are using a stainless-steel frame. It can have several shapes. In this case, we use a triangular frame and at the base of the triangle are two cameras: one on the right side and one on the left side. And they are focusing directly on a bait container that is in between the two cameras. So we are getting animals like sharks, which are normally very difficult to study, to come closer to the cameras and thus we begin to generate information on how many there are, which other species are swimming with them in the environment, when there are more, when there are less...

LN: Maybe it's not as photogenic a job as the submarine, but it's a job that requires physical effort and has many steps: cutting up bait, then going out

in a small boat to launch the structures into the sea, picking them up after an hour and a half, downloading the files from the cameras, reviewing the videos to note any sightings, and starting the process all over again.

Radio exchange: They are going to... we are going to drop the first line of cameras, which is the AIS, but the AIS is going to be the last flag to be dropped. Over.

It's recording now, 100 percent, recording. Little sign and applause. Gently, Olman.

Come on, buddy.

LN: During the 10 days launching BRUVS into the water, about 900 hours of underwater footage were gathered in the pelagic zone, that is, in the area closest to the surface. And there were several exciting sightings.

All: Wowwww...

MC: Yesterday we had the great opportunity to identify the first school of hammerhead sharks on this seamount, right? We've been here for four days now and yesterday was the first time we saw a large school and that's almost one of the goals of these expeditions, to be able to really demonstrate that there is an aggregation of individuals, right? We saw up to 60-70 individuals. So that's something very important: to arrive here and to be able to detect that.

LN: This was not only exciting to see, but it could be evidence of a theory about the existence of a magnetic corridor in the Coiba Mountain Range. This is how Hector explains it.

HG: Because this is a corridor, this is a corridor, for example, which we suspect we call a magnetic corridor, which is associated, let's say, to this great line of mountain ranges, which unites all these four countries and this magnetism is supposed to attract certain species, highly migratory species such as sharks and turtles...

LN: And this magnetism allows these migratory species to find their way underwater and move between the waters of the four countries -Panama, Costa Rica, Ecuador and Colombia- depending on their needs. This is explained by Erick Ross Salazar, marine biologist and executive director of the Migramar network. Erick was one of the coordinators of the expedition together with Héctor Guzmán.

Erick Ross Salazar: Well, migratory species are species that under different circumstances or parts of their life cycle, take place, for example, on the coast when they are born or when the mothers arrive to have their young and as they grow, they move away from the coast to feeding and reproduction sites far from the coast. It could be, for example, from the mangroves in the area of Chiriqui and going towards Cocos Island or Galapagos when they are already big to feed and reproduce. So here we see the importance of not thinking only about one part of their life cycle, but about the different components, different stages and the migrations that connect these sites, these zones that are like highways for the animals that take them from one place to the next. We have seen evidence of quite a few hammerhead sharks and schools of them, so it makes us think that maybe this Coiba mountain range that reaches Yurupari and Malpelo in Colombia could be a transit zone for these species.

LN: The last day of work was very emotional, because we saw for the first time an unusual fish in the BRUVS, the sharptail mola, a very rare species to observe even though it lives in oceans around the world. And on the submarine dive that day, a site was found with a very special shark species.

ERS: A shark that is considered by many to be very primitive, because of the shape of the fins on its tail. In English, its name is prickly shark... I had forgotten the name in Spanish, but...

LN: In Spanish it is the "tiburón negro espinoso" ..and it was not only one shark, there were several.

HG: It is a rather rare little shark, there is not much scientific information. The one they call "pickle". We filmed it there; it is an animal about three meters long. It is from deep areas...

LN: In the end, all these incredible sightings in just 10 days of work revealed to us how special the Cordillera de Coiba is, but they also left us wondering, if the scientists could stay longer at sea or if they could repeat the expedition at another time of the year or if they could get a submarine capable of going even deeper, how much more would be left to discover? And what can be done to protect all the biodiversity that we already know is there? To begin with, as Erick says, protection must be coordinated among the countries involved.

ERS: These are shared resources that must be coordinated between... between authorities and scientists in order to understand them. If we don't do it this way, we are not going to be successful. It may be that country X is taking responsible management measures, but when entering country Y, fishing is different and is more...more exploitation is allowed, so the efforts of a country are not going to be successful because there is no coordination or research. And the importance is that the species do not... do not respect the borders do not... do not ask for a visa to enter Colombian waters, they simply enter...

LN: And, on the other hand, there are the plans that have already been approved for Panama, such as satellite monitoring of the protected area.

HG: There is already a real-time satellite and radar monitoring from space to know what is happening inside this protected area of almost 68,000 km². It is the only and the first marine protected area in the country that has this surveillance mechanism, which I think is very important, it is innovative and is evolving over time. I have to make that very clear.

LN: That is to say, it is a plan that is adjusted from time to time to adapt to changing circumstances. And it is an opportunity for scientists, governments and private enterprises to collaborate in the development and implementation of innovative technologies to most efficiently monitor these remote areas and to ensure their true protection. Because these protected areas so distant from the mainland are not always respected, as we saw first-hand with the fishing boat, but also in the submarine dives.

HG: Despite the depth limitation, in all the dives we have done to date, we have found fishing equipment on the bottom with large amounts of fishing lines everywhere. In fact, we have to always keep this in mind when we are navigating with the submarine so as not to get entangled.

HG: We only have about 36 to 36-38 hours left to navigate from the point where we are now, exactly at the northern limit of the protected area, the 6 30 parallel, and from there 36 hours later, leaving in one hour, we will probably arrive in Panama City in the early morning of May 10th.

LN: For Héctor, the expedition had concluded successfully...

HG: Totally satisfied...

LN: Well, except for one small disappointment.

HG: I was struck by the fact that I did not see any mammals here. Cetaceans in general are starting to show up here, uh.... At the end of July and especially in these very oceanic areas.

LN: And as if he had called them with his mind, on the last afternoon at sea before arriving in Panama City, a group of dolphins appeared on the horizon and accompanied us for at least half an hour, diving, jumping and scampering around each other on the bow of the ship.

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LN: Our podcast team includes me, Leila Nilipour, as well as Ana Endara, Linette Dutari, Elisabeth King, Lina González, Johann González, Jess Sadeq and Sharon Bryant. Episode artwork is by Paulette Guardia. Extra support comes from PRX. Our show is mixed by Melissa Pinel. Our episode's music is by Epidemic Sound. If you liked this episode, please share it with other people. And thank you for listening.