Title

Coral Nurseries: Growing Coral in a Not Only Biological Sea

Author

Rivera Sotelo, Aida Sofia

Publication Date

2021

Peer reviewed|Thesis/dissertation

Coral Nurseries: Growing Coral in a Not Only Biological Sea

By

AIDA SOFIA RIVERA SOTELO
DISSERTATION

Submitted in partial satisfaction of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

Anthropology

in the

OFFICE OF GRADUATE STUDIES

of the

UNIVERSITY OF CALIFORNIA

DAVIS

Approved:

Marisol de la Cadena, Chair

Timothy Choy

Suzana Sawyer

Joseph Dumit

Committee in Charge
2021

Abstract

Coral coverage reduction of up to 90% became a barometer of planetary health in the last three decades. As a result, coral scientists anticipate coral extinction with catastrophic effects on life in the oceans and propose direct interventions to rehabilitate ecological functions and extend corals' lives. Some scholars have offered a critical approach to coral restoration's naturalization of corporate forms of responsibility (Moore 2018) and controversies among coral scientists about what coral restoration can achieve (Braverman 2018). My dissertation draws upon twenty months of immersive study as a volunteer for the Center of Research, Education, and Recreation (CEINER) in the Rosario archipelago (part of the Corals of Rosario and San Bernardo Nature Reserve). CEINER simultaneously works on coral restoration and the assisted reproduction of endangered fish species. In addition, I volunteered for other coral restoration and reef checks in Isla Fuerte, Santa Marta, Taganga, and San Andrés. I also attended and presented posters and papers at international conferences on conservation biology, coral science, and ecological restoration. My work with scientists and other residents and visitors in the Rosario archipelago has pushed my analysis beyond extinction's recognition to consider the migration of coral and fish further and deeper in the ocean. Using the word "migrations," I intend to reframe the terms of destruction from planetary accounts to elusive ecologies—for both scientists and artisanal fishers. I explore different and co-incidental sea compositions, undecidable temporal horizons in coral reproductive urgencies, and more ways through which various islanders grow coral and fish in this sea. My research conceptually integrates and advances discussions surrounding extinction, managerial juridical frameworks, and environmental and animal studies. Throughout my dissertation, I build a vocabulary to think and imagine affective sea ecologies and unlikely, partial, and strategic collaborations among coral restoration scientists and other islanders.

Table of Contents

Acknowledgements

In 2012, I visited Dr. Arturo Escobar in North Carolina, searching for personal and academic advice. One of his students, Laura Gutiérrez, hosted me for an entire week, and I met with Arturo every day. I was deeply attracted to the post-development conceptual conversations and I felt indebted and constrained by my training in political ecology. Arturo recommended that I work with Marisol de la Cadena at the Department of Social Anthropology at the University of California, Davis. I feel grateful for the hospitality of Arturo's students and his advice. I do not see myself sustaining more than seven years of PhD training anywhere else. Marisol is one of the sharpest thinkers I have ever met. Also, I have received the guidance and support of various faculty members as a student, teaching assistant, and mentee. Tim Choy listened attentively during multiple walks and talks and gave feedback on many versions of texts. Suzana Sawyer offered me encouragement and detailed feedback. Joe Dumit made me feel that scholarly work and contact improv can be fun. Alan Klima guided me through writing and meditation workshops. Cristiana Giordano invited me to creatively experiment with methods. I feel indebted to my cohort and other students who generously engaged in discussions. In Davis, I met wonderful human, dog, cat, bird, and squirrel friends and found a community in Capoeira. All these people made me feel loved and sustained during the most difficult parts of the program.

From the beginning of my studies, I knew I wanted to investigate wetlands. First, I explored a potential project in the Cauca River in Antioquia, Colombia. During my first preliminary fieldwork in 2015, I visited campesino friends from the *Colectivo de Comunicaciones por El Derecho a la Tierra* in El Bagre. Isabel Cristina Zuleta from *Ríos Vivos* introduced me to people who fished for gold in the Cauca River in Pescadero Ituango. Isidro Álvarez Jaraba introduced me through his writing and friends to the big Mojana, *el país de las aguas* (the country of waters), where many rivers meet. I am profoundly grateful and permanently indebted for the hospitality

and generosity of the people who welcomed me into their homes and lives. After that preliminary fieldwork, I learned I may not be able to do extensive fieldwork in those places, and Marisol and I decided to reorient my exploration to the sea.

The Caribbean of Colombia, especially Cartagena, is a familiar place to me since my mother and her family are from there. I am especially indebted to my grandmother, mother, aunts, and cousins, who have created a sense of place with me. My mom, some aunts, and cousins joined and visited me on trips on buses, tours, and boats during my fieldwork between 2016 and 2019. In addition, my mother and father shared with me their experience working with artisanal fishers in Cartagena in the late 1970s and early 1980s. Because of them, I met some artisanal fishers in La Boquilla and Ararca (Barú).

As part of my fieldwork, I attended international conferences in conservation biology (International Congress for Conservation Biology, Cartagena, 2017), ecological restoration (Reef Futures: A Coral Restoration and Intervention-Science Symposium, Florida, 2018), and coral science (the 14th International Coral Reef Symposium, online, 2021). In addition, I attended the screening of the documentary *Saving Atlantis*, organized by *Salvemos Varadero*, a civil society initiative to protect the Varadero Reef in Cartagena. At these events, I met scientists who were willing to talk and expressed curiosity toward my project. I am particularly grateful to Valeria Pizarro and Elvira Alvarado. Valeria put me in contact me with more people and Elvira welcomed me to her personal archive. Bladimir Basabe and Rafael Vergara, activists of *Salvemos Varadero*, were also open and generous. I volunteered for various coral restoration and Reef Check programs in Isla Fuerte (ProCoReef), Santa Marta and San Andrés (Corales de Paz), Taganga (Alianza Coralina), and Islas del Rosario (Center for Research, Education, and Recreation, CEINER). I am

deeply grateful to Fabio Gómez, Phanor Montoya, Nuphar Charuvi, Jaime Rojas, and all the people who became my professors in these trainings.

Esteban Zarza, who led research in the Corals of Rosario and San Bernardo Nature Reserve in 2016, introduced me to Jaime Rojas, the scientific director of the CEINER lab. This lab, which studies coral restoration and the assisted reproduction of endangered fish species, became my home in the Rosario archipelago. Jaime Rojas accepted me into the lab as a diver in 2016. It was not clear to him why I wanted to spend months and months at the lab as an anthropologist, but he thought I could eventually help with the communities. I am grateful to Juan Camilo Zárate, Robin de la Rosa, Adrian Devia, Punei, and the interns at the lab who patiently trained me in all the daily activities. I am thankful to Rafael Vieira, Ingrid Vieira, and all the workers at the *Oceanarium* for their support and hospitality for over a year. I found a profound joy in daily encounters with coral, fish, turtles, dolphins, birds, and dogs. Because I was a volunteer at the *Oceanarium*, I traveled from La Bodeguita to the San Martín de Pajarales island in El Alcatraz motorboat for free, and from Isla Grande to the Bazurto fish market in the public motorboat for a discounted rate. In Palmar, the home of the lab in Isla Grande, Deya, Tico, Chiqui, Yarley, and their family offered me meals, advice, guidance, and care.

At first, some people at the Community Council of Black Peoples of Islands did not understand what I was doing as an anthropologist at the lab. Anthropologists, such as Lavinia Fiori and Carlos Durán, had previously supported the organization of the council and the claim of collective land rights. Despite how odd my work seemed for the Community Council, the Council gave me permission to do ethnographic research in the islands and to participate in some of their activities. Thanks to their support, I attended the training of eco-guides from Isla Grande and Barú and the first consultation of the management plan of the marine protected area in 2018. I feel

gratitude towards Estefany Powell, Lieutenant and Director of the Corals of Rosario and San Bernardo Nature Reserve (*Parques*) between 2017 and 2018, and Diego Duque, delegate of *Parques* in the archipelago, for their kindness and encouragement. After my fieldwork, I have continued to be in contact with Lavinia Fiori, Juan Camilo Zárate, Jaime Rojas, Phanor Montoya, Diego Duque, and Fabio Gómez, who have shared their feedback and insights.

I feel deep gratitude and appreciation to Miguel (El Tubo) and El Caña (El Tigre), who were the first artisanal fishers who welcomed me into their canoe. I cannot fully express how much confidence I gained on our trips. It also helped other fishers to gain some confidence in me. Cruz, El Gallo, El Lati and Libinston welcomed me to their canoes and motorboats too. With all these people, I learned that I could not learn about fishing but by fishing. El Ñato never let me in his canoe because I was a woman, but he shared stories and challenged me with questions. Jairo Julio and other fishers, who are also farmers, crafters, and eco-guides, shared stories. Damasita, Carmen, and Tomasita showed me that women are fishers too. In the case of Carmen and Tomasita, they are fishers who travel where there is only *agua y cielo* (water and sky). I never joined the journeys to the places where there is only water and sky, but I learned of them through the stories of Carmen, Tomasita, El Lati, Arismel, El Cosito, and Cidi. Kevin, son of Tomasita, and the public-school motorboat, helped me move from island-to-island multiple times.

I am grateful to Don Blas with his wide smile and bright eyes. We crossed pathways many times in Isla Grande. He reminded me of my father somehow. When I told him that, he asked me, surprised, if my father was red like me. Don Hernando (El Negro) was easy to talk to and spend time with. I deeply appreciate his advice, his enthusiasm, and friendship. The subaquatic guides became my professors in each training. Nemo and Filiberto taught me that the archipelago is more archipelagic than I initially thought. I am grateful to many more people in the islands with whom

I crossed paths, and shared food, stories, and life. Some friends visited me in the islands, and I noticed new things through their fresh eyes. Also, the Women's Circle in Cartagena taught me that women's circles are the best therapy for me.

My participation in various groups and events has nourished my writing process. I am grateful for the collective process in the writing group organized by Marisol de la Cadena. I am especially grateful to Mariel Garcia Llorens, Fatih Tatari, Kristi Onzik, Marie MacDonald, Annie O'Connor, and Renan Martins Pereira. Taylor Bell and Kristi Onzik have revised my writing multiple times. Over the years, I have met and shared ideas with other sea ethnographers. I feel gratitude for the continuous exchange of ideas with Damien Bright, Cameron Allan McKean, and Annet Pauwelussen. During the first months of the pandemic, the Earth Activists and their permaculture trainings infused my last chapter.

Likewise, I am grateful for the feedback I received at the 14th International Coral Reef Symposium (2021); the Colombian Science and Technology Studies Colloquium (2020); a private talk about coral restoration practitioners organized by the José Benito Vives de Andreis Marine and the Coastal Research Institute (2020); a webinar organized by the master's program in anthropology at Universidad del Magdalena (2020); the gathering of the Coral Cabal at the annual meeting of American Anthropology (2019); the annual meeting of the Society for Social Studies of Science (2019); the Colombian Congress of Anthropology (2019); the Caribbean Studies Association Annual Conference (2019 and 2018); Reef Futures 2018; the third Latin-American Conference on Alternatives to Development, Political Ecology, and Common Goods (2018); two presentations in the study group of social studies of science, technology, and medicine at Universidad Nacional de Colombia (2018); and a presentation in the nature and culture study group

at Universidad Javeriana (2018). I am also grateful to Kirstie Zehring who edited the last version of my dissertation.

I received financial support from the Ministry of Science, Technology, and Innovation of Colombia (previously Colciencias), the Department of Anthropology at the University of California, Davis, The Hemispheric Institute on the Americas, the International Coral Reef Society, and the Miguel Vélez Fellowship. In addition, I received travel grants from the Caribbean Studies Association, Graduate Studies at the University of California, Davis, and the International Coral Reef Society.

Finally, I am grateful to Kala, a puppy who has taken me for walks during the wrapping up of this dissertation.

Where to begin

Underwater my muscles relax
A feeling of expansion starts from my chest
I turn around
Up, I see the surface
A layer of seawater covers me
Light takes the form of silvery snakes that continue their trajectories behind

Back in the sea-surface
Only my head is outside of the water
I look down and float
After a few months
I am at ease with the feeling of wet air in my mouth
I breathe with my snorkel counting from 1 to 10
My hips initiate an undulatory movement that my head follows

As I dive in
I slowly decompress my air cavities
My nose, my ears, my mask
I can be suspended at various depths
The thermic sensation and colors change
Pain in my ears warns me about the depth I can reach this time
My right arm shows me the way to be pulled out of the water
Somehow, I feel embraced

Rosario archipelago, October 2018

***

This research emerged during what had been the most prolonged bleaching event of the Great Barrier Reef in Australia, between 2016 and 2017. I constantly read the news and saw photographs that announced the potential extinction of corals with catastrophic effects on life in the oceans. Most of these stories amplified the voices of marine biologists, who explained that bleaching is a disruption of the symbiotic relation between polyp animals and *zooxanthellae* microalgae—a response to a slight increase in the sea's surface temperature. The media coverage of bleaching implied a specific explanation of what corals were, independent of their location.

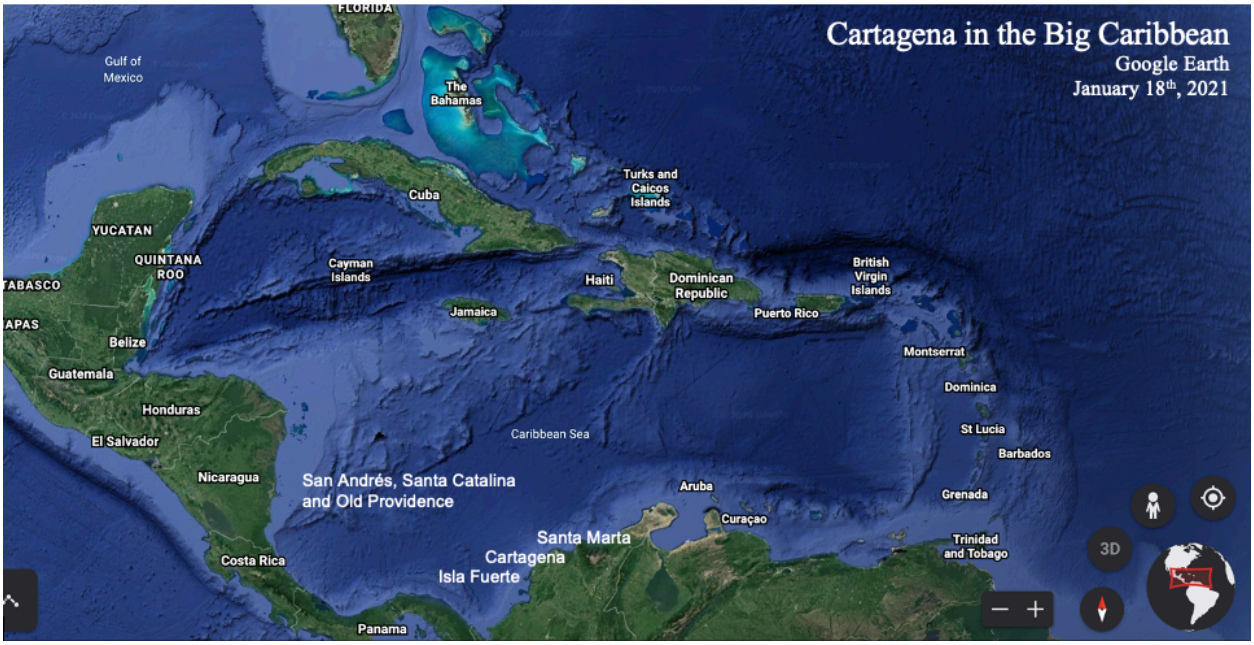
Only a few anthropologists had written about coral and they had scientists and labs as their main entry point. In 2010, Eva Hayward published her *Fingeryeyes: Impressions of Cup Corals* in the first Cultural Anthropology Special Issue on Multispecies Ethnography. Following Donna Haraway's lead, Hayward attends to how she and lab cup corals both sense, apprehend, and leave impressions on one another (Hayward 2010). In 2016, Stefan Helmreich published *How Like a Reef: Figuring Coral 1839-2010.* He starts his text by referring to Donna Haraway. His text reads like a history of coral science and explains how coral became a barometer of planetary health in the late twentieth century (Helmreich 2016). For Donna Haraway and anthropologists inspired by her, coral symbiosis lures their imaginations to forms of politics that are not grounded in the premise of an individual (Haraway 2017; Gilbert 2017).

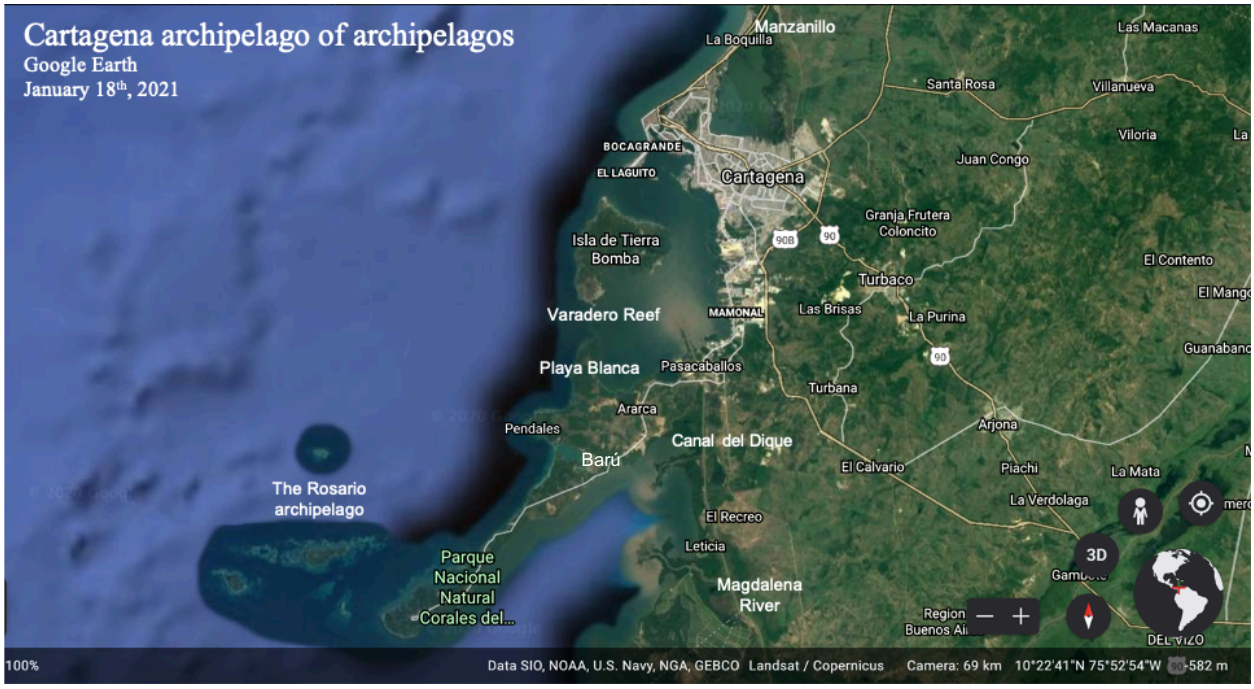
Other works offered a critical approach to coral restoration's naturalization of corporate forms of coral, labor, and responsibility (Moore 2018), and the translation of what coral *is* to community conservation advocates in Indonesia (Pauwelussen and Verschoor 2017). In 2018, Irus Braverman published the first ethnographic book about coral restoration. *Coral Whisperers:*

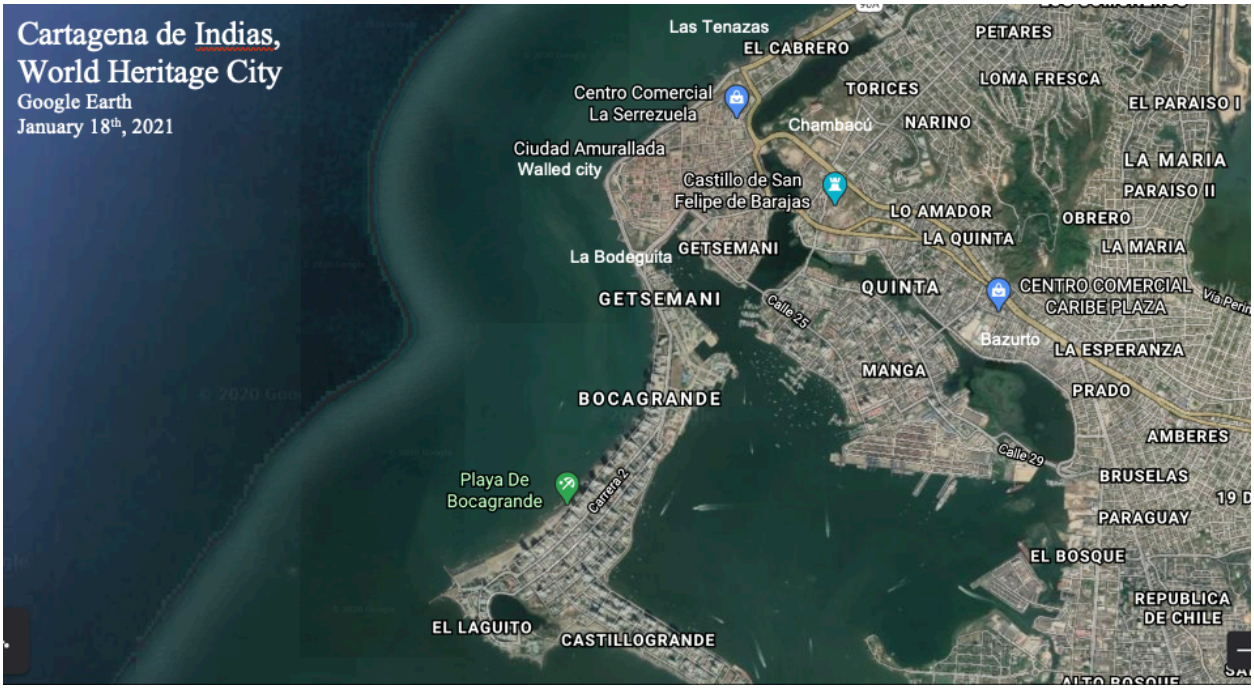
Scientists on The Brink offers an analytical account of interviews with coral scientists who work on coral restoration and others skeptical of what coral restoration could accomplish (2018).

My initial curiosity took me to the Caribbean of Colombia where corals have bleached for prolonged and repeated periods of time since the 1980s. In some places, coral coverage of reef-building corals, such as *Acropora*, have decreased up to 90% in the last three decades. My dissertation is an ethnographic account of coral in the Caribbean Sea of Colombia. It draws upon immersive study among experts in international conferences on conservation biology, coral science, ecological restoration, coral restoration programs, and 20 months of ethnographic research in the Rosario archipelago (part of the Rosario and San Bernardo Corals Nature Reserve and the touristic district of Cartagena). Although coral scientists and labs have also been my entry point into coral, the people I met living in the islands have also pushed, challenged, and added conceptual analysis to what corals are up to. My work integrates and advances discussions surrounding extinction, managerial juridical frameworks concerning the sea, and environmental and animal studies.

Cartagena de Indias






Cartagena de Indias,
World Heritage City
Google Earth
January 18th, 2021
Las Tenazas
EL CABRERO
PETARES
Centro Comercial
La Serrezuela
TORICES
LOMA FRESCA
EL PARAISO I
Chambacú
NARINO
Ciudad Amurallada
Walled city
LA MARIA
Castillo de San
Felipe de Barajas
PARAISO II
LO AMADOR
OBRERO
LA QUINTA
La Bodeguita
GETSEMANI
LA MARIA
QUINTA
CENTRO COMERCIAL
CARIBE PLAZA
GETSEMANI
Calle 25
Bazurto
LA ESPERANZA
MANGA
PRADO
BOCAGRANDE
AMBERES
Calle 29
Playa De
Bocagrande
Carrera 2
BRUSELAS
PARAGUAY
EL BOSQUE
REPUBLICA
DE CHILE
EL LAGUITO
CASTILLOGRANDE


The Rosario archipelago
Google Earth
January 18th, 2021
Tesoro Isla
Orika
Isla Grande
Enchanted
lagoon
Oceanarium
Pavitos
Isleta
Palmar
Rosario Isla
Playa de la
Península
de Barú
ISLAS DEL ROSARIO
Isla Arena
3D

My work conceptualizes coral and coral reefs in Cartagena (including the Rosario archipelago). Cartagena is a place I call home. My mother, who worked full-time in Bogota, always sent me to my grandmother's house during my vacations. It is difficult for me to remember the first time I visited the Rosario archipelago. Traveling to the Rosario archipelago was special. It happened around Christmas time when my mother could join us in Cartagena. My mother, some aunts, my cousins, and I traveled on a one-day trip onboard El Alcatraz (named after the gannet bird), one of the first boats to offer an all-inclusive day pass in the 1990s. Like many families from the continent, my family saved money the entire year to spend a day in the Rosario archipelago. Unlike many *cachacos* [people from inland Colombia, especially from Bogota], who also traveled on El Alcatraz, my family lived in Cartagena and my mom did not have to pay for accommodations. El Alcatraz departed around 8 a.m. from La Bodeguita, a tourist harbor near downtown. It arrived at 11 a.m. at the San Martín de Pajarales Island, where the *Oceanarium* is located. After, the motorboat stopped on another island for lunch and some snorkeling and beach time. We would be back in the city around 5 p.m.

Sometimes my mom and some of my aunts took my cousins and I to the beach in Bocagrande (where most of the hotels were located), La Boquilla and Manzanillo (on the way to Barranquilla), and Tierra Bomba (a small island in front of Bocagrande). One of my aunts drove us to those places. To go to Tierra Bomba, we parked behind the Hilton hotel in Bocagrande and paid for a 10-minute ride on a motorboat to the public beach. At the beach, we rented a tent for the day and bought the inescapable meal: fried fish, coconut rice, fried plantain, lettuce, tomatoes, and Kola Román (a local brand of soda).

Although I do not remember the first time I visited any of the aforementioned places, I remember the first time I visited Playa Blanca, Barú. I was a teenager—I remember that a cousin

invited me to join him for a one-day bus trip with his girlfriend's family. Her family had rented a bus to go to Playa Blanca together. I would say there were 50 people on board, or at least I remember it as such. I remember that the bus crossed the Canal del Dique on a *planchón* (a floating platform). I also remember the first time I slept at the Rosario archipelago. It was my mom and I. We stayed for a night or two in La Cocotera, a recently expropriated house in Isla Grande run by the newly constituted Community Council of Islands. It was also the first time I saw bioluminescence at night in the Enchanted lagoon. Later, as my mother decided it was too hard on her back to do the bumpy trips to the islands, I learned how to scuba dive and traveled by myself. My first dive was near Pavitos in the Rosario archipelago.

In 2017, many years later, I moved to Cartagena to do my ethnographic fieldwork. At that time, many more motorboats traveled for one-day trips to the islands from La Bodeguita. I also learned that I could take the public boat from the Bazurto fish market. In La Bodeguita, *Parques* (the government institution that manages nature reserves in Colombia) charged an entrance fee for both Corals of Rosario and San Bernardo Nature Reserve. However, *Parques* did not charge fees in any other place, which made it cheaper for many people to visit the islands. Tourists who took the public boat spent at least one night on the islands—the public motorboat only returned to the city the next day. Most of these tourists stayed in eco-hotels on Isla Grande, which were numerous—many more than the few I learned about in my first visit to La Cocotera. There were also many more diving schools that did not have to stop on an island in the archipelago. The schools' motorboats departed from and arrived at ports in Bocagrande and Manga. The briefing that preceded the dive was onboard the motorboat. It consisted of instructions, a description of the underwater tour, and basic safety rules. Many hotels extended towards La Boquilla and Tierra Bomba and offered all-inclusive day passes in their enclosed resorts.

In 2017, I learned that I could take a public bus to Pasacaballos, Barú island. It was possible due to a bridge inaugurated in 2014 that crossed the Canal del Dique. From Pasacaballos, I could pay for a motorcycle ride to Ararca or Playa Blanca. When I visited some of the artisanal fishers with whom my father and mother worked thirty years ago in Ararca, I found out that most of their grandchildren did not fish. They worked for the Decameron resort. The effects of the expanding tourism industry were apparent, even in villages. There were many hostels in Playa Blanca and many more Community Councils than the one of Islands. By 2018, I remember that the construction of the paved road from Pasacaballos to Barú town, partially over water, required that some marine biologists relocated corals and urchins.

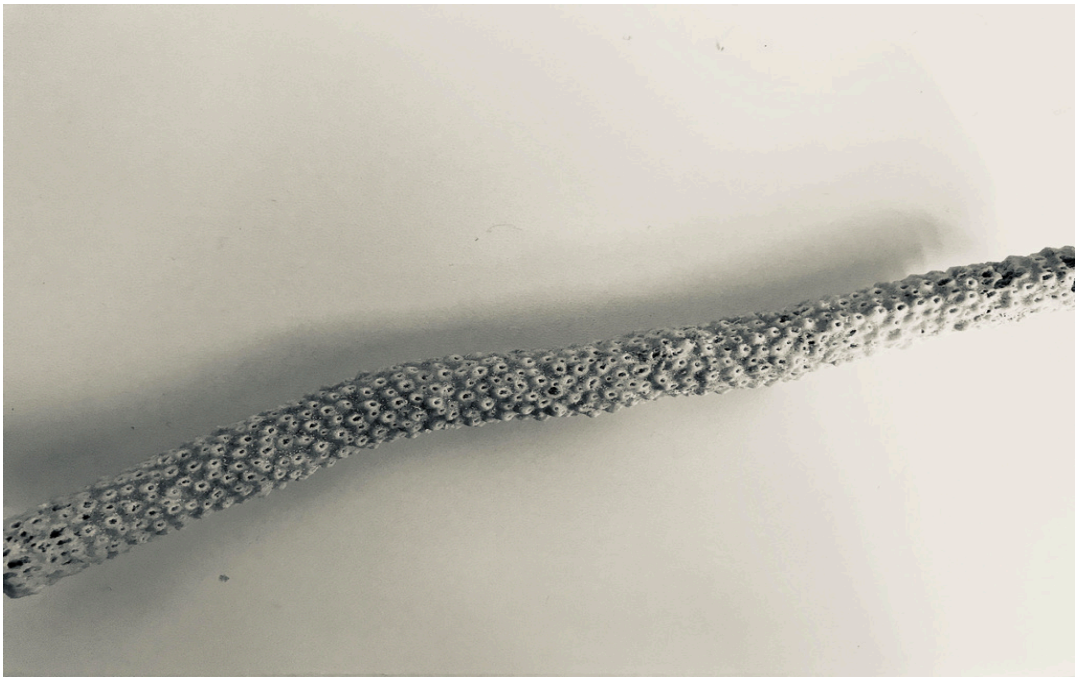
With the paved road, it became possible to drive from Cartagena to Playa Blanca. From Playa Blanca, I could pay for a 20-minute motorboat ride to Isla Grande, like what I used to do with my family to travel to Tierra Bomba. Also, my roommate and her friends, all from Cartagena, used to rent a yacht for a parties onboard. They would go to Cholón in Barú and I saw similar parties in other places, such as Punta Brava in the Rosario archipelago. None of these visitors had to pass through any control point by *Parques* or the Community Councils.

More than ever before, I felt that like a lighter skin *cachaca*—I had to bargain for the price of everything. Taxi drivers and motorboat owners gave inflated prices to verify who would pay them. This practice was widely accepted, but raised the prices for *cachaco* families who saved money the whole year to visit the beach. La Negra Eliza, the owner of many motorboats that travel to the Rosario archipelago from La Bodeguita, explained the situation. Why would I sell a ticket for $70,000 Colombian pesos ($20 US dollars) if there is someone who will pay $120,000 pesos ($34 US dollars) for it? Over the past ten years, Cartagena had become a convention center for multiple international annual events, such as the Cartagena Film Festival, the Cartagena Classic

Music Festival, and the Hay (Literature) Festival. The construction of the bridge has made the islands more accessible by public buses, cars, and motorboats. At the same time, the increasing construction of exclusive resorts for international tourists has kept tourists close, and yet apart, by fences, fluorescent bracelets, and tickets.

Cartagena is not only a touristic district. It is also the location of one of the largest Port systems in the Caribbean region of Colombia and a petrochemical center. The Canal del Dique is an engineered branch of the Magdalena-river. In the 1980s, it was straightened to enable the navigation of large vessels to an oil refinery. The navigation of vessels, ships, and cruises requires constant dredging and the suspension of sediment in the water column. Only the northerly winds during the dry season blow the sediment back to the continent. During the rainy season, the southerly winds push fresh water, algae, and sediment to the Cartagena Bay and the Rosario archipelago. The first time I interviewed coral scientists in Cartagena, I noticed they were concerned about ongoing industrial developments that somehow seemed more pressing than sea warming and acidification. In 2013, *Parques* created the Deep Corals Nature Reserve to protect deep corals from offshore exploration and exploitation.

Writing an ethnography of coral today



Acropora cervicornis skeleton in my desk, Davis, California, June 2020.

Diploria labyrinthiformis skeleton, Palmar's backyard, Isla Grande, January 2018.

While I type these words, a skeleton of *Acropora cervicornis* lies beside my hand. I remember the multiple dives where fingery skeletons of dead coral seemed to belong to cemeteries of past seascapes. I learned to think of them as remnants of the shallow coral reefs, before massive bleaching started in the 1980s. The second photograph is a close-up of the backyard of my home in Palmar (Isla Grande). Rosario is a coralline archipelago, which means that coral skeletons create a habitable surface. Looking at the ground, I also learned to think of these forms as accounting for timescales that span millions of years, when the surface was underwater.

Fingery skeletons, coralline surfaces, and I meet in times that islanders[1] describe as *el mar se está comiendo las islas* (the sea is eating up the islands). The reflexive tense also indicates a process in which the sea is eating itself. Alongside geological accounts, an activist and black scholar, Jannia Gómez González (2020), states that some islands have not always been islands—the constant traffic of slave ships in the seventeenth century initiated sedimentation in the Cartagena Bay (Kairmari in Karib). Through that process, Tierra Bomba became a separate island. Islands have appeared and disappeared in colonial and industrial developments in Cartagena. Today, *el mar se está comiendo las islas* speaks of these living pasts and lifeways dissolved into the sand and washed away by seawater.

[1] Islander is a translation of "isleño," which locally has various connotations, but means a resident of the islands. Also, "isleño" is how people from the Community Council of Black Peoples self-identify and trace kinship with people in other islands, mainly with people from Barú and Santa Cruz del Islote. Don Hernando, an elder of the Community Council, distinguishes between residents of the islands through a story of occupation. This story says that there were three waves of occupation of the islands. First, there were indigenous people who disappeared from the islands during the Spanish conquest. Second, black artisanal fishers who have traveled and lived in the islands since the early twentieth century. Third, recreational, wealthy, and lighter skin fishers who have bought land on the shoreline and small islands from artisanal fishers since the mid-twentieth century. It is the case of Rafael Vieira's father, who purchased the island of San Martín de Pajarales from Yeyo's father. Rafa, who has lived with his family on the islands since the 1970s, calls himself an isleño too.

In my manuscript, I inherit various stories. I borrow my understanding of what it is to inherit from Vinciane Despret. In her words:

> [To inherit] is a task, a pragmatic act. Heritage is built and is always transformed retroactively. It makes us capable, or not, of something other than simply continuing… In English the term remember [se souvenir] can take account of this work that is more than just memory: 'to remember' and 'to re-member' [recomposer]. To create stories, to make history to reconstruct, to fabulate, in a way that opens other possibilities for the past in the present and the future. (Despret 2016: 178)

I inherit stories of the Anthropocene, *maritorios*, and planetary accounts of saving coral reefs (reef futures and *Salvemos Varadero*). First, the term Anthropocene emerges as a concept in earth sciences and points to the transformative effects of human activities on the earth. In the decade of 1990, Paul Crutzen, an atmospheric chemist and Nobel Prize winner, suggested the Anthropocene could name a new superseding epoch to the Holocene. The use of the concept has emphasized the stressing effects of warming and acidifying oceans in coral reefs. In the words of Donna Haraway: "Warming and acidification of the oceans are known stressors that sicken and bleach coral reefs, killing the photosynthesizing zooxanthellae and so ultimately their cnidarian symbionts and all of the other critters belonging to myriad taxa whose worlding depends on intact reef systems." (Haraway 2016: 56) Within the Anthropocene stories, bleaching and dying coral worldwide evidence and forecast mass extinction and global disasters.

Related concepts to the Anthropocene are the Capitalocene (Haraway 2016) and what I call the Extractionocene. The Capitalocene challenges the assumption of a generalized "Anthropos" responsible for planetary catastrophes. In Haraway's words: "The Anthropos is not Burning Man after all" (Haraway 2016: 48). Based on the work of Latin-American scholars who conceptualize

extractivism (e.g., Gudynas 2015), I add that the burning man (the man that burns fossil fuels) can also be other than capitalist, and it can also burn fossil fuels with redistributive purposes. Mineralized corals deep in the ocean become unconventional fuels in times of depleting reserves on land. In that sense, the Extractionocene could more precisely name the current epoch.

Second, *maritorios* mirror territories in Colombia. Territories name place-based lifeways through social movements. Sometimes territories are translated as land, but territories exceed re-distribution as a primary reference in discussions of land in Latin America. The Colombian state recognizes collective rights of territories to ethnic minorities, including Community Councils of Black Peoples in different places in the country. Eika de la Rosa explains the meaning of territory within Plan de Vida (Living Plan) of the Community Council of Islands as: *"El territorio es ese relacionamiento que tenemos nosotros con todo lo que nos rodea. Hace parte de nosotros, de nuestro ser. Es algo con lo que estamos ligados desde el momento en que nacemos"* [Territory is our way of relating with all that surrounds us. It is part of us, of who we are. It is something we are attached to since our birth] (Consejo Comunitario de Islas 2015). The Community Council of Islands suggests that the concept of *maritorio* extends their territorial claims to the aquatic and subaquatic seas.

The ethnographic work of Ana Isabel Márquez has contributed to the conceptualization of *raizal maritorios*, which exceed the administrative Colombian borders by following the construction and use of wooden boats and turtle fishing, done for consumption and markets in the Great Caribbean (Márquez Pérez 2014; 2016). Márquez has also drawn similarities in the dispossession of marine and coastal territories in San Andrés, Santa Catalina, Providence, and Barú (Márquez Pérez 2018). Likewise, Andrea Leiva has elaborated on the occupation, use, and organization of the space in Islote through practices such as *calzar* (surface making) and mobility

based on tourism and kinship (Leiva 2013). In the work of both scholars, movement on boats and networks is critical. Today, the Colombian state's recognition of *maritorios* is ambiguous. It does not grant collective rights to the aquatic and subaquatic seas. However, as Vanessa Cárdenas emphasizes, for the first time, the Colombian state consulted an alliance of community councils about the management plan for the marine reserve in 2018 (Cárdenas 2020). One expectation of some leaders from the Community Council of Islands is that my work as an anthropologist can contribute to that discussion.

Third, planetary accounts of saving reefs take different forms. I call these accounts planetary because the premise is that corals are primarily scientific domain, and corals are the same corals worldwide, independent of their location. One of these accounts is what coral restoration scientists name reef futures. These futures are uncertain yet anticipated: warmer and more acidic shallow seawater. Coral restoration scientists work to grow corals that able to survive and thrive in those futures. I work with these scientists. I respond to the trust and expectation of some that my work could advocate for futures with coral reefs. Another variation of planetary accounts is *Salvemos Varadero*, which is an initiative to protect the Varadero reef at the mouth of the Cartagena Bay from further dredging. This reef has already lived under stressful conditions, such as the constant traffic of large ships. *Salvemos Varadero* has mobilized the tools of reef futures to claim protection for this reef. Mission Blue (an international network of marine protected areas) declared Varadero a Hope Spot—Varadero embodies knowledge that can help scientists learn how to reproduce the reefs of the future.

I inherit these stories, meaning that they make me think, and I feel obliged to respond to them in a way that holds them together. At the same time, I retroactively intervene in these stories to experiment with slightly different understandings and calls for response. I compose tentative

stories that simultaneously acknowledge and betray the legacies of human exceptionalism. I understand that humans are exceptional in at least two ways: in terms of capacities (such as sentience and cognition) and in how those capacities legitimize a hierarchical relationship, conceiving of ourselves as "more than" nonhumans. Human exceptionalism also creates a human/nature separation that has expelled humans from the seawater and has made *maritorios* impossible in the Historical Archive of Cartagena.

Michel Rolph Trouillot (1995) asks: "If some events cannot be accepted even as they occur, how can they be assessed later? In other words, can historical narratives convey plots that are unthinkable in the world within which these narratives take place? How does one write a history of the impossible?" (73). By unthinkable, he means "that which one cannot conceive within the range of possible alternatives, that which perverts all answers because it defies the terms under which the questions were phrased" (Trouillot 1995: 82). A history of the impossible is a history of events that were unthinkable as they happened (such as the Haitian revolution), hence, they became non-events in the historical archive. If *maritorios* have been unthinkable for historical archives, how do we find historical evidence of human lifeways under the sea surface, deep and far in the ocean? How do we tell the relational materiality of subaquatic seas? I suggest that thinking ethnographically about human and non-human lifeways entangled in coral and coral reefs may open more conceptual possibilities for *maritorios*.

Coral reefs: a submarine and superficial continuum

The poem at the beginning of this text points to my body underwater. Koleka Putuma writes a quite different poem named Water; in her poem, she evokes the memory of going to the beach on New Year's Eve. She refers to elders forbidding her (and other black women) from going into the deep. She wonders why she feels like she is drowning every time she looks out to the sea. She says

that others mock black women for not being able to throw themselves into something instrumental in trying to execute their extinction. Drawing upon this poem, Jannia Gómez González (2020) claims the shoreline as the ground of her research and the mangrove as an archipelagic figure.

When I heard Jannia Gómez González (2020) read this poem and heard her elaboration on life of the ongoing past, I felt interpellated in the very same body of my research. In the Rosario archipelago too, many black women avoid diving into the sea water. Some women fish from the shore and some artisanal fishers, like Tomasita and Carmen, fish with nylon in places where there is only *agua y cielo* (water and sky). The shoreline and the boat are also how many residents and visitors relate to the sea. To Jannia's stories of shores and mangroves, I want to add stories of a coralline continuum curling underwater and on the surface.

Stony corals create substrates by secreting calcium carbonate. Coral, sponges, and algae overgrow those calcareous skeletons, which resemble bones and are openly exposed to material processes of decomposition and re-composition. Underwater and on islands, coral skeletons (such as the ones in the photographs) are neither dead nor living organisms. In the simultaneous processes of decomposition and re-composition, coral become soil. Lichens broke the rocks and mangroves rooted in proximity to others. As much as islanders spend many hours of their lives on boats or underwater, the lifeways of various residents and visitors of the islands (as known today) also depend on the continuity of coralline islands as habitable surface.

For me, writing an ethnography of coral today is an act of inheriting. It is an act through which, as a writer, I respond to a sense of obligation with specific stories. This act is creative not only in what is said, but in how it is said. I hope these stories can activate existing possibilities of more than a single, linear, and catastrophic future. When I remember, I do not remember alone but with and through relationships in which I also participate. I come back to the photographs and the

poem at the beginning of my work. Today, when corals are disappearing and the sea is eating up the islands, corals also create nurseries and soils. In diving, as in writing, I not only cross space, but also my habits of movement and description. Through a subtle change in movement and narration, in my dissertation, coral reefs become a submarine and superficial continuum.

A Map for the Reader

My dissertation includes four chapters and three interludes. They can be read in sequence or separately. Each text includes references to other texts in parenthesis. The chapters are reflections and propositions about coral restoration as practiced in the Rosario archipelago. The interludes inquire about different approaches to animal bodies, species, and individuals, all whose lifeways are deeply implicated in coral reefs. They also help me to reflect on the kind of animal that is coral.

Chapter one is *Elusive ecologies Alongside Extinction: An Invitation to Dive into a Sea of Massive Births.* In this chapter, I take the simultaneous and massive gathering, hatching, and spawning during seasonal storms as an entry point for *elusive ecologies.* By elusive, I refer to the migration of fish, coral, and perhaps these massive births, which are out of reach for scientists and artisanal fishers. *Elusive ecologies* are affective ecologies, deeply entangled in specific ethics of work, effort, and care by scientists and fishers to remain proximate to fish and coral. This concept unsettles recognized ideas in extinction, reframes destruction, and claims more ways to imagine human intimacies with the deep and open ocean amid uncertainty.

Interlude one is *What is Sound If We Immerse ourselves in Coral Reefs?* This interlude approaches sound as an immersion, a dive into coral reefs, which is different through various technologies, concepts, and body receptors. Like in chapter one, humans immersed in coral reefs

appear small and constrained in their perceptive capacities. Yet, at the same time, differently skilled receptors make multiple human bodies too.

Chapter two is *Co-incidental Compositions in Marine Ecologies.* This chapter introduces reef futures as imagined by coral restoration scientists alongside a baseline story of corals dying worldwide. I show how the reefs of these scientists overlap with state property and *maritorios* of Community Councils of Black Peoples. I expand the analysis of marine ecologies by thinking through the specific tools, skills, questions, and intimacies that develop divergent perceptual and affective ecologies in coral nurseries, reef checks, and various artisanal fishing techniques. My argument is that coral does not precede the relationships in which it emerges, and coral animals that are also *piedras* (stones) coincide with their dissolution into the sand during the last three decades. I am interested in this kind of *co-incidence* as it may allow for unlikely and strategic alliances among scientists and artisanal fishers beyond the nature reserve's constraints. This chapter reinforces the invitation of chapter one and interlude one—to think through movement and migrations.

Interlude two is *What May Seawater and Marine Individuals Teach Us About Sea Ecologies*? In this interlude, I address environmentalist, animal rights, animal welfare, and state property approaches to the lives of animals in captivity at the *Oceanarium*. As the *Oceanarium* prevents judgments for animal mistreatment, other questions and opportunities to build intimacy with these animals (as species and individuals) are erased from the exhibition of them. It is a case of inseparability of these animals' wellbeing and the seawater in which they live; the lack of place of the dead, sick, and disabled in the exhibition; and the financial sustainability of zoos and aquariums that operate as refugee, rehabilitation, and conservation centers today.

Chapter three is *Intra-penetrating Restorations in an Archipelagic Place and a Technoscientific Milieu.* In this chapter, I situate coral restoration in an archipelago of archipelagos where the sea eats the islands, and mixed waters permeate bodies and burst open categories of speciation in accounts of biodiversity. Likewise, I think with, against, and *across* technoscientific milieus. By considering bio-industrial chemical ecologies, I reconsider the temporal horizons and reproductive urgencies of the climate science informing coral restoration. *Intra-penetrating restorations* call for process-oriented protocols grounded in experimental assessments that advance anti-black racism and challenge the inevitability of industrial chemicals in marine science and in Cartagena.

Interlude three is *A Reflection About Personhood and Punishment in the Rosario Archipelago Through the Lives of Dog Islanders*. In this interlude, I explore how conservation and animal rights watch over animals as endangered species and innocent sentient beings. Dogs are not a target of conservation, but have recently become protected under animal rights in Colombia. I simultaneously explore the noninnocence of disobedient dogs and the people who poison them as a consequence-free action in Isla Grande, where dogs are disposable lives. I wonder if not on the grounds of dogs' innocence and perpetrators' guilt, how do we imagine an ethics-politics that does not become a death trap for disobedient dogs? How else may we imagine animal rights and conservation if not on the grounds of innocence and punishment?

Chapter four is *Nursery-ing: A Proposition for Nourishing Observatories, Nurseries, and Gardens Throughout the Archipelago.* Coral restoration scientists (also aquaculture researchers) and other islanders widely use the word nursery to name different places and practices. Throughout the chapter, I build up a vocabulary of nursery-ing by exploring the nourishing potentials of various fish and plant nurseries in the Rosario archipelago. In the process, I reclaim neglected grounds for

artisanal fishers who are also fish harvesters and farmers. In doing this, I elicit an imagination of the many ways the coral and fish nursery at the CEINER lab could be and how this lab can create conditions for different coral reefs conceptually and materially.

The epilogue reflects on *what kind of animal and ecology is coral* in this dissertation.

CHAPTER 1

Elusive Ecologies Alongside Extinction: An Invitation to Dive into A Sea of Massive Births

In the Rosario Archipelago on the Caribbean coast of Colombia, the elders say that around the full moon, under the influx of the *vientos* (southerly winds) and the seasonal rain, *el mar pare* (the sea births). Fish gather massively, the turtle eggs hatch, and coral spawns around the same season. It is a sea-wide profusion of fish coming together in recurrent places, newborn turtles dragging their little bodies through the sand and into the seawater under storms, and coral sperm and millions of white floating bundles, exploding and mixing in turbulent seawater.

Focusing on these nights might be counter-intuitive given the proliferation of deathly accounts of endangered animals, such as fish, turtles, and corals. As a composition of simultaneous gatherings, hatchings, and floating bundles, *el mar pare* (the sea births) points to something other than a problem of reproduction. Much scholarship on corals tends to inquire about death as a marker of biodiversity loss through a biological lens. My work suggests that fish, and perhaps corals, are dying and moving out of reach for artisanal fishers and scientists. It is what I call *elusive ecologies.*

I use the word *elusive*[2] to allude to an ethics of work, effort, and care that artisanal fishers and coral restoration scientists (who are also marine fish aqua culturists) continue proximate to fish and corals. In this sense, the artisanal fishers and scientists are the reference from which fish and corals are distancing. In this story, corals and fish are not necessarily disappearing from the planet but from certain lifeways that require proximity to continue. I choose the word elusive

[2] I might use the word *esquivas* in Spanish.

instead of other possible words, such as evasive and fugitive, because the word elusive carries a feeling (perhaps) of indifference on the part of the fish and corals moving deep and far into the ocean. I use the word *ecologies* to name the profound ways in which the lifeways of artisanal fishers and scientists are intimately compromised by the disappearance of fish and corals near the shore. *Elusive ecologies* unsettle ideas of recognition in extinction accounts by reframing destruction and offering stories open to uncertainty and not knowing.

Extinction Accounts

According to the extinction studies group: "Extinction is fundamentally a deathly process. It is, by definition, a collective death, the end of a living kind. But this larger ending is pieced together out of the deaths of countless individual organisms" (Rose, Van Dooren, and Chrulew 2017: Loc 343). The various extinction accounts make visible and present the violence, grief, and mourning involved in worlds that disappear, commemorated by the death of the last ones of a kind. Likewise, extinction accounts confront human practices that participate in the end of worlds that are also partially their own. Vinciane Despret beautifully articulates the deep connection: "The last American Passenger Pigeon (*Ectopistes migratorius*) in the wild is shot by the last American hunter of Passenger Pigeons" (Despret 2017: Loc 3734).

During my twenty months of ethnographic fieldwork, I found multiple accounts of the decrease in coral coverage in the Rosario archipelago beginning in the 1980s. No one told me a story of linear causality, but instead, I heard various accounts about the simultaneity of multiple events. In the following paragraphs, I offer my compilation of floating bundles, held together in a story of simultaneity that describes a decrease of almost 90% in shallow reef-building corals.

In the late 1980s, the Caribbean experienced the deadly effects of a massive and prolonged bleaching event. Coral scientists identify bleaching as the whitening of corals caused by the disassociation of the coral animal and the *symbiodinum* (*Zooxanthellae* microalgae). Without the microalgae in their tissue, coral polyps lose their colors and ability to photosynthesize. Bleaching occurs as a response to a slight variation in the temperature of the sea surface (1-2 degrees Celsius). It does not mean that corals die immediately, but prolonged bleaching make corals more susceptible to disease. In the 1980s, various diseases spread among shallow corals, especially among the *Acroporas*. The temporary disappearance of the long-spine black urchin (*Diadema antillarum*) enabled algae to overgrow, competing with corals for light and space. In the 1980s, Rafa, the director of the *Oceanarium,*[3] observed a proliferation of seaweed in the Rosario archipelago. Rafa says that he tried to remove the seaweed at first, but after a while, as it kept coming, he gave up.

Around the same time, the Cartagena government widened and straightened the curves of an engineered branch of the Magdalena River (Canal del Dique) to allow for the transportation of oil to a refinery in the Mamonal petrochemical center (Mogollón Vélez 2013). The Magdalena River crosses densely populated settlements and cities in Colombia. It receives and collects sediment, debris, and waste dumped by various industrial and urban operations. The curves of the rivers slow down the speed and decrease the force of the freshwater. With the modification of the channel, an unprecedented *bombazo*—a bomb of sediments, nutrients, and seaweed—hit the corals in the Cartagena Bay and the Rosario archipelago. José Vicente Mogollón Vélez describes the seawater in the Cartagena Bay as clear and transparent before the dredging of the curves of the

[3] The *Oceanarium* is a center of research, education, and recreation. It includes a lab and an exhibition open to tourists. It is in the San Martín de Pajarales Island in the Rosario archipelago, within the Corals of Rosario and San Bernardo Nature Reserve.

river. According to him, he could see corals, sea stars, urchins, snappers, and other big fish. Today, the seawater in the Cartagena Bay looks *color panela* (sugar cane color) most of the year. Artisanal fishers from Ararca say that they perceive the sedimentation as blocking their access to the sea. They also find mud in their equipment. Only seasonal *brisa* (northerly winds) pushes the sediment into the open sea, the ocean.

Corals seem to do better under stable conditions of light, salinity, and temperature. The precipitation of sediment can asphyxiate the coral polyps. The navigation of big ships through the Canal del Dique and the Cartagena Bay requires constant dredging. In the words of Echeverría de Ripoll and Báez Ramírez (2001), for the Cartagena port, dredging is a question of *renovarse o morir* (renewing or dying). The dredges move and suspend sediments, algae, and all that comes with them into the sea curtain. The bomb of sediments and algae intensified the effect of dynamite used by some artisanal fishers at the time. Boom! Dynamite left holes beneath corals and dead fish, as they floated to the surface. The Tesoro Island, one of the places less affected by the influx of freshwater coming from Canal del Dique, was one of the most damaged by dynamite. Some fishers also talk about various oil spills and the dumping of the dredged materials from Cartagena Bay in nearby areas. They associate these spills and dumping of dredged materials with the spread of a poisonous fish named *sapito* (little frog). Many fish—especially *saltonas*—died after eating *sapito*.

Acropora palmata was used to build tourists resorts such as Majagua and recreational houses of people from the continent that bought land from the islanders (see chapter 3). Some islanders also sold corals in Cartagena as construction material. In the words of Mirna, a resident of Tierra Bomba Island, what people from Cartagena are proud of came from the islands. The simultaneity of bleaching, the spread of diseases, the temporary extinction of urchins, the

engineering and dredging of Canal del Dique, *bombazos* of sediments and dynamite, and the trade of corals as construction materials, among other extinction accounts, led to what Esteban Zarza et al. (2014) describe as the loss of up to 90% of coral coverage in some places.

Rafa says that the reef north of Isla Grande extended miles and miles to *Periquitos,* Barú*,* in the early 1980s. Some corals were as big as trees. There were places that the boats could not cross. And many islanders say that when the tide was low, some coral islands emerged from the sea. *Acropora* corals used to be the dominant species in the reef crests. Yet, since 1983, most of them have dissolved into sand and rubble (see chapter 2).

Elvira Alvarado in an *Acropora palmata* reef in the Rosario archipelago in the early 1980s. The picture is part of Elvira's personal archive. The picture's description reads: "*A. palmata* used to be a dominant species in the reef crests at the Park, but since 1983, the populations of ***Acropora*** species have registered mortalities that reach 90%." Used with permission.

Coral research in Colombia started as research on massive deaths. In the 1980s, Elvira Alvarado, a young marine biologist, was mostly interested in *Polychaeta* (sea worms).[4] She was attracted to their forms. However, as she observed the massive deaths of corals, she decided to

[4] *Polychaeta* live embedded in coral reefs' bodies. They have colorful, tree and flower-like forms that are very sensitive to movement. A simple movement above them and they hide deep into coral skeletons.

specialize in them. In doing so, she opened a path for coral research in Colombia. Elvira showed me the first maps she drew on parchment paper. In 1985, she drew the areas with reefs in dark green. In 1988, she drew the loss on the map, painting the few remaining patches in light green. She also showed me many pictures. Whereas I was looking for size, she insisted: corals did not look sick in 1983. Corals were not bleached, with colorful spots, or overgrown by algae. Her pictures are close-ups. Only in a few I could gauge the dimensions of these large corals in relation to human bodies. *Acroporas* did look like trees I had never seen.

Nowadays, the seascape includes large extensions of flat areas covered by finger-like *cascajo* (rubble)—the skeletons of what were once corals. These large coral cemeteries overlap with current reefs, which are dominated by *Orbicellas*, corals that rise like mountains in the sea. Elvira says that even though *Orbicellas* and other types of corals survive in deeper water, they diminished in size and health. Some *Diplorias* (brain corals) had been as big as 3.5 meters in diameter, but these corals are rarely found anymore.

Fish have also diminished in numbers from the shallow reefs and shoreline waters. Rafa explains that fish populations in coral reefs are diverse rather than abundant. Diversity is a matter of many different kinds—not necessarily many of the same type. In the times of dynamite, fish were overfished. In Rafa's and Elvira's terms, overfishing is not a matter of large volumes, but a threshold. Overfishing means that fish in the reefs have reached a point in which their capacity to reproduce is at stake. Elvira states that once the fish in reproductive age are all caught, it is hard for their population to reach large numbers again, especially if fishing continues.

The sea of the Rosario archipelago is a depleted sea. It is a sea where corals and fish have decreased in numbers due to variations in the sea surface temperature, acidification, and many more past and contemporary human and non-human doings. Following Deborah Bird Rose (2011),

death narratives call on survivors for some response. She reminds us that what matters is the flip back and forth between death and birth. She refers to a double death. One is death that inheres in life as living beings bound up in communities—where death is the counterpoint to communal living. This death is inseparable from life. The second death is the will-to-destroy—the death which attacks the generative quality of life. It compromises the conditions and capacities for birth. This second one is the death of extinction.

For artisanal fishers,[5] death in the Rosario archipelago is an ordinary death that inheres life, something other than the second death of extinction and its irreversibility. Fishers are daily and directly exposed to killing and dead bodies. They possess a subtle sense that as one fish dies, another one is born. Birth is inseparable from this ordinary death. No fisher on the islands denies that corals and fish have disappeared from shallow and coastal seawaters. However, they perceive that the big and commercial fish are moving deeper and further into the open ocean. *Perhaps,* massive births continue in those places. Some artisanal fishers have followed fish with motorboats, GPSs, and scuba equipment. Something else alongside extinction is happening in this sea. Fish have not only died. Fish have also moved away.

El mar pare **(the sea births)**

El mar pare is an expression I heard from elders in Isla Grande to describe massive fish gatherings. I use it to describe a proliferation and simultaneity of gatherings, hatchings, and coral spawning under seasonal storms. In this section, I offer a brief story of fishers moving after fish, even where the lighthouses and islands disappear, and another story of coral spawning, both as entry points to *elusive ecologies*.

[5] Artisanal fishers characterize their fishing as artisanal to differentiate it from industrial and subsistence fishing. Artisanal fishing covers a variety of techniques that are partially and totally forbidden in the Corales del Rosario and San Bernardo Nature Reserve.

Moving after fish where the lighthouses and islands disappear

It is around the full moon during the rainy season. *Cosito* knows that the moon and the rain move the fish. Early in the evening, he prepared his rain jacket, various lights, the GPS where he saves the locations of the different *bajos* (fishing places—see chapter 2), the anchor that grounds the boat in a place, and a variety of nylons and hooks to support fish of several weights. During the day, he received the sardine he ordered from the *Bazurto* fish market. Some other fishers probably caught it early in the morning with a *boliche* (a net that closes like a bag) in *Las Tenazas* near downtown Cartagena (see chapter 3). Cosito travels alone in his boat, which could perhaps fit one or two other people. He turns on his 30-horsepower motor and travels for an hour or two, until he cannot see the lighthouses and the islands disappear. As the fish become more difficult to find close to shore, he travels farther and farther. He throws the anchor. He kneads *marisco*, a mix of sardine and sand, and throws it into the seawater. He ties a line of nylon around a toe on each foot and another plastic around a finger on a hand.

Fishing with a nylon line is an art of feeling weights—the weight of the anchor at the bottom of the sea, the weight of the nylon together with the stone and the hook, and the weight of the fish taking the hook. Fish catch differently. The snapper takes the hook and runs away. The grunt fish first tastes the bait, and after, comes back and eats it all. The *mero* fish, the giant grouper, gulps the bait and leaves the fisher pulling, without fighting back, only moving its head from side to side. Around 4 a.m., alongside many fishers of Cartagena and its surroundings, *Cosito* arrives at the Bazurto market in Cartagena to sell his fish, per kilo, to an intermediary. The night was good. *Cosito* caught enough fish to cover the price of gasoline and made three or four hundred thousand Colombian pesos (around one hundred US dollars). The ice is ready to keep the fish fresh. Around 6 a.m., Cosito arrives back on Isleta. Cidi, his partner, is waiting for him, sitting in

a chair in front of their house. When Cosito arrives, Cidi feels that she can sleep. Around the same time, the first customers arrive at *Bazurto*—women, in many cases. They select what they want and move to the table where two men scale the fish. The guts in the fish bodies are the ultimate proof that the fish is fresh. To preserve the fish for longer, some sellers remove the guts from the fish and keep the fish frozen. Some fish could remain frozen for many months. When people go to the fish market to buy fresh fish, they buy the fish with the guts inside. Then, they ask for the guts to be removed from the fish in front of them.

Annual Massive and Synchronic Coral Spawning

Coral scientists think that corals reproduce in two ways: asexually and sexually. A coral polyp can clone itself and proximate clones with the same genetic material grow a colony. Corals reproduce both ways in these nurseries (see chapter 2). About a decade ago, the *Centro de Investigación, Educación y Recreación* (CEINER) laboratory built an under-seawater nursery separated from the wild by a metallic net. They used some trays to grow fragments of corals, but the tide washed the trays away. After, the Coral Restoration Foundation and *Corales Vivos* trained the rangers of the Corals of Rosario and San Bernardo Nature Reserve and the researchers at the CEINER lab to work with PVC tree-like structures. Rafa says these structures are better because they move with the sea. As in most of the other restoration programs in the Caribbean, researchers at the CEINER lab work primarily with *Acropora cervicornis* and *Acropora palmata*. These corals grow faster than other corals, almost ten centimeters per year. Also, *Acroporas* grow as branches, which makes it easier for the scientists to measure their growth, and to manually cut them.

In addition to asexual reproduction, once a year, coral (hermaphrodite animals) release bundles (imagine delicate bags) with sperm and eggs during seasonal storms. Coral scientists think that when coral release the bundles, they also release a pheromone that tell corals of the same

species to release their bundles too. Under the storms, the bundles break, and the material is mixed, enabling fertilization and larvae propagation. Coral scientists have found that corals are very regular in their spawning, which allows researchers to prepare for the collection of gametes. Coral researchers think that sexual reproduction leads to genetic diversity and more adaptability to climate change. By collecting gametes, these scientists hope to be able to grow hundreds of thousands of genetically new organisms.

The *vientos* (southerly winds) and the rain bring the freshwater and sediment from the Magdalena River to the archipelago. At the CEINER laboratory, researchers cut fragments of *Acropora cervicornis* from the nurseries. An abundance of some sort of white seed, unobserved over the past three years, dissipates all doubts; the corals are about to spawn.

Juan Camilo Zárate installing the traps in the *Acropora cervicornis* nursery, CEINER lab. Photograph by Denise Klinkenbuß. September 2018. Used with permission.

A week after the full moon, the researchers install traps, hoping to collect a few of the white bundles released from the various colonies and morphotypes.[6] For the last two weeks, the researchers have designed the traps based on models used by other researchers in nearby Curaçao,

[6] A morphotype describes a reef of origin. Different morphotypes mean different "reef mothers."

but with recycled materials available on the islands. A trap consists of a plastic bag tied to a plastic test-tube. Around 5 pm, when there is still some sunlight, the researchers tie the traps to the PVC-tree nurseries with a string. In the case of spawning, the test tubes capture some floating white bundles. The scientists carefully bring the test tubes to an airconditioned room to be mixed with others in large beakers and to monitor samples under the microscope. That night the researchers do not collect bundles, but the next morning they learn, through the Coral Spawning Research Group, that corals of the same kind spawned in Curaçao. So, the next night, they set up more traps, and only one-colony spawns. This signal, together with news of spawning in other places through the Caribbean, announces "the big night."

The night of the spawning was breathtaking. Even sick corals massively spawned, releasing gametes through their expanded polyps. Hound fish, sardines, and dolphins,[7] all seemed to celebrate, active and noisy beneath starry skies. The night of the spawning, the researchers observed samples under the microscope and counted first, second, third, thirty-sixth cleavages of embryos. The day after, the scientists felt tired from the physical work and sleep deprivation. The researchers worried that the slightest mistake in checking for temperature changes in the embryos' medium[8] with thermometers and all of them could die. Soon the embryos began to look "off" to the naked eye and to smell like rotten coral. Under the microscope, the scientists witnessed how the embryos cells collapsed. All of the embryos died. Among thousands of bundles of spawn in the sea, the researchers collected but a few. They placed their faith in genetic diversity in the remainders, floating in a sea surface of variable temperatures. This time, these scientists missed a

[7] In 2019, around the *Acropora*'s spawning, Luna (bottlenose dolphin/*Tursiops truncatus*) gave birth to Vida, who joined Sol and Kristal born during the previous rainy season in November 2018.
[8] The medium is seawater in plastic bowls under controlled temperature.

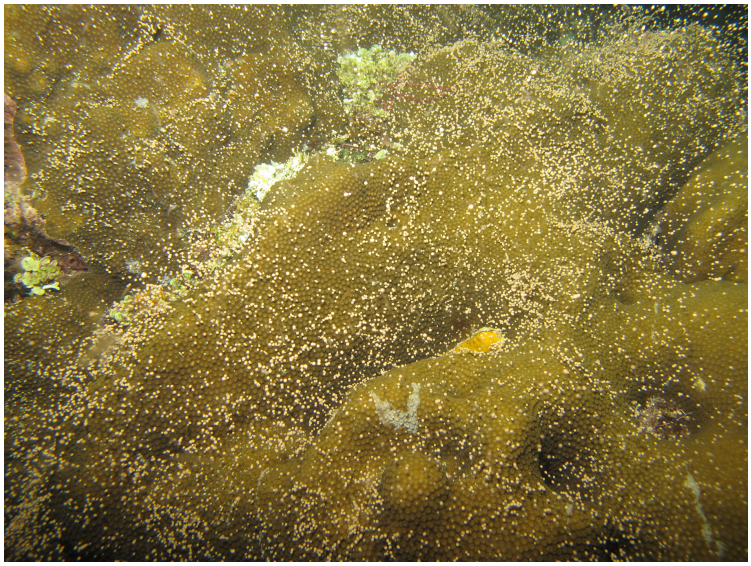
chance to witness the larvae and coral recruits. For another chance, they must wait at least a year, and likely much longer, for their personal lives to coincide with the spawning of these corals.

El mar pare (the sea births) points to simultaneous occurrences, a convergence in time and place of events, which cannot be managed or discerned in terms of linear causalities. Yet, these indiscernible and uncertain entanglements are meaningful for massive fish gatherings, the massive annual spawning of corals, what artisanal fishers call a good night, and what the scientists call reproductive success.

A month after the *Acroporas*' spawning, it was the spoiled corals of two of the most prestigious coral researchers in Colombia's turn to spawn. Elvira Alvarado and Valeria Pizarro came from Bogota and Santa Marta to witness the spawning of the *Orbicellas*. They have followed these events for decades, most of the times funding their research themselves. Elvira explained that many researchers work with *Acroporas,* a type of coral among the most affected since the 1980s. Nonetheless, she thinks that coral restoration needs other species too. *Orbicellas* are the survivors and they add tri-dimensional shapes to the reefs. Researchers from the Nature Reserve and the Navy joined the collection of gametes. This time there was no need to use the traps and recycled materials available at the lab, because the *Orbicella* researchers brought brand new and sterile materials.

These scientists collected the bundles spawned by corals close to Tesoro Island, an untouched area according to the reserve's mandates. One group of researchers harvested the traps from colonies previously marked for collection. The material had to be taken to the laboratory soon, but not so fast as to avoid auto-fertilization. The other group of researchers (which I was part of) registered the times of release and estimated the number of colonies that spawned. Zero (colonies spawning) is information—Valeria warned us. I remember feeling overwhelmed

underwater in a place with the largest *Orbicellas* I had seen in the archipelago, close to many divers, expecting the giants to spawn. The polyps looked like breasts and the bundles nipples. We immersed ourselves around 9:15 p.m. A few minutes later, *Orbicellas* began releasing their yellowish bundles and the sea was dressed in millions of bundles all around. The same night of the *Orbicellas'* spawning, the eggs of Carey turtles hatched in the Tesoro beaches. The little ones dragged their bodies to the seawater in the middle of a thunderstorm. Other turtle eggs likely hatched on Rosario Island and other islands in the archipelago.

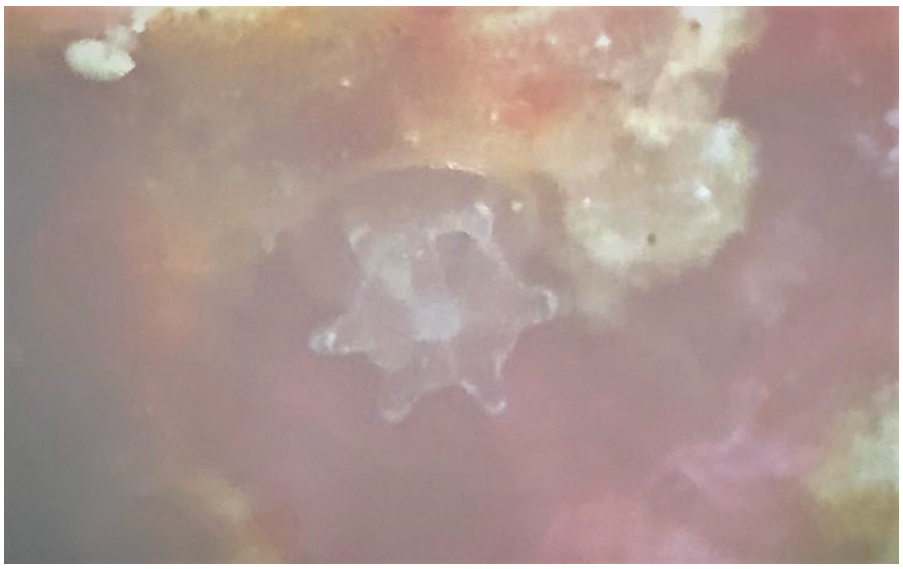


Spawning of *Orbicellas*, Tesoro, Rosario archipelago. Photograph by CEINER—*Oceanarium* Islas del Rosario. October 2018. Used with permission.

At the laboratory, the researchers mixed their harvest. Around the fourth day, we observed "competent larvae" under the microscope. These "competent larvae" can swim, respond to environmental cues, metamorphose, and settle down. With time, I have learned that whenever these researchers are uncertain about something, they attribute it to environmental and chemical cues. A few scientists studied the preferences of larvae to settle among various algae. They think that the hairy arm-like cilium, which covers the coral larvae, is sensitive to changes of pressures

that produce reef sounds. In other words, larvae swim towards the sounds of the reefs (see interlude 1). As soon as the larvae settle in coralline algae, they start a process of metamorphosis into a coral polyp—called recruit (baby coral).

Throughout the following month after the spawning, larvae started to settle and metamorphose. The researchers think that the larvae survive because they have protein reserves for the first few weeks. The first recruit appeared to the scientists' eyes on the day 17 after the spawning. "It is mother's love," Elvira said. At this stage, it is vital that recruits absorb *zooxanthellae* (symbiotic microalgae) for survival. The researchers changed the tube filters that provide seawater supply to enable the entrance of microalgae. By day 53, less than 5% of the recruits survived. These babies hold hope for genetically diverse coral nurseries. "These few could be the future," Valeria Pizarro said. Whether the recruits are surviving in Tesoro and other places in the archipelago is uncertain. I understand Valeria's statement as these few recruits can be the future of sexual reproduction in coral restoration labs.



A coral recruit (baby coral polyp), 17 days after the spawning, CEINER lab. Photograph by CEINER—*Oceanarium* Islas del Rosario. October 2018. Used with permission.

Spawning and coral survival depend on simultaneous convergences, including those that escape the rationale of the coral scientists. It is unknown and probably unknowable why corals spawn the same night that turtle eggs hatch. How and why do the same kind of corals annually and synchronically spawn under storms around the world? How and why do these spawning events relate to fish massive gatherings?

In the lab, the *Acropora* embryos never reached the point of "coral babies," and less than 5% of *Orbicella* recruits survived. Some people might think of these results as failures, but the researchers resist this interpretation. It is the farthest they have monitored coral embryogenesis and development. It does not imply that the results at the lab reflect the results of the spawning at large. These few could be the future—not necessarily of corals in general, but of coral research at the lab. With far less experience and resources, the survival results were very similar to those at the CARMABI research station in Curaçao. The scientists at the CEINER lab returned the surviving babies to the nursery underwater, and they died, overpopulated by algae, not long after. These researchers did not expect to prolong the lives of the baby corals under the physical and financial conditions at the lab. Something other than assisted reproduction happened for these scientists. The dreams of these coral restoration scientists exceed what they can do, as they rely on annual spawning in ways that they cannot fully control. The researchers witnessed and placed their hopes on an event that depends on more than the slow, arduous, and uncertain progress of their science and funding. The next section will touch on the migration of fish, particularly of the *mero guasa* (*Epinephelus itajara*). It illustrates how fish have not only moved away from fishers, but also from scientists and their attempts of assisted reproduction, similarly to corals.

The Last Fish Are Moving Away

Extinction studies point to the accumulative and slow death of the last ones of a kind as part of an evolutionary lineage and as individuals. The deaths of these last ones are irreversible and nostalgic. According to Thom Van Dooren (2014), the death of extinction is also the life of individuals in captive-breeding conservationist programs, the lives of those who refuse to breed into a world that they might not consider worth living. The last ones in the archipelago are inseparable from a reference to someone else. The reef that extended miles and miles to Periquitos was the last one Rafa chose to see. The embryos and baby corals are the last ones of a spawning season. The last ones even return to re-populate an area, as does the long spine black urchin. The last ones are also those who have not yet moved away from the scientists and fishers.

Mero guasa, *Epinephelus itajara,* CEINER laboratory. Photograph by Juan Camilo Zárate. January 2018. Used with permission.

The last *mero* fish from the archipelago live in underwater enclosures at the *Oceanarium*. The scientists consider *meros* (*Epinephelus itajara)* to be an endangered species. In the wild, on the other side of the metallic net, *meros* spend most of their adult life in the same coral reef. They grow slowly, reach their reproductive age (adult age) when they are five years old, and they live

and mate in the same places for as long as possible. Biologists call this behavior site fidelity. When reefs dissolve, *meros* lose the sites of their fidelity. Like sharks, *meros* are on the top of the trophic chain, and their presence in a reef indicates that a reef is lively—there is food.

The artisanal fishers think that the *meros* at the lab are the last ones, not because they are the only ones, but because the *meros* have moved away. They think *meros* have moved to deeper, more remote reefs. Elder fishers tell me that 20 years ago, *guasas* (*meros* of 2.5 meters and more than 400 kilos) lived in El Caño de la Guasa between Isleta and the Isla Naval. These fish were not long as they were wide. They lived in a cave. A fisher fished one *guasa*, and another one would come with the rain and *vientos* (southerly winds) in October and occupy the cave. *Meros* are sedentary. A fisher explains: where one sees one, one finds it. The fishers say that some *meros* were so huge that many men would be needed to pull it out of the seawater. When they were cut open, people say *meros* contained objects as large and varied as entire lobsters, nets, and fishers' shoes. *Meros* do not chew these objects, though; they suck and gulp. Some skeptics do not believe that *meros* have shoes inside them. They say that *meros* throw up what they dislike. Why would they like a shoe? Some islanders claim there was a time when a *mero* sucked the head of a fisher and threw it up. The fisher still lives in Barú, and he is called "vomited by *mero*."

Mero fish are considered gentle and curious. The artisanal fishers say that *meros* do not swim away when approached, *vienen pa' encima* (they swim closer). Perhaps, for this reason, they are easy prey. Fishers say that *meros* leave their caves to gulp food at night and they hide around dawn. The first nights of full moon, the fish are very active. Some of them even float to the surface. Those nights, it is easier to catch them with nylon line. *Meros'* meat is white, with only a few spines. *Meros'* meat is cut as fillets. However, as the fish grows big, the meat turns *rucha* (hard). More than one fisher told me of a time when they brought a giant *mero* to the *Bazurto* fish market,

as if they had won the lottery, and they returned home with the *mero's* head and some money to cover their gas. One kilo of *mero* costs $14,000 Colombian pesos (a little more than $4 US dollars). Starting at 150 kilos, the fish becomes cheaper because the meat is *rucha*. Many times, the *mero* arrives alive to *Bazurto.* Fishers say the *mero* does not move to survive out of the water. Without even pouring seawater on them, *meros* can survive up to 10 hours out of water.

Without mangroves, the cave in El Caño de la Guasa eroded. Now, there are only a few giants in the archipelago. The fishers say the *meros* have moved away—rarely does a fisher see one around the Rosario Islands anymore. They have gone deeper into the sea, only reached by those who fish with scuba tanks. Some fishers say that fishers with scuba tanks do not let *meros* come up to the *seco* (the shallows), where they can gulp crab and fish. There are *meros,* but in other places. They have moved away. *Mero* fish might think, *no voy donde me puyaron* (I will not go where I was pricked). There are less *meros* in Barú than a few years ago, but the fishers can still find them. *Meros* like the muddy water, the estuaries, and the mangroves. Some fishers say that there are more *meros* near Barbacoas Bay and Boca Cerrada.

Moving away is quite different from dying. In the case of the *guasas* in El Caño named after the fish, if a fisher caught a *guasa*, another one would come with the rain and southerly winds. The situation changed when the cave eroded, since *guasas* no longer have a place to come to. The scarcity of *meros* in the archipelago is not only a matter of overfishing,[9] but also a matter of erosion and other disappearances, such as those of mangroves. The fish that moved away may not be dead. *Meros* may be closer to the mangroves in Barbacoas Bay and Boca Cerrada, and farther and deeper. Some fishers travel farther to places where the islands and the lights disappear from their sight,

[9] Some fishers also claim that conservation has been a response to overfishing, and it has also pressed overfishing by displacing the fishers to a few places where artisanal fishing is allowed and possible.

where there is only *agua y cielo* (water and sky), and other fishers use scuba tanks to reach deeper and deeper, up to 40 meters.

Not all fishers can do that. To go farther out into the sea, the artisanal fisher needs a motored boat, gasoline, and a GPS. To go deeper the fisher also needs scuba equipment and the means to compress air. Even if the fisher has all this equipment, these fishing practices are more dangerous. More than one fisher has disappeared on far out trips in the sea. A few scuba divers have not kept track of the time underwater and suffered decompression sickness. The longer the diver stays deep, the more saturated with nitrogen their tissues become, and the less time (air) they have available to compensate on their way back to the surface. A fisher once told me that when fish *pica* (catch the bait), the devil comes inside the fisher, and the fisher loses their sense of safety. Some fishers have followed fish deeper and have not come back to the surface.

Despite some *meros* not having died, fishers are concerned about fish moving away. Some of the fishers cannot catch as much fish as they used to, near the shore. Others travel farther and deeper to the limits of their safety. Others denounce that when the "Vikings" (illegal fishing boats) pass trawling the sea (800 meters deep), there is nothing left for them to catch. Every time, it is harder and harder to be an artisanal fisher. Many restaurants and hotels in the islands buy cheaper and frozen fish in the *Bazurto* fish market. The owner of a fishery in *Bazurto* told me that Japanese ships with tons of frozen fish arrive at Cartagena once or twice a year. Although many work as tourism service providers on the islands, there are still some people who depend primarily on fishing to feed their families, to drink a few beers during the weekend, and to pay for their children's education in the city. Fishing offers more than economic means. Many fishers say they like to be on their own, without anyone telling them what to do. Sometimes fishing is more profitable, less demanding, and more satisfying than waged labor.

Every time that a fisher goes fishing in the nature reserve, they also resist a form of extinction different from the quantifiable loss of biodiversity. They resist the disappearance of the worlds that are shaped and characterized by their lifeways, which are more than survival. These worlds are other than waged and subordinated labor. The survival of the fisher's sea rests on the fish' and corals' survival as well.

Artisanal fishers and fish are tied together. A fisher tunes his rhythms to the rhythms and likes of the fish to be able to catch them. Some fishers know the places and timings of fish's massive gatherings. From October to December, around the full moon, some fishers say that *meros* gather in cooler waters at *bajos* (fishing places) such as 3 y 4 and Tortugas. A scuba fisher says he has never seen *meros* spawning, but he imagines it is like what ballistae fish do. Far away, where canoes cannot reach, the ballistae fish dig and bury their eggs in the sand. The eggs seem like the ball of spider net. The fish stay beside their eggs, taking care of them. Both male and female fish care for their eggs. Perhaps a lucky fisher catches a fish in one of these sites and together, fish and artisanal fisher become another entry in the list of the last ones.

Fishing *mero guasa* in the 1970s. This picture is part of the personal archive of Rafael Vieira. Rafa is the one on his knees holding a smaller fish on the bottom right. Used with permission.

Around 1975, Rafa, the director of the *Oceanarium*, often spent 6 to 7 hours in the seawater daily. When Rafa returned to Colombia from his training as a taxidermist in England, he moved to the small island his father had bought in the archipelago. Back then, Rafa dreamed of a sea monster, a *mero guasa*. He has been obsessed with them ever since. Rafa was a fisher himself. Then, he envisioned the assisted reproduction of *meros*, a technology he wanted to transfer to his fisher friends in Boca Cerrada. No one in Colombia had reproduced *meros* before. Rafa sent Jaime, the scientific director at the CEINER lab, to learn about the reproduction of *Epinephelus sp* by marine aquaculture scientists in Thailand. The first *meros* came to the *Oceanarium* more than 30 years ago. Rafa caught some of them and other fishers brought the rest. Twice, the *mero* fish at reproductive age (5 years and older) got sick and died. The oldest *meros* died in 2017, from disease, and every time it is more and more difficult to find them.

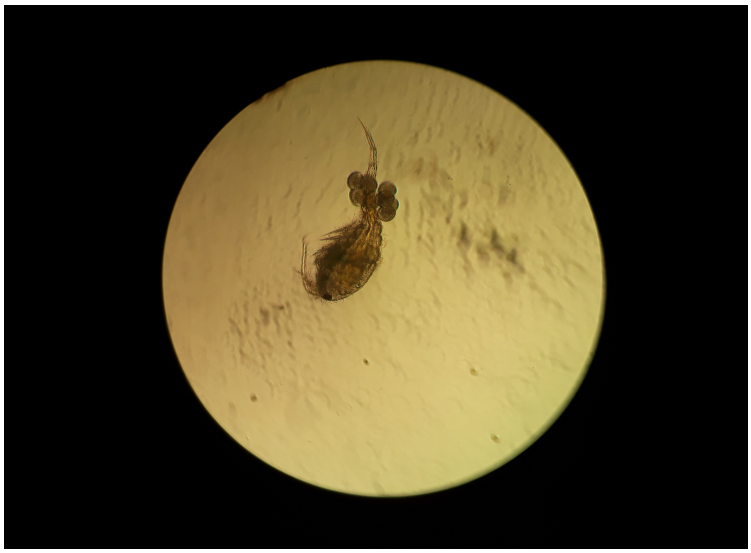
The lab started as aquaculture rather than a coral restoration center in the 1990s. All their work with corals is from the last decade. Now, it is not enough that *Epinephelus itajara* is a

vulnerable species listed in the International Union for Conservation of Nature Red List. The lab is now asking for funding from coral conservation organizations, claiming that the *mero* can eat lionfish *(Pterois volitans)*—an invasive species that came to the Caribbean from the Indo-Pacific Ocean, perhaps through a hurricane, ballast waters, or aquariums. The lionfish is considered a voracious predator of little fish. Without any natural predator in the Caribbean, it has expanded in extension and depth. Why would the *mero* not gulp up the lionfish, if it sucks up so many other things?

Meros were successfully bred at the lab in 2015 and in 2020. In 2015, most of the juveniles died because of changes in their diet.[10] The lab has not accomplished a moment of fish repopulation or technological transfer to fishers. With and without funding, the reproduction of *meros* continues because of Rafa's appreciation for these fish and Jaime's interest in aquaculture. The reproductive season extends from May to July;[11] however, the program requires attention throughout the year to maintain the stocks of microalgae needed to feed rotifers (zooplankton—small animals that move with the sea currents) that feed the fish larvae. The researchers think that the fish larvae require the stimulation of chasing live food. The larvae mouth grows throughout the first few days of its life, but at first, it is so small that it needs to eat the smallest rotifers, or it dies of starvation.

[10] Fish adapt slowly to changes in their diet. Once they learn to eat imported and expensive pellets, they hardly ever receive fish. When they are very young, these refusals imply that they are likely to die (see chapter 4).

[11] It is not entirely clear to me why this is the reproductive season. I wonder if it may be because the lab cannot deal at the same time with two reproductive seasons (fish and corals). Around April, I remember placing cameras for a couple of hours to watch the fish's behavior and to look for reproductive signals. It was hard to compare with anything because there was no record of different moments for the year and day. I remember some moments where a fish hit and bit another. Those were moments usually read as a clue of reproductive competition. We separated the fish that seemed to be fighting.



Rotifer, CEINER lab. Photograph by Juan Camilo Zárate. March 2018. Used with permission.

These scientists, as much as the fishers, also resist the disappearance of a world, as they love it—a world that is not without *meros*. Caring for these *meros* happens through their maintenance and daily labor at the lab. It also points to affective dispositions that are different for Rafa and Jaime. Rafa carries the memories of his youth chasing sea giants as well as a persistent sense of gratitude and retribution towards artisanal fishers in Boca Cerrada. Jaime is an aquaculture scientist at heart. In the case of the researchers at the lab, care is ordinary and most of the times temporary, until they change jobs or their internship ends.

Responsibility in captive-breeding conditions requires promptly addressing and maintaining the living conditions of microalgae, rotifers, and fish. Some of the researchers, even in temporary situations, "care from the guts," an expression of Wallys, who prefers to be called the dolphin's mother rather than the dolphin's main trainer. "Care from the guts" means that these people can imagine what is the best for *meros,* rotifers, and microalgae in concrete situations. Their ability relies on paying attention to detail. For example, it requires anticipating that it is not good

for *meros* to eat frozen fish. It means holding the *meros* underwater until they recover after they are tested for semen and eggs.[12]

Daily, the researchers maintain and reproduce the conditions of sea currents, where plankton, including microalgae and rotifers, live. In their effort to maintain *meros*, their obligations extend to microscopic planktonic beings. For instance, microalgae need lots of air and the light is always on for them to photosynthesize constantly. Both microalgae and rotifers require lower temperatures than those on the sea surface, between 17-20 Celsius. This means that they need to have the air conditioner permanently turned on. Depending on the volumes of rotifers, they also need air, but not to the point of bubbles, because they could die if they become trapped inside the bubbles. The sound in the airconditioned room is that of the bubbles, *blublublublublu*. The room smells like algae and rotifers. The color of the medium and its smell are key for these little planktonic beings. Rotifers under the microscope move in various directions and come close enough to touch one another, a matter of "chemical cues." The researchers count microalgae and rotifers too, but their color and smell indicate something is wrong first. The medium is seawater that comes to the lab through filters and pipes. They suck seawater from 30 meters deep—where water is supposedly cleaner.

As much as in the case of the spawning, the researchers prepare and maintain daily conditions for potential reproduction. The researchers do not control or know all that is involved in the conditions that make reproduction successful. Sometimes the microalgae and rotifers die or do not grow as fast as the researchers would like. Sometimes rotifers die despite the researchers

[12] Holding *meros* underwater was one of my favorite activities at the lab. For a few minutes, while the *meros* woke up from their *eugenol* temporary sleep, we (interns and volunteers) were able to hold the weight of one *mero* at a time and we felt their skin and breathing.

spending many hours slowly filtering to prevent them from being hit by the flowing water. Something else on the part of the rotifers and algae needs to occur for reproduction to be successful at the lab. Sometimes, *meros*, rotifers, and microalgae do breed. Perhaps, sometimes, *meros*, rotifers, and microalgae identify something worthy in their world to pass on.

Between May and July, the researchers catch the *meros* of the *Oceanarium* exhibition, who live under seawater separated from the wild by a metallic mesh. The researchers use *Eugenol*, an oily chemical compound that smells like cloves, to temporarily put the fish to sleep in surface tanks with seawater and aeration. This operation allows the researchers to test the fish, who might otherwise bite them. The researchers identify each fish with a number in a chip inserted under each fish's skin, close to the dorsal fin. They rub the fish around the urogenital opening to see if they expel a milky yellowish substance that scientists call semen. If the fish shows semen, the researchers identify it as a male, and record this in a table. If not, they insert a cannula to see if it has eggs. If it does, they identify the fish as female. If it does not present one or the other, the researchers classify it as undefined. The identified sex of the fish could potentially change from time to time based on "environmental cues."

At the end of the season in 2018, there was not a single male *mero* in the lab. The youngest adults had not produced semen when the researchers tested them. Desperately, to save the reproduction season, the researchers deemed to catch Squeezy[13]—the largest *mero* who lived in the coral nursery (see chapter 4). Not only could they not catch Squeezy, but Squeezy disappeared

[13] The biologists at the lab named Squeezy. S/he lived at the coral nursery. The first time I saw Squeezy was while cleaning the nursery structures. Squeezy was above me in a diagonal angle. S/he was the largest fish I had ever seen. I remember feeling a little scared. At that time, Juan Camilo, Robin (a lab technician), and I used to feed the fish inside the seawater. Perhaps Squeezy let us pet her/him because we came with food. Maybe we also smell a bit like fish. Sometimes, even when I did not have fish and approached the nursery to measure the physical-chemical patterns from the surface, Squeezy showed up. Somehow, Squeezy knew it was me. S/he related to us.

without anyone being able to explain how s/he crossed the metallic net that enclosed her/his nursery. Doña Edelmira says she saw a *mero* wandering around the net a couple of nights. I imagine that perhaps Squeezy ran away and could not find its way back. A month after, a few fishers told me that they saw a *mero* around the Rosario Island. *Meros* do not last long around there. I speculate that a fisher probably caught Squeezy and sold her/him in *Bazurto* per kilo. If not, maybe Squeezy lives where other *meros* moved away, where no fisher or researcher would ever catch them. Jaime thinks that fishers in Boca Cerrada and Santa Cruz del Islote might help him find *meros*. It has been many years since Rafa fished recreationally for giant *meros.* He knows his friends, professional fishers from Boca Cerrada*,* might know. Months pass without many *meros* in reproductive age at the lab.

If *meros* moved away, maybe their ability to bear new life is not necessarily compromised. Perhaps, some fish are also gathering massively, out of reach for artisanal fishers and scientists. This understanding expands the scenario of double deaths described by Rose (2011). There is more than a double death going on in this sea. Fish moving away partially overlaps with extinction. In the case of extinction and in the case of fish moving away, fish are out of reach of researchers and artisanal fishers. Elusive fish exceed the knowledge of scientists. Perhaps, elusive fish maybe a perceived extinction and an onto-epistemic limit for scientists. Based on the methods at the CEINER lab (and perhaps in many more labs), there is no way for scientists to imagine that fish might be migrating too. Artisanal fishers, however, have followed the fish to more remote places. But how remotely could artisanal fishers go to go after the fish?

Reframing Destruction Beyond Changing Climates

What if corals have also moved away, farther and deeper, alongside fish? I remember the first time I interviewed the director of the Deep Corals National Reserve in 2016. I asked him about the

effects of warming and acidifying seawater 100 meters below the surface. He suggested that those changes may be less dramatic at that depth, although no one knew for certain. Most of the research in depth focuses on biological communities—a topic that is relatively easier to collect data about. Divers with special training can dive up to 100 meters, where humans cannot remain for long periods of time because of the pressure and cold weather. At 200 meters and deeper (the twilight zone), there is neither light nor symbiotic algae. Deep corals need to catch their own food. Researchers can only imagine what is underneath by examining the catch of pelagic nets[14] and through very expensive images taken by remote operation vehicles (ROVs.) In 2016, my impression was that the director of the reserve was personally more concerned about dredging, industrial fishing (80 meters deep and more), and offshore explorations and exploitations (800-1200 meters deep).

Great barracudas, snappers, pelagic stingrays, bull sharks, and green sea turtles dive 90 meters under the surface and above the twilight zone. The bottle nose dolphin can dive up to 290 meters deep, and the leather back sea turtle can reach up to 900 meters deep.[15] In the tropics, the main target of industrial fishing is shrimp. According to Juan Manuel Díaz from *Mar Viva*, a non-governmental organization, the nets plough the ground as if they were tractors and 15-70% of the catch is wasted.

Offshore prospecting starts with seismic studies. The probability of the existence of hydrocarbons is calculated based on how sound expands miles below the seafloor. Sound travels farther in the water, affecting animals whose lives and migrations depend on their ability to sense

[14] In many cases, these possibilities of knowledge only come together with the financial and infrastructural support of the industrial fishing industry, hydrocarbon companies, and the Navy.
[15] Neal Arwal. *The Deep Sea*. Available at: https://neal.fun/deep-sea/?fbclid=IwAR3ihthAIbI9ukovUpznEUhThCeyGzmOJZxC1kVobM4mR3kSwOV3Q_vqMZc

sound. It is the case of coral larvae that might get lost in their attempts to swim towards coral reefs (see interlude 1). It is also the case of *meros* who seem to rely on certain sounds to feed, gather and spawn in specific sites (Mann, Coleman and Koening 2009), where the sea births seasonally.

Building upon Hannah Appel's (2012) ethnographic research on offshore work, workers in oil-drilling rigs introduce large iron tubes to stop deep holes from collapsing and burring valuable equipment. These workers constantly manage over pressurized formations and releases of gases to prevent explosions and fire hazards that come with hydrocarbon's properties (Appel 2012). In the case of a drilling failure, the hydrocarbons hardly reach the surface, making it impossible to gauge the dimensions of the damage. In 2010, the oil-drilling rig Deepwater Horizon operated by British Petroleum exploded and sank in the Gulf of Mexico. The pipe leaked oil and gas for over 87 days—the largest oil spill in marine oil exploitations. Only part of the oil reached the surface, part of it suspended in the mid-waters and sank deep, where the effects are not measurable.

In January 2020, widespread media circulated millions of images of burned and dead kangaroos and koalas in the bushfires in Australia. The smoke crossed continents via the wind and reached Chile and Argentina. Perhaps, the winds also carried the smell of the burned, of those charismatic (Lorimer 2015) enough to appear on covers and of those unnamed and perhaps unloved (Rose and Van Dooren 2011). Social studies of extinction have taught us that extinction is a slow and cumulative process. Few days were enough to end the lives of individuals and the evolutionary lineages that burned in the fires in Australia, California, and the Amazon, among many other places in 2019 and 2020.

If something goes wrong in the deep, there may be no one to photograph the bodies of the dead and the survivors. Who would be able to reach out? Who would be able to imagine Rose's

call for a response? Days might pass before some of the bodies in the process of decomposition reach the shores. For a minute, imagine that you are a fish. There is a lateral line in your body that detects waves of movement. Your capacity to detect those waves guides your sense of orientation in the water. It helps you to join schools of fish and to mislead predators. Now imagine, a strong seism hits you, perhaps destroying your internal organs. Let's imagine that if you survive, you end up quite disoriented. The oxygen drops in the water, and some of the hydrocarbons adhere to your tissue and gills. You might find it hard to breathe and you would most likely drown.[16]

Today, offshore exploitations are more expensive than other available practices, such as fracking. Nonetheless, it may be a matter of time until current oil reserves on land are exhausted. Whereas fracking continues to be banned in Colombia because of social pressure,[17] the deep sea is assumed to be a place without people. According to Appel (2012), despite offshore exploitations being more expensive, some companies are willing to pay as offshore continues to be far from communities and social and environmental contestations.

Appel's (2012) research looks at "offshore" as not given, not a geographic location, and not placeless. Instead, she looks at "the work required for the transnational oil industry to disentangle the production of profit from the place in which it happens to find itself—in this case, Equatorial Guinea—and to structure liability and responsibility in such a way that it can seem to remove itself from local, social, legal, political, and environmental entanglements" (Apple 2012: 692). In her analysis, offshore is a work-intensive effort to sustain "modularity," which includes

[16] I am thankful to Alejandro Triana, Ph.D. in fish toxicology at UC, Davis, for his willingness to imagine and brainstorm ideas with me.

[17] For instance, this is a news article that points to the mounting social pressure against fracking. "Por ahora no habrá fracking en Colombia," *Revista Portafolio.* September 10th, 2019. Available at: https://www.portafolio.co/economia/por-ahora-no-habra-fracking-en-colombia-533433. Last accessed in October 2019.

mobile technologies and personnel, and juridical spaces in which companies can operate in Equatorial Guinea "just like" elsewhere.

As of today, following a precautionary measure, fracking is suspended in Colombia. Nonetheless, economic analyses[18] warn about the effects of this decision on energy self-sufficiency and public funds. Economic analysts estimate that the country only has reserves of oil and gas to last the next four years. Without exploiting unconventional reserves, the state would have to pay billions of Colombian pesos to supply the refineries. The potential loss is also calculated in terms of qualified jobs and investments. The pressure for unconventional and offshore explorations and exploitations seems unavoidable.

By 2019, oil and gas are extracted in the offshore Tayrona block. In recent years, Ecopetrol, a state oil company with public and private investments, has promoted the exploration of other reserves in the Caribbean Sea including the Sinú, Guajira, and Colombia blocks—areas with potential for oil and gas exploitation. Likewise, Ecopetrol has found other blocks in collaboration with companies such as Anadarko, Chevron, Petrobras, and Shell. The publicly accessible information about these blocks remains obscure. One way in which Hannah Appel (2012) grounds these oil drilling rigs as a place is by following the embodiments of rigs, workers, and juridical frameworks. I wonder how the migration of fish and coral may offer another topology of place and intimacy with concrete people.

No one knows for sure how much the fish near the shore and shallow corals depend on what happens farther and deeper. No one knows if the fish and corals that moved away do not return because they do not want to or because they cannot. This uncertainty is not a matter of

[18] "Las cuentas del fracking," *Revista Dinero*. September 19th, 2019.

knowledge. Some of the juridical frameworks that regulate offshore operations assume that there are no human communities affected because these operations are farther and deeper. Nonetheless, if the lack of knowledge about currents and deep-sea ecologies is used to support this argument, the impossibility of knowledge could be also framed otherwise to state that these operations may directly affect deep fish and coral with concrete effects on people. The survival of these fish and coral is deeply tied to the maintenance of the seas that the scientists and artisanal fishers of this chapter work to sustain in affective and ordinary ways.

International law understands the territorial sea as beginning 12 nautical miles from the shore where coastal states are sovereign over the aerial space and consisting of the superjacent surface water, the water column, the seabed, the ocean floor, and the subsoil mining resources (1982 United Nations Convention on the Law of the Seas). In the exclusive economic zone (200 nautical miles from the shore), coastal states maintain rights to explore and exploit natural resources and other states have freedom of navigation and overflight. Within the 200 nautical miles, and as part of the use of resources, the national states define boundaries between development and conservation. Beyond that point, the *alta mar* (high sea, open ocean), is a juridical and geographic place framed as a common heritage of mankind, a place of freedom where no state can claim sovereign rights. In this juridical framework, the high sea is a threshold of accountability for industrial operations. According to Irus Braverman and Elizabeth Johnson (2020), the United Nations is currently negotiating a regulatory platform to expand marine protected areas beyond national jurisdictions.

In Colombia, the Community Councils of Black Communities of the Islands demand the state recognition of *maritorios* beyond the shoreline. The *maritorios* extend the idea of collective territory beyond the surface and the recognition of rights to guarantee the permanence and lifeways

of ethnic communities. Anthropologists such as Ana Isabel Márquez and Andrea Leiva have contributed to the conceptualization of *maritorios* by analyzing family, fishing, navigation, and tourism networks, even beyond national borders in the Greater Caribbean (Márquez Pérez and Crawford 2016; Marquez Pérez 2014; Leiva 2013). However, the position of the Colombian State towards the *maritorios* is ambiguous. In 2018, for the first time, the Colombian State consulted an alliance of nineteen councils on a management plan for the protected marine area of the Rosario and San Bernardo archipelagos. Nonetheless, it still does not recognize the equivalent of collective titles in the aquatic and underwater space.

In a speculative gesture, I propose that we imagine other forms of intimacy and closeness that link fishers, scientists, and the migration of fish. Speculative gestures allow us to imagine possibilities difficult to conceive with the available tools. In this way, I venture to ask, to what extent do the fish not return to the shores because they cannot? The shortage of conventional reserves and controversies over methods such as fracking on the continent put pressure on offshore exploration and exploitation. If we cannot generate alternative imaginations about how human intimacies are woven in the open and deep sea, this type of exploration and exploitation will reappear as an unavoidable extractive horizon in the Caribbean and many other places. My provocation is to think creatively about *elusive ecologies* despite the uncertainty about fish and coral migrations. Creative speculation here becomes a method to refute the demand for clarity in knowledge and the inevitability of offshore extractive horizons.

When the ecologies of artisanal fishers and coral restoration (and marine aquaculture) scientists are becoming elusive, dredging, industrial fishing, the construction of wire networks, and offshore oil explorations and exploitations urge profound changes to the deep. Perhaps the *elusive ecologies* I describe in this chapter are also elusive because there is an onto-epistemic limit

to the technoscientific and juridical understanding of the sea that cannot be solved with more of this kind of knowledge.

Perhaps, *remembering el mar pare* (sea births) might be crucial to call back some fish. Maybe, some corals would come to the shore alongside fish. I have noticed that widely spread information about corals points to things corals do for fish, but there is less information about things fish may do for corals too. Herbivore fish control algae overgrowth when they eat. With their movement and poop, they make food available for corals too.

I borrow from Vinciane Despret and Michel Meuret (2016) their conceptualization of *remembering*. In the South of France, in the 1960s, agricultural modernization based on rational fenced grazing led to the disappearance of previous transhumance practices. With the disappearance of these practices, wolves moved away. In the 1990s, young people from urban backgrounds decided to become shepherds. In the process, they had to learn how to connect with herding practices—in becoming shepherds, these youth had to remember. By remember, Despret and Meuret mean that the youth had to *compose with* sheep, dogs, and pastures *new ways of becoming* shepherds, *with each other*. The sheep had to learn how to live in an unfenced world. In the partial recuperation of more-than-human transhumance worlds, the wolves returned as materialized memories of unfenced practices. The youth reclaimed a world of relations that had disappeared by actively experimenting ways to bring herding practices to the present.

In the Rosario archipelago, in the 1980s, the simultaneous occurrence of bleaching, diseases, temporal disappearances, a proliferation of algae and sand, and various kinds of bombs led to a dramatic decrease on coral coverage and fish numbers in shallow areas. While scientists have conceptualized this in terms of a slow and accumulative process of extinction, artisanal fishers have moved after their fish, farther and deeper. By remembering, I imagine corals scientists,

artisanal fishers, ethnographers, corals, and fish becoming others with each other in the partial recuperation of the reefs and mangroves of fish fidelity.

If the *meros* in captivity die at the CEINER lab, scientists will pass on the protocols to reproduce *Epinephelus itajara*, a fish whose species identification is recognized in Thailand and Florida. The scientists will leave the registers of their breeding and their protocols to raise microalgae and rotifers. Rafa's friendship with other fishers, Jaime's passion for aquaculture, and the gut labor of many researchers, interns, and volunteers, may be erased from the scientific reports, journal papers, and accounts of endangered species. Some of the sensorial, relational, and material forms of the sea may wash away with the fish, just as the waves that *meros* create with their sounds. The ethics and effort to remain proximate to the fish and coral disappearing from the shores might also vanish in scientific accounts (see interlude 1).

By attending to stories of *elusive ecologies*, I reorient scientific concerns beyond stories that say that generic humans are killing the sea and themselves at a rapid and irreversible rate. Fish and coral moving away may orient the inquiry to something that exceeds the narrative of extinction. Far and deep enlarge a scope of extinction beyond the knowledge and the grief of death and call for speculative gestures to compose other stories of intimacy and connection. If anyone, the artisanal fishers may know the most where fish moved away. Artisanal fishers have innovated artisanal techniques. With GPSs, motorboats, and scuba tanks, artisanal fishers have followed the fish father and deeper. Marine researchers could learn about migrations by opening their own concepts to those engaged in artisanal fishing. Together, scientists and fishers could work better to call back coral reefs near the shores (see chapter 4).

Floating Bundles

Overall, this opening chapter is an invitation. It builds upon discussions in social studies of extinction and my wonder as a witness of coral spawning. Lured by the richness of these nights, I could not start the first chapter anywhere else. This chapter suggests accounts characterized by an additive approach. In other words, when I refer to elusive ecologies alongside extinction, I am saying: these are stories of extinction that also teach us about more than death. They also teach us about the ethics of coral scientists and artisanal fishers—their effort to remain proximate to corals and fish. These stories are also about changing climates and development-driven operations.

This chapter ends in the spirit of *remembering as a matter of a creative composition* of ethical and political obligations. We (coral scientists, fishers, ethnographers, and other sea lovers) should remember a birthing sea before it is gone and because we do not want it to be gone. *Elusive ecologies* and a curious approach to sea births might guide a re-composition of our concepts and investments to elicit intimacy in uncertainty.

INTERLUDE

What is sound *if* we immerse ourselves in coral reefs?[19]

Groupers booming, the hydrophone recording, Robin and I holding the camera and hydrophone while pushed by the bum, the ***b****buum* traversing Nelsy, and noisy mollusks clicking, trickling, sparkling, cracking, snapping. *Oceanarium*, San Martín de Pajarales Island. Robin de la Rosa took this photo for Nelsy's experiment. July 2018. Used with permission.

My first encounter with Nelsy happened in the Alcatraz boat on our way to the Rosario Islands. I was returning to the islands from a short stay in Cartagena and Nelsy was heading to the islands for two-weeks of field research at the CEINER lab. At that time, she was about to graduate as a Bachelor of Science in biology and had a couple of semesters left to finish her social anthropology

[19] This text started as an invitation of Bob Wren, my neighbor in Davis, who is a musician, to engage with Hildegard Westerkamp's Kits Beach Soundwalk (1989). Nelsy Daniela Niño has generously provided details, some phrases, and has read and commented on various versions of this text.

double major. When I inquired about her passion for marine research, she referred to an intimate memory. In her words:

> I have listened to sounds since I was in my mother's womb. While my mother caressed her belly, she asked me: 'Daniela, let me rest a little bit.' But I kept moving through her womb, floating around in that pool that was made just for me. She was tired, and I kept moving whenever I wanted without feeling what she needed. She was trying to work, but I would not allow her to concentrate. Music started to sound far away. She noticed that my movements were slowing down. She approached the stereo and talked to me: 'Do you like that? Is that what you were looking for?' She finished her words, and she noticed I was calm.

This memory resonated with my feelings while diving in seawater, a sense of immersion in a womb-like medium: aqueous, contained, with a different range of possible movements and orientations than the atmosphere. Under seawater, gravity is suspended within the first 25 meters. I feel weightless and can move with the slightest amount of effort. A subtle variation in the position of my head and hips, and I can easily flip. I need to exhale to move and remain down intentionally. Sometimes I use a weight belt to gain some more time underwater. After a point of neutral buoyancy, relative to each human body's composition and gear, human bodies rapidly freefall. My memory of ascending after the freefall point is like hiking up a mountain. Before I met Nelsy, I had not reflected on how much my feeling of immersion is one of whispers, calls, and sometimes overwhelming pulsations. What follows is a short experiment based on my encounter with Nelsy and others in the Rosario archipelago. In this text, I will lead you through various stories in which a *what if* and *as if* open possibilities in the exploration that ask, What is sound if we listen to coral reefs?

When we met, Nelsy and her professors Oscar Laverde and Alberto Acosta wanted to create a passive acoustic monitoring system, an assessment of the status and key functions of coral reefs that did not depend on the regular immersion of divers. Most of the contemporary coral reef monitoring systems rely on divers' immersion and their ability to identify and count certain species of fish, invertebrates, coral coverage, and diseases. These immersions occur as part of expeditions and citizen scientists' training in programs such as reef check (see chapter 2). The immersions are too expensive to be done on a regular basis. Other researchers worldwide have been experimenting with passive acoustic monitoring assessments for the last two decades at least. Nelsy and her research team thought that sound offers innovative opportunities for marine research in Colombia. They thought that rather than divers, a hydrophone might help marine scientists assess a reef's health. Underwater, sound propagates four times faster than in air with variations depending on the temperature, depth, salinity, and composition of the medium. Also, sound travels 100 times farther, different from light, which is filtered, scattered, and lost in the first 100 meters of the water column.[20]

In the Alcatraz boat, Nelsy carried a black bag as if she was holding a treasure. She explained it contained a hydrophone (C55—Cetacean research technology), which was very difficult to access because it is quite rare and expensive in Colombia. This omnidirectional hydrophone records a wide range of frequencies in all directions. The microphone is very sensitive to sounds, which these researchers classify as biophony (mammals, fish, crustaceans, and mollusks), geophony (air, waves, rain), and anthropophony (sounds generated by humans, for

[20] Imagine the ocean as a multi layered medium that varies in temperatures and salinity. With depth the seawater usually becomes saltier and cooler. Marine scientists imagine that sound bounces between layers traveling for longer distances. Around 800 meters depth a **So**und **F**ixing **a**nd **R**anging Channel (SOFAR) allows sound to travel for hundreds of miles around the globe. For more information, see: https://oceanservice.noaa.gov/facts/sofar.html

instance, using motorboats) (Niño et al. 2017). In this classification, humans are made into an exception, a different category from bios-, intricately entangled with machines like motorboats. Alberto had borrowed the hydrophone from a renowned researcher and conservation advocate in Colombia, María Claudia Díaz-Granados. She had used it in an expedition to record the sounds of humpback whales in Antarctica.[21] Maria Claudia's research coincides with what Nelsy identifies as the focus in bioacoustics research, i.e., communication signs of a single species, especially mammals. These sounds are the most widely documented and publicly accessible in sound libraries, including the one of the *Instituto de Investigación de Recursos Biológicos Alexander von Humboldt* (Alexander von Humboldt Research Institute of Biological Resources) in Colombia. Other sounds have been less documented, making it difficult to identify their specific emissions.

Nelsy and her research team use the word *paisaje sonoro* (soundscape) to describe their approach to a passive reef monitoring system. In their words, a soundscape is: *"la combinación de los sonidos producidos por fuentes vivas, abióticas o humanas"* (the combination of sounds produced by biotic, abiotic, and human sources) (Niño et al 2017: 67). Nelsy says this approach simultaneously attends to all the sound sources, adding complexity to the analysis. By her use of the word complexity, I understand that complexity derives from paying attention to "all" sound sources. Also, hydrophones record what Nelsy calls "symphonies." In music, a symphony consists of a particular composition for an orchestra. One of the main difficulties Nelsy finds in her work is to separate what she hears in the recording as "symphony" into species emissions. This step is critical for their research, as one of their underlying assumptions is that biodiversity (understood as numbers of species) is an index of reef's health. The conceptual operation of disaggregation of

[21] Curiously, this technology "emerges from the noise of the Cold War, which reveals the songs of the whale" (Helmreich 2017: 153).

a symphony into species surveys shapes sound in particular ways and poses the puzzle of identifying "species emissions" to these scientists. At this stage of their research, Nelsy and I met.

***

It is a quiet afternoon. I am in the San Martín de Pajarales Island. It is sunny, hot, and dry for July. In the archipelago, the sea is relatively flat. The sound of the waves, *om shhhhhh ommm shhhhh*, is a distant memory. Everyone has slowed down now that the tourists have left. I see Nelsy sitting in front of a glass aquarium full of grunt fish. She has her headphones on. They plug into a digital recorder with a pre-amplifier. The recorder plugs into the hydrophone. The glass aquarium offers a "semi-contained environment." For Nelsy, it means that she can create sonic images hearing and gazing. Also, she can estimate the resonance of the sound bouncing off the glass and installation with some information about the materials and dimensions of the aquarium.

Through her modes and technologies of attention, Nelsy notices. Some grunt fish touch mouth to mouth with their mouths wide open. Other grunt fish chew some sand. The tiny sounds that Nelsy hears are the meeting of seawater, glass, sand, the rocky coralline installation, the grunt fish kissing, chewing, eating, floating, moving, crossing the water. The sea is loud around these tiny sounds: knocks, bites, swallows, songs, calls, clicks, bursts, whistles, moans, slaps. The frequency of fish sounds is 96,000 hertz. This means that fish produce sounds at a very high frequency that is inaudible for humans—humans can only hear frequencies ranging from 20 to 20,000 hertz.[22] Nelsy and her technologies convert higher frequencies into audio for humans. For

[22] Acousticians describe sonic as the range of sound wave frequency audible for humans. Infra- and ultra- have sonic as a reference. Infrasonic waves travel longer distances and ultrasonic waves enable some animals, such as dolphins, to locate and have a sense of orientation based on the reflection of sound (echolocation).

Nelsy, the high frequency of fish sounds also means that their recordings occupy more memory space in her computer than other sounds, for instance, the sounds of birds (1,000 to 8,000 hertz).

In bioacoustic terms, health is more like a rhythmic composition of presences and absences, of peaks and valleys, of ups and downs, of perceptible and non-perceptible polyphonies. Nelsy and her research team have little if no reference to the specific sounds of fish species, which makes listening for species an unfolding invention and discovery in their practice of acoustic associations. Some species might be subtle. But Nelsy tries to listen to those tiny sounds in detail. The rain, the wind, the waves, the motorboats, mostly the motorboats, interfere with her listening. These sounds occupy most of her acoustic attention. She cannot distinguish the tiny sounds amidst the sounds that intefere. But bio acousticians have created filters and equalizers: Nelsy uses Adobe Audition and Raven Pro to cut the noise. She can pretend it is not there, no rain, no wind, no waves, no motorboats. Then, she can attend to the tiny intimate voices of living bodies.

Fish vocalize through their movements. Bones and the swim bladder rubbing various muscles produce high-pitched sounds. Skulls, ribs, pectoral girdles, and vertebrae cracking, touching, hitting, breathing, swimming. With a subtle beat of the abdomen against the seafloor, the internal muscles against the swim bladder all pulsate[23] as a drum, like a heart. *Pum pum pum pum*. Nelsy still hears at the same glass aquarium, and the sounds are already changing. She hears a soft whistling. She waits longer, and the recording gets a little heavier. *Shhhhhh* ***shhh shhhhhhh***

[23] Reading Peters (2015), I have realized that this kind of pulsation is an expression of constant breathing, which not all marine animals share. Cetaceans and free divers hold their breath underwater and need to resurface to breathe, which also creates non uniform pulses.

shhhhhshhh. Imagine the sound of oil burning in a frying pan, a bowl of toast cereal popping at the contact with milk.[24] Nelsy often hears resemblances of this sound in various locations.

For Nelsy, these are the sounds of small mollusks, clicking, trickling, sucking, rumbling, snapping. These sounds usually appear when recording high frequencies. She cannot erase these sounds as she does with the rain, the winds, the waves, the motorboats. She cannot pretend the sounds are not there. Eliminating these noises is getting rid of the vocalizations of fish too. She cannot hear the fish, but she hears the fish with the voices of these mollusks, clicking, trickling, sucking, rumbling, snapping. In another location, without the hydrophone, Nelsy and I float on the tranquil sea surface. We can hear the somewhat overwhelming sound of mollusks, while we look at the stars. ***Shhhhhh shhhhh shhhhhhh shhhhhshhh***. Nelsy and I, like the fish and with the fish, can only be immersed within the noisy and ever-present mollusks. Recall, the sound of oil burning in a pan, a bowl of toast cereal popping at the contact with milk.

In another location, Robin, the technician at the CEINER lab, and I dive into a tank with ballistae fish. Robin holds the camera and I hold the hydrophone. Robin has lived all his life in the archipelago, is very stable underwater, and can hold his breath for longer than I can. I move more. Nelsy is sitting on the wooden platform above. For her, it is more difficult to hear without seeing. She hears nothing. By which she means, she cannot hear any vocalization that can be attributed to a fish. She hears the movement of the metallic net, likely my fins, bubbles, and resurface to breathe.

In another location, Robin and I immerse ourselves among groupers. Some groupers curiously approach first. After, the groupers move back, close to the metallic nets and under the platform. When Robin and I intrude under the platform, we hear and see the only audible sound

[24] I thank Nelsy Niño for the description of the sound of mollusks as being like a bowl of toast cereal popping at the contact with milk.

for us, *buuuum*. The sound underwater feels like an explosion, a wave that abruptly expands and hits us on its way. With her headphones, Nelsy also hears ***b****buuum*. She describes the sound as a booming that enters through her ears, but it traverses her whole body. She hears the only distinguishable sound she can write a paper about. She has enough information about the fish to tell a story. *Buuuuum,* ***b****buuum*. The story is possible because of the recording; however, it needs more than the recording to become a story that scientists can recognize. To write her paper, Nelsy writes a story that transduces sounds into visual spectrograms. In the end, Nelsy and her team could not publish the paper they had intended. To publish this paper, they need a story that gives the impression of controlled conditions, reducing ambivalence, and pacifying uncertainty. They may have to stabilize the grouper's sound through recordings over the years and at different times within a day and various seasons.

Although this paper might not be published in a few years, Nelsy's research works for me as a provocation. *If* a range of frequencies indexes a reef's health, at what frequency does a coral reef start and end for bio acousticians and their audio transducing technologies? In other words, while the reef sounds, reefs are also made to be through sound technologies and conceptual frameworks, such as biodiversity conservation. *What if* listening to symphony can add another mode of complexity that does not require sound disaggregation into species emissions?

My neighbor, Bob Wren, a musician, imagines himself listening to Nelsy's recordings. Maybe a coral bed is a "sympathy in feeling for a base tone." For him, sympathy carries the idea of the sound that cannot be disaggregated into specific emissions. Reefs may be more like a distinct "signature blend." How long in terms of evolutionary time might a coral reef take to create a voice? Would the pitch of these reefs be higher over a thousand years? Perhaps—he imagines an increasingly inaudible time-place. Inaudible does not mean the absence of sound but a limit to

human hearing capacities. *If* silence and deafness are conceived inside an audible range of frequency for humans, the oceans might become more silent for humans, as human ears (as of today) might not be able to hear.

In a dream, turtle women remove their shells and hang them in *Acropora* trees. We sing and comb seaweed and seagrass with our tiny nails. A big fish gets closer, swinging its back tail from side to side. Clicking, chewing, trickling, sparkling, bubbling, biting, singing, calling, slapping, jumping, bouncing off within the sound. *Shhhhhh* ***shhhhh shhhhhhh*** *shhhhhshhh*. Tim Ingold (2011) proposes another figure different from the soundscape to think through sound. For him, the sound is an *experience,* an immersion, "the world in which we find ourselves" (Ingold 2011: 137). Sound is not a *what,* but an *in.* Sound wave frequencies and a diversity of embodied sensors, of which ears are only a kind, may elicit multiple sensorial immersions.

During the spawning season, some researchers at the lab mention that coral larvae swim towards the sound of the coral reef (see chapter 1). When I asked more questions, one of the scientists, Valeria Pizarro, emphasized that it does not mean that coral larvae hear, but that they may sense sound. Coral researchers have recently proposed that the oceans' currents alone cannot explain these larvae's dispersal and settlement. So, coral researchers speculate: *what if* for a short period in corals' life span (from hours to weeks), coral larvae (<1 mm) move with the currents (as plankton) and "free-swim" towards the coral reefs?

Vermeij et al. (2010) suggest that the larvae of coral with cilia (imagine sensory hairy arms) all around their bodies may be able to sense "underwater sound fields." For these researchers, sound propagates as "particle motion" (vibration) and "acoustic pressure." The extent of the fields depends on the frequency, source of power, and the receiver. Some of the experiments designed to test this hypothesis observe the movement of coral larvae exposed to underwater speakers

playing calls and grunts of fish and "the continuous crackling sound of snapping shrimps." The researchers observed that independently from the chamber's orientation containing the larvae, coral larvae consistently moved towards the speakers (Vermeij et al. 2010: 1). The paper concludes by saying that the extent to which the movement and settlement of coral larvae respond to sound is uncertain. However, scientists keep designing experiments that make the hypothesis more and more feasible. Like Nelsy and her research team, these scientists are confronted with things they cannot explain with the concepts, tools, and materials currently available. They need to create openings that take the form of *what-ifs* or speculations. As in the case of Nelsy, speculations may need more time and continuous experimentation to become authorized knowledge. These openings are also non-innocent openings. *If* larvae swim toward the sound of coral reefs, maybe noise pollution affects coral larvae's settlement.

A more recent study tested variations in coral larvae's response to "differences in sound levels and reef characteristics." Lillis et al. (2016) designed differences in sound that account for different sites described as distinctive in coral reef condition and fish abundance, and "acoustic characteristics" (such as sound pressure levels and frequency content). In this experiment, the researchers attached the chambers to the seafloor and exposed the larvae to "ambient soundscapes" (instead of speakers) for one to two days. Their research suggests that larvae are more likely to settle in the loudest reefs. This description of the sound is distinctive. It does not identify specific emissions but the loudness of a sound.

Luis, the marine biologist who recommended the papers above to me, says that the studies are not *contundentes* (conclusive). He thinks that researchers cannot be entirely sure about their statements. There are other factors that they cannot control, such as light, hydrostatic pressure, and chemical cues. Even when the researchers cannot be sure, saying what they say matters to them

for acoustic cues to become a thing to consider amidst uncertainty. For instance, Lillis et al. (2016) imply: "*If* degraded reefs lack the appropriate acoustic cues to induce settlement, or produce acoustic cues that deter settlement, reef restoration and recovery could be inhibited, and habitat degradation perpetuated" (Lillis et al. 2016: 16). It is interesting how these various studies (including Nelsy's) are not merely shaped by sound but also shape sound in the ways that they can tentatively suggest a healthy reef, noise pollution, and recovery likelihood.

As imagined by their researchers, sound for coral larvae is more like a touching vibration tasted through hairy and moving cilia. Also, in these studies, sound is the sensation of pressure changes as experienced by specialized receptors (such as ears in humans). Underwater, pressure increases with depth. When I learned to dive with recreational divers and scientists, I learned that I must equalize my air cavities on my way down. I frequently move my head from side to side, pinch my nose with my fingers, and blow air to my ears. If my ears hurt, I learned that I could not keep going down as my eardrums could break. The ears work as a warning while going down. When I blow air to my ears, I also equalize my nose and the mask to adjust to the surrounding pressure increase and the proportional decrease in gas volume.

Some of the fishers *a pulmón* (free divers) in the islands are deaf in one ear. Once I asked one of these divers, El Caña, how losing hearing affected his diving. He said: *hundo más* (I can sink deeper). Deeper, colors banish with light. Red disappears within the first 5 meters, orange within the first 10 meters, yellow within the first 20 meters, and green within 30 meters. Deeper, it is a sea of blue tonalities and shapes. In the *Island of the Color Blind*, Oliver Sacks tells a story of a traveler who finds an island of colorblind people with no concept of sight (Sacks 1997). Shapes count as clues that suggest the presence of lobster and crab. Divers, like coral larvae, may experience the underwater as a field of water-waves and movement vibrations. I still think that not

hearing means no warning on how deeply I can go down and safely return to the surface. Perhaps, El Caña attends to more subtle signals, such as the slowing rate of his heart or his blood flow velocity, the blood shift from his extremities to his core as he descends on a single breath. With every second holding our breath, the human metabolism slows down. Being awake consumes lots of oxygen. Slowly the body prepares to fall asleep and maybe blackout. To stay longer underwater, free divers befriend those sensations, relax with certain contractions, and have their specific cues for resurfacing. El Caña may attend to more cues that I did not learn, making different skilled human bodies and sonic receptors.

By thinking of changes in pressure, I also wonder about fish. *What if* their internal organs also explode when pulled out of the water faster than their ability to compensate for changes in their surrounding pressure and the variation in the volume of gases in their bodies? *What if* that is what I see in the bulging eyes of some caught fish when they reach the surface? Juan Camilo, the field biologist at the CEINER lab, explained that a lateral line crosses the fish bodies. According to him, the fish's ability to detect various pressure waves in multiple directions is distributed across their body. Maybe that is also similar yet not the same for coral larvae, El Caña, and I.

Sound is made to be through concepts that vary in bioacoustics studies, there are different assemblages of frequencies, pressure variations, fields, and a variety of receptors (not only ears) and concepts. Sound propagates in seawater mediums that differ in salinity and temperature. It traverses and bounces off "layers" in the ocean, architectural compositions, and porous bodies in permanent movement and exchange in breathing. Bodies phonate, receive, and direct sound. Tim Ingold (2011) speaks of sound as immersion, and my exploration shows that sound sounds differently for multiple bodies with different training and concepts. Speculation here is something that marine scientists do actively when confronted with things that they cannot explain with the

available concepts, tools, and materials. Speculations allow these scientists to state ideas that might require time and persistent effort to be authorized as knowledge. By engaging with different bioacoustics studies, I speculate too and imagine other possible ways to conceive coral reefs, different from the (dis-) aggregation of species.

Like in chapter one, the human here seems too small immersed in coral reefs. *If* coral reefs vibrate increasingly in lower and higher frequencies, at least some humans may not be able to hear a thing. Are coral animals different for the immense variety of marine residents? Well, corals are and are not different for marine residents. In the next chapter, I will expand on the idea of *co-incidental compositions*. I will speak about material divergencies in coral that is also *piedra* (stone) in artisanal fishing and the *co-incidence* of their dissolution into the sand in the last three decades.

CHAPTER 2

Co-incidental Compositions in Marine Ecologies

At the Reef Futures 2018 Conference: A Global Coral Restoration and Interventions Science Symposium, coral scientists and restoration practitioners from around the world gathered in Florida to address the practices and material interventions that might help corals survive acidifying and warming seas. At the symposium, the various events covered topics such as management and implementation tools, structures for nurseries and outplanting, monitoring assessments, community engagement, coral recruitment, design, and funding (often tied to tourism). Some of the restoration proposals were controversial, such as in the case of assisted evolution and bio-/geo-engineering. Assisted evolution scientists expose corals to warmer and more acidic seawater in a lab and select the corals that survive those conditions for repopulation purposes. Bio-/geo-engineers suggest ideas such as a gigantic gun-like machine that fires millions of coral fragments into a 3-D structure in Australia.

Despite the differences among the proposals, the premise underlying the Symposium was the need for restoration to construct the reefs of tomorrow. The keynote speaker was Richard Vevers, the producer of the Netflix documentary *Chasing Corals*. One of his opening remarks was: "We (advertisers and scientists) created the bleaching event." Only then did I realize that what Verves calls "messaging" may have contributed to the stabilization of the story of dying coral and the unquestionable urgency of reef restoration. This messaging shapes coral ecologies, which actively amplify a feeling, consisting in the aesthetics, sensitivities, and orientations that have developed through the authorized knowledge of scientists.

The 2017 documentary covered the prolonged and devastating bleaching event in the Great Barrier Reef in 2015. To be physically present for the bleaching event, filmmakers and underwater camera technicians relied on the United States National Oceanic and Atmospheric Administration (NOAA) scientists. These scientists model variations in the temperature of the sea surface. The filmmakers also reached out to other coral scientists to expand on the significance of the event. Their message is: The sea surface is warming, and these images document the progressive effects on corals. In the film's messaging, coral is animal. Coral animality matters to explain bleaching, a disruption of the symbiotic relationship between coral polyps and the zooxanthellae that live in their tissues (see chapter 1).

In the diverse media coverage and documentaries, coral always appears as a dying animal and a reef independently of its location. For instance, *Saving Atlantis* by directors Joseph Smith and David Baker documents the worldwide death of corals in a broad range of locations, from Hawaii to Cartagena, Colombia. This documentary has interviews with various people (not only scientists) and moves quickly from one place to another without modifying the baseline story. In one interview, an indigenous woman from Hawaii says: "we cannot live without the ocean." As presented in the documentary, the ocean is common to various people in multiple locations. However, the scientific account of a single and shared ocean does not grasp how her ocean is the ocean of the documentary and perhaps something else.

I attended the screening of *Saving Atlantis* in Cartagena. The organizers were some of the leaders of *Salvemos Varadero* (Let's Save Varadero). Varadero is a reef located in the mouth of the Cartagena Bay, which is at risk of being destroyed by dredging operations that seek to permit the entrance of larger ships into the port. The reef is next to an island called Tierra Bomba. Under the current legislation, dredging Varadero is only allowed if people from the four Black

Community Councils of the island accept these works in a "prior consultation process." The prior consultation is a right that the Colombian state grants to "ethnic minorities" (indigenous, gypsy, and black afro-descendant peoples) in rural areas. The consultation occurs as part of an assessment of the environmental impact of development driven projects, such as the expansion of ports. Under law 70 of 1993, the Colombian state consults black afro-descendant communities organized as a *Consejo Comunitario de Comunidades Negras* (Community Council of Black Peoples).

In the Caribbean, only in the early 2000s, some islanders organized in Community Councils. In 2014, the Colombian state recognized their rights to collective land; however, one of the councils' claims is that their territories extend beyond the surface. *Maritorios* is the name that the councils give their marine living space beyond the shore. The councils have made a legible claim to the national state by using some of the *escrituras* (land titles) in the Historical Archive of Cartagena. These documents show evidence of the presence of black afro-descendent people in Barú since colonial times. Nonetheless, these same documents seem insufficient to proof *maritorios*.

The Colombian state partially recognizes *maritorios*. On the one hand, the state consults Community Councils of Islands over subaquatic dredging and conservation management plans. On the other hand, it does not grant collective rights over the aquatic and subaquatic sea. According to the national constitution (Art. 101), the beaches, the territorial sea (12 nautical miles from the baseline), and the exclusive economic area (200 nautical miles) are national property. In administrative terms, the word "sea" usually describes a horizontal distance from the shoreline where national states hold internationally recognized rights to pursue "maritime" (economic and military) activities. Beyond that point, different countries dispute *altamar* (the high seas, the ocean) through international agreements.

Coral reefs overlap with *maritorios* and the national sea. At the time of the screening in Cartagena, the consultation results were uncertain. During the discussion that followed the screening, some people highlighted the "planetary" condition of coral. In that context, I felt that they were saying that the national state should not only consult the councils from Tierra Bomba. Coral is planetary as coral is only coral independent of its location. Likewise, coral is planetary in a nationalist narrative that reclaims the right to be consulted about the port's expansion for all citizens. Coral reefs overlap with *maritorios* and with national state property. As state property, specific reefs are also divided between conservation and development, which in this case also means the edge of the dredging in the Varadero reef.

The "planetary" condition of coral and coral reefs is a question of the sea's current and possible composition. It is a question of the diversity of practices that can turn into a somehow stabilized story of salvation and development. Within the limits of nature reserves, the designs of the reefs of tomorrow do not have to negotiate the divergences and tensions within a sea that may be more than a sea of conservation biology and national property. Also, these designs miss the opportunity to create improbable alliances to protect corals from industrial developments in Cartagena. Industrial operations such as dredging could potentially destroy situated corals and reefs at a faster pace than sea warming and acidification.

In this chapter, I argue that the sea of the Rosario archipelago and the Cartagena Bay is composed in more ways than those described by marine conservation, restoration, and the national state, and that these compositions are divergent and co-incidental. This characteristic of *co-incidental compositions in marine ecologies* is crucial to the improbable alliances that support lively seas with coral reefs. I explore the sea through various techniques of artisanal fishing in the

archipelago. By doing this, I acknowledge how the councils find a profound tie to *maritorios* in artisanal fishing practices.

Maritorios may translate into coral reefs where artisanal fishers go fishing. However, a direct translation assumes that the composition and ecological relationships of *maritorios* and corals are the same, which assumes a difference in the names. Direct translation reveals an asymmetry in which corals seem to describe a single sea ecology better. *Maritorios* may translate into a geographical area. This translation may contribute to the incorporation of *maritorios* into the management plans of nature reserves. However, nature reserves' confinement and fixed boundaries do not accommodate for moving *maritorios* entangled in fish migration. Likewise, *maritorios* may translate to traditional knowledge. However, this framing maintains the hierarchy in which traditional knowledge is subject to scientific corroboration. Any cast of doubt around the coexistence of the biological sea and *maritorios* has concrete effects. Coral conservation and restoration promoters fearing and anticipating the destruction of corals promotes the substitution of artisanal fishing for tourist-oriented activities that can foster both coral and economic growth. My provocation is that *maritorios* may be the coral reefs where artisanal fishers go to fish, and the artisanal fishing in which other divergent and co-incidental compositions and ecologies emerge.

Tim Ingold's (2002) conceptualization of enskilment helps me think of different sea compositions and ecologies. He defines enskilment as: "a perceptual system of the hunter attuned to *picking up information* [emphasis added], critical to the practical conduct of his hunting, to which the unskilled observer simply fails to attend" (Ingold 2000: 55). I take from Ingold his emphasis on a perceptual system that attunes and trains bodies in movement, bodily orientation, and rhythm. I understand enskilment as a process of developing a skilled perception of sea compositions and ecologies. Those ecologies are many times questions that practitioners deem

relevant in terms of tools, a pace, repetitions, sometimes mutual dependencies, and stories, such as those that open this chapter. My field also makes me think that enskilment might be a matter of picking up information imperceptible for unskilled observers and a growing feeling of intimacy and affection that develops through recurrent practice. In this sense, these ecologies are perceptual and affective ecologies.

Considering more than one sea composition and ecology disputes the monopoly of conservation biology on defining nature, poses a challenge to prediction, and opens other political horizons for *maritorios* in the name of black politics and in the realm of equally real, divergent, and coincidental sea compositions and ecologies. My conceptualization of sea ecologies does not only emphasize difference. It is also interested in exploring *co-incidence*. For instance, these compositions and ecologies co-incide in synchronicity and elusiveness (see chapter 1), as well as tools, such as GPSs, lights, buoys, compressed air, gasoline, and corals that are simultaneously animals and rocks. They coincide in stories of destruction with regulatory implications for artisanal fishing. They also coincide in their dissolution into the sand in the last three decades because of climate change, dredging, and other industrial operations. Likewise, *co-incidence* is my exploration of other potential grounds for partial and strategic collaborations and alliances among scientists and other islanders beyond the constraints of nature reserves. In a way, *co-incidence* is my way to compose stories of sea lifeways that hold things open together.

This text is organized into three main parts. The first part, co-incidental marine ecologies, speaks about divergent ecologies and compositions through trainings in marine conservation and artisanal fishing. The second part, Co-incidental Dissolution into the Sand, elaborates on the process of divergent materials becoming sand. Finally, the last part offers some possibilities for reef conservation and restoration.

Co-incidental Marine Ecologies

Coral Reefs

In the first part of this section, I explore what kind of enskilled ecology a coral reef is and what some of its components are as they unfold in the work of the reef restoration nursery at the CEINER lab and in the Reef Check training. Reef Check is a reef monitoring method oriented to citizen scientists whose observations may alert scientists about the health of a particular reef. During my fieldwork, I volunteered for more than a year at the CEINER lab nursery and was trained in the Reef Check method in Santa Marta and San Andres (other islands in the Caribbean Sea of Colombia). The nursery and the Reef Check require practical applications built on enskilment developed through experience. Coral reef emerges in a perception that is inseparable from the training on the surface and underwater. Identification guides, transects, scuba diving equipment, and acrylic tables examine corals—as a growth rate, as a substrate, and as a measure of health, which does not stand alone but is examined in relation to fish, invertebrates, and other sea substrates.

All the work in the nursery and during the Reef Check is done with scuba equipment. The time to work in the nursery and on the Reef Check is relative to the scuba diver's consumption of compressed air. We, as scuba divers, pace our work to have enough air to return to the surface safely. The information gathered is also conditioned by time, which is air underwater. The nursery and Reef Check happen within 10 meters deep and in a contained place, enclosed or delimited by a metric line (a transect). In this contained frame, trainees examine through tools, including the metric line, as well as concepts, such as health and fragility.

Corals' health is perceived through corals' tissue. A coral colony can be bleached (white) but maintain the structure of its polyps. For the coral researchers, this means that the fragment is not necessarily dead. A colony could present white, black, and/or purple spots and bands, which the researchers call disease. It can show bites of fire worms and snails. It can look burned. Only when the polyp structure dissolves and the algae overgrow do the coral experts describe the coral as dead.

The fragility of coral relies on the thought-feeling that corals can easily die and be stressed. Corals can die by touch. They can also be stressed by subtle changes in temperature and competition for light and space with sponges and algae. Corals can also be asphyxiated by sediment. These ideas shape the body positions of the scuba diver and compel them to maintain a relative distance to these untouchable corals.

Coral restoration and Reef Checks ask different questions. Whereas growth is a persistent question in the nursery, coverage is crucial during the Reef Check. The exercise of identification (composition) and ecology (association) translates into reports of the growth of fragments (in the case of the nursery) and reef health (in the case of the Reef Check). In the lab, these reports travel to meet current and potential sponsors; in the case of Reef Check, these reports feed a worldwide database. The Reef Check data informed the United Nations' warning on the effects of global climate change in the early 1990s, turning corals into a barometer of planetary health. My argument here is that corals and coral reefs do not precede the trainings, attunements, tools, questions, and stories that make corals appear as such in the nursery and Reef Check. Also, corals/coral reefs train us to have an embodied perception of the sea, one in an untouchable proximity.

Interestingly, as part of these trainings, beside one slide that describes corals as animals, corals do not necessarily have to be animals. Corals grow as trees in forest-like nurseries and stand

as substrate in Reef Checks. Yet, coral is not a tree and not any substrate. The Reef Check divers look for the health of corals and not of any other substrate. Unlike rocks and sand, coral can be sick and die. In the nursery, the liveliness of the coral relies on the perception of a growth rate, the tissue texture, and the mucous response to stress. The researchers' realization of these coral capacities requires monthly and systematic monitoring, and regular observation beyond what appears in the official reports.

The question of growth

Educational tree at the CEINER lab. It illustrates the growth of *Acropora cervicornis* fragments from zero to four months old (on top) to colonies of one year and four months old (on the bottom). September 2018.

Coral nurseries are more closely informed by forest nurseries than they are by the assisted reproduction of other endangered animals, such as mammals and birds. Coral nurseries, like plant nurseries, do not seem to raise many concerns about the captivity of their individuals. Also, the enabling premise in coral nurseries is that corals can regrow like plants. In that sense, a coral

nursery is like a garden and coral restoration like gardening, which is a word used constantly at the CEINER lab (see chapter 4).

The nursery uses a PVC forest where coral fragments hang, distant from the seafloor, and move with the waves. The nursery receives daily supervision. Also, every month, three to four scuba divers remove what looks like a mess of undistinguishable things growing together in the PVC trees. Interns and volunteers clean the trees with a brush. With the aid of scientists at the lab, I learned to distinguish the mess as sponges, algae, and fire-coral growing on top of each other. The purpose of cleaning the trees is to control the weight and buoyancy of the tree and to reduce the competition between corals. Many particles are suspended in the seawater and move with the currents. The feeling is itchy and burning on the skin. Sometimes some of us have skin rashes for a few days.

Juan Camilo, the field biologist at the CEINER lab, does a systematic monitoring assessment of the trees every month. Tags with a letter and a number identify each PVC tree structure. Only coral fragments of the same reef origin hang in the same tree. Juan Camilo has marked various coral fragments from the top, middle, and bottom of each tree with fluorescent plastics. To work on the trees, the body position of the scuba diver must be vertical to avoid unnecessary movement that can break the fragile fragments. Divers need to have a precise control of the scuba equipment and their buoyancy. Juan Camilo measures the coral fragments' size and diameter by using a king foot instrument (like a ruler that allows measuring length and width). Juan Camilo measures the marked fragments following a particular order, by morphotype, tree, from top to bottom. He annotates his measurements in the same order in an acrylic table that he later transcribes into an excel database. He also takes photographs.

Coral fragments grow over months. The monthly repetition of the monitoring assessment and the systematic recording of the data make comparisons and a perception of growth possible. This particular attention emphasizes the changes in the same place throughout the seasons, month by month. Juan Camilo analyzes these changes while comparing with the CEINER lab's registers of the sea surface's daily physical conditions (temperature, salinity, and oxygen saturation). When the fragments reach a particular size and volume, researchers outplant about 90% of the coral fragments and cut the others into pieces to repopulate the trees. Interns learn to cut fragments with a hard knock against the surface. Anytime we move coral fragments outside the seawater, the fragments release a clear substance like saliva, which coral scientists identify as a mucous secretion signaling stress. The substance has a strong rotten smell that I always associate with corals.

The outplanting location is a mutual agreement between the CEINER lab and *Parques*. Some of the considerations for choosing a location are the relative proximity to the lab and the shore, the depth, the neighboring corals, and the space available to install the igloo structure. The igloo looks like a tunnel made with a metallic grid. At the intersections, coral gardeners tie coral colonies with a plastic band seal. The tunnel creates a 3-D structure, modeling a living reef. These structures may be too open for lobsters and fish to find refuge and hide from the light. However, they might be attractive to future eco-tourists.

Acropora cervicornis outplanting in an igloo metallic structure at the Luis Guerra Reef. Photograph by Lavinia Fiori. May 2018. Used with permission.

Based on the work at the nursery, coral growth is a function of sedimentation and competition. It is measured in length, width, volume, and months. It varies through seasonal changes described as temperature, salinity, and oxygen saturation. It emerges through the systematic register of monthly monitoring assessments. This knowledge of coral growth is based in a feeling developed through the repetition of assessments and a perceptual system trained in vertical orientations and the consumption of compressed air (which is also specific to each diver).

The realization of corals for researchers, interns, and volunteers at the CEINER lab is also deeply tied to the regular immersions that living on the islands makes possible. Swimming and freediving with Juan Camilo, I learned to slow down. We spent hours in the water and a couple of minutes in a single spot. These kinds of immersions usually happened in our free time. In those immersions, I approached and swung my hands close to *Montastraea cavernosa*. The tentacles of some polyps would follow and continue the movement while others would hide. In those moments I wondered, could corals do something beside stress and be something other than fragile? This

kind of experience does not translate into the reports or the account of growth, but it is part of my personal and intimate experience of coral, not necessarily as animal, but as animated. I learned with Juan Camilo that his appreciation for corals also grows over time in those regular encounters.

With Juan Camilo and interns at the lab, I felt lured by coral variations over time, in the spawning event (see chapter 1), and with different light. For instance, I find fascinating that *Diploria labyrinthiformis* (brain corals) can look very different under light depending on whether it is day or night. During the daytime, the surface of the coral looks like a firm labyrinth, from which it takes its name. At night, the polyps expand covering the labyrinth and looking more like an anemone. I also find quite intriguing how the polyps vary in texture. The polyps can get as firm as a rock, but are also sometimes jelly and very excitable. A feeling of intimacy and affection grows from close and regular contemplation, from noticing variations, subtle responses in swinging and hiding tentacles, and admiration for a polyp tied to millions of polyps making a lively reef. Likewise, there is something quite enticing in the different responses of polyps. For example, my hand-swinging in proximity makes an encounter by waves of movement rather than the reciprocation of gaze. While distinctively responding to waves partially created by my hands, I feel that polyps may also be into something else.

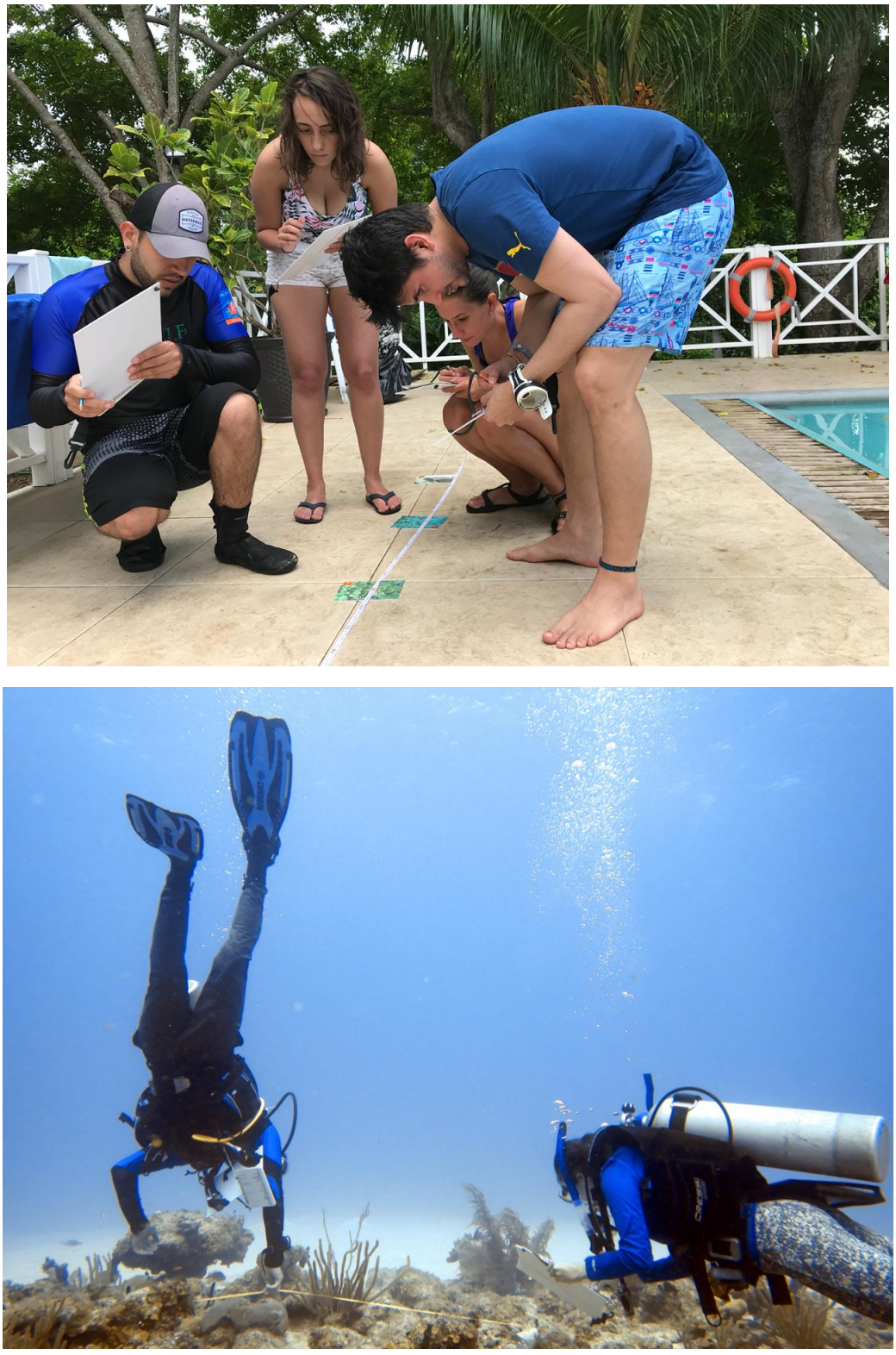
The question of Reef Health

In Reef Check, the volunteers repeat the exercise as part of annual expeditions to Santa Marta, San Andrés, and Providencia. The Reef Check trainees do not necessarily have a sense of how corals grow over the year, but learn a method that associates numbers with reef health. Health thus flags specific associations based on skilled observations of certain sea compositions and their quantities. Identification guides play a pedagogical role in the training. The ability to identify, see, and name relationships in biological terms is fundamental to describing the health of coral reefs. We, scuba

divers, immerse in water with acrylic tables and pencils to draw and write down observations in the terms we learn from identification guides and slides on the surface. Before the immersions, the scientific experts show slides that describe categories as much as relationships. Illustrations and photographs always accompany the descriptions. The slides emphasize the most characteristic forms of each type. The distinctions are sometimes challenging to grasp. Some instructors draw summary-diagrams that abstract only the main characteristics of a category to avoid confusion. For instance, to distinguish a parrotfish from wrasse fish, the instructors emphasize the fish's mouth that looks like a parrot's beak. I would draw the stary polyps of corals to mark a distinction from the sponges.

The names and shapes are carefully memorized and tested on the surface and in immersions. Underwater, the trainees should identify the category by pointing to both the form and the illustration in the identification guide. Sometimes, the divers could ask and respond with hand signals, such as a fist to describe a property of rock or the speed of a hand movement to distinguish between heavy sand that precipitates and soft sand that suspends in the seawater.

Reef health emerges as an observation based on specific tools, body positions, and movements. In Reef Check, scuba divers learn how to identify coral and other substrates alongside a metric line of 100 meters (a transect). We also register our observations in an acrylic table. To count substrates, the scuba diver gets closer to the bottom and follows the transect. Every 0,5 meters, the diver estimates the kind of substrate: hard coral, soft coral, recently dead coral, algae that indicate the presence of nutrients, sponge, rock, gravel, soft sand, thick sand, and others. The scuba diver looks at the water curtain, imagines five squared meters and estimates the percentage of coral coverage.



Transects on the surface and underwater. Reef Check San Andrés. Photos by Corales de Paz. October 2018. Used with permission.

In Reef Check, coral is a reef component, but the reef is also more than coral. The reef is also composed of fish, invertebrates, and other substrates. Instructors train students to follow a particular order in their observations. Scuba divers register the information in a fixed matrix in acrylic tables underwater and compare their data on the surface. To count fish, the scuba diver needs to be horizontal looking to the seawater curtain. The diver waits five minutes in the beginning and another 5 minutes every 20 meters to allow fish to feel more comfortable with them. The diver needs to be vertical upside down to count invertebrates. In Reef Check, the scuba diver looks close at coral without touching. Like in the nursey, coral is considered to be very fragile. The proximity to coral depends on the scuba diver's buoyancy skill and the bulky scuba equipment. The scuba diver looks close but not too closely, describing a zigzag with their movement over the transect. The transect gives the diver a sense of orientation.

In Reef Check, numbers of a few fish and invertebrates translate to reef health. The divers identify and count: Nassau grouper (>30 cm) (*Epinephelus striatus*), bass and groupers (>30 cm) (*Serranidae*), grunt fish (*Haemulidae*), angels (*Pomacanthidae*), snappers (*Lutjanidae*), parrots (*Scaridae*), butterfly (*Chaetodontidae*), morey (*Muraenidae*) and surgeon (*Acanthuridae*). Also, we count the following invertebrates: flamingo snail (*Cyphoma gibbosum*), long black spine sea urchin (*Diadema antillarum*), white urchin (*Lytechinus variegatus*), triton snail (*Charonia variegata*), cleaning shrimp (*Stenopus hispidus*), pencil urchin (*Eucidaris tibuloides*), lobster (*Panulirus spp*.), gorgonacea, shovel snail (*Lobatus gigas*), *Octopus spp*., fire worm (*Hermodice carunculata*), and coral crab (*Carpilius corallinus*). Reef Check researchers consider these species key for the ecology of the Caribbean reefs. At the same time, these counts create a particular account of reef ecology and health.

Reef Check connects numbers and the species' functions and effects. For instance, if groupers, the triton snail, and the shovel snail report low numbers, they are at risk of extinction. Large predators such as groupers and sharks indicate that there is food for them. If groupers and sharks are difficult to find in a coral reef, it may also speak to other missing fish in the trophic chain. The flamingo snail and the fire worm are predators of coral and the long spine black urchin, the triton snail, and the white urchin eat algae that compete for space and light with coral. Several algae indicate an abundance of nutrients. This approach to coral ecology is slightly different from biodiversity. While biodiversity (see interlude 1) lists all the different species, this approach chooses only some species considered to be key for the reef and corals. Health in terms of biodiversity is a proxy of many of different kinds, and for Reef Check, health is a function of many of key kinds.

The nursery's and Reef Check's enskilments are grounded in a knowledge that is also a feeling that shapes and is shaped by specific conceptual questions, which also frame material designs, like the form of the outplanting structures and their location. As I explained in the introduction of this chapter, coral biological ecologies are a formal and authorized knowledge that must be constantly achieved by the recognition of scientific communities (such as during the Reef Futures Symposium), the national state (the edge between conservation and development), and sponsors (multilateral organizations, tourists, and offshore extraction companies, among others). However, coral ecologies are also different from other kinds of ecologies that are denied the possibility to become authorized knowledge. Those knowledges that are enskilled ecologies of a different quality are constantly confronted with coral in the conservation area. In the Corals of Rosario and San Bernardo Nature Reserve, fishers who face conservation on the water think that corals are inseparable from conservation.

Bajos of fishing

At the beginning of my fieldwork, every time I asked fishers about corals, they responded with stories of how the delegates of the Corals of Rosario and San Bernardo Nature Reserve confiscated their fish and fishing equipment. They said that the reserve representatives had kicked them out of certain places, such as Rosario and Tesoro. They emphasized how large the reserve was: "we travel for 40 minutes to an hour and it is still part of the nature reserve." When I insisted on asking about how corals related to their fishing practice and how they have changed over time, they responded with a variation of the same statement: "I do not know about corals, but about fishing." *Bajos*, fishing places, only appeared when I did not ask about coral. In this way, I learned that conservation biology prevented me from considering other co-existing sea compositions. Unlike coral reefs, *bajos* do not factor into state consultation processes and the ambiguous recognition of *maritorios*. In the following part of this section, I would elaborate on the enskilled, perceptual, and affective ecologies of *bajos*.

Bajos are not only a location in space, but a place found through skill. Filiberto, a subaquatic eco-guide and former fisher, told me the story of an old man who found a *bajo*. He saw the *luganos* (pelicans) fishing, and he decided to fish next to them. The old man came back home with lots of fish. The following day, his son offered to go with him. On the boat, the old man seemed to be searching. After a while, his son asked him what to look for. The old man told his son that he was looking for the *luganos*. He could not find them. Then, the son asked his dad to go back home. The old man could not find the *bajo* without the *luganos*, and his son could not find the *bajo* without his dad, and he and his dad returned home without any fish.

Finding a *bajo* is not necessarily finding a georeferenced location but finding something that suggests the presence of fish. The old man did not see the fish, he saw the *luganos* fishing. A

bajo is not only a location, but the fish. It is a fish-location that is accessible for bird and human fishers. Enskilment in *bajos* implies learning to see traces of fish, such as birds fishing. Sometimes, finding *bajos* is finding *luganos* fishing, and many times, it is also fishing with them. *Luganos* can identify schools of fish from the sky and point out the direction to other birds and humans. They forcefully precipitate into the seawater leading with their beak. They plunge, creating a noisy splash. Human fishers, on their part, share their catch with the birds. *Luganos* eat some of the fish enclosed in nets and hooked with nylon lines.

One day, Tomasita, a fisher from Isleta, told me that a few researchers saved the sites of some of the *bajos* in a GPS. They had maps. These maps were essential for the researchers to advocate for spots where fishing should be allowed within the nature reserve. They came to Isleta and asked Libinston, another fisher, to go with them for half an hour. In the words of Tomasita: *Quizá querían ver* (perhaps, they wanted to see). I wondered what they could have seen if the GPS found georeferenced locations, but a *bajo* is a place of a different quality. According to Luis, Tomasita's son, the nature reserve fixes areas where artisanal fishing is restricted or forbidden. But fish are not always in the same location. Even if the nature reserve sets some places where fishing is allowed, it does not mean that fishers would always find fish in those locations. Fishers move with their fish. In fishing terms, the word fish indiscriminately describes the catch of fishing. Fish and fishers after fish move following the patterns of seasonal winds, rain, and the moon cycle.

More and more, the big fish that are also the commercial ones, such as *mero* (grouper), *pargo* (snapper), *jurel* (horse mackerel), and *picúa* (barracuda), move to more remote places (see chapter 1). Near the shore, fishers find *carajuelos* (squirrelfish), *isabelitas* (queen angel), *pargo risa* (parrot fish), *morenas* (moreys), *lijas* (leatherjacket fish), *vaquitas* (box fish), and *roncos*

(grunt). To find more commercial fish, fishers with nylon and motorboats follow the fish deep and far. In those places, fishers use a GPS and stronger lines to bear a fish's weight of 1 to 20 kilograms.

According to El Lati, a fisher from Isleta, he must be very courageous to go to those places where the islands disappear from his sight and there is only *agua y cielo* (water and sky). Sometimes fishers travel to places such as Bajo Bote, Bajo Oscuro, Las Palmas, or Casinva and they only catch one *jurel* (horse mackerel) and two *picúas* (barracudas). When that happens, fishers cannot recover the money they invest in gasoline. The following day, they have to *volver a tirar riesgo* (retake a risk). They go even farther to Frijolito. From Frijolito fishers cannot swim or paddle to any island if something happens to their motorboat or the winds turn bad. The bottom is more than two hundred meters deep. In those two hundred meters many things can get tangled in the line that connects the anchor and the motorboat. As the fish move to those places, *bajos* become less and less accessible to artisanal fishers.

Fishers describe *bajos* as shallow areas. What makes a *bajo* a shallow area is that the fisher can reach the bottom of the sea. This capacity depends on the fishing technique. Tomasita explains that there are shallow and deep *bajos*. The distance to the surface is calculated in *brazas*. *Braza* is a unit that refers to a free-diving stroke. In other words, a stroke is not merely a length. The unit also depends on the embodied skill of the fisher to dive while managing various tools, including dipsticks and hooks used to grab lobsters and crabs. *Braza* can also be the length of the nylon line equivalent to the distance between one hand and the other when the arms are wide open. In this case, *braza* is relative to the arms of the fisher.

Shallow *bajos* can be as shallow as two strokes deep. *Buzos a pulmón*[25] (free divers) can stand up in these places with their head out of the water. Deep *bajos* could be deeper than twenty *brazas*. The fishers who fish with nylon first throw a stone tied to a string to *sondear* (probe/sound) the bottom. Only if the stone reaches the bottom, the fisher throws the anchor. When the stone does not reach the bottom of the sea, the fisher calls the place *hondo* (deep). *Hondo* surrounds the *bajo*. Fish come to eat at the *hondo* around the *bajo*. The distinction and connection between *bajo* and *hondo* matter because the fishers can anchor their boats in *bajos*, but fish eat in the *hondo* that surrounds *bajo*. The edge *bajo-hondo* suggests that *bajo* is a category that does not stand alone. *Bajo* is an ecology with the *hondo* and with those for whom the edge *bajo-hondo* is a fishing enabling place.

El Caña, who fishes *a pulmón* (by freediving), only paddles to shallow *bajos* and orients himself based on terrestrial references. For instance, he finds a location by observing how an island (Rosario) looks beside another island (Yiyi), or the point where the Movistar (cellphone) antenna is above Isla Naval. He specializes in lobsters, crabs, and snails sold to tourists. Other fishers who also fish near the shore, like Cruz, use a technique called *correteo*. The word *correteo* comes from the word *correr*, which translates into English as to run. *Correteo* refers to the "run" of the fastest fish after what they perceive as a living prey. The fisher holds the bait on the metallic line in the back of a moving motorboat. Cruz sits beside his 30-horsepower motor. He uses some fish meat as a bait in the hook. With speed, the fastest fish, such as *jurel* (horse mackerel), *picúa* (barracuda), *pargo* (snapper), *cherna* (bass), *caritos*, and *guajús*, jump and catch the bait.

[25] *A pulmón* literally translates to lung. It emphasizes the skill to dive without scuba equipment.

Cruz and a *jurel* (horse mackerel). *Correteo* near the shore of Isla Grande. August 2018.

Brisa (northerly winds) bring water from the ocean and move the freshwater and sediment away. *Brisa* is the best for fishers *a pulmón* (free divers) like El Caña, because the water turns transparent and he can see from the surface and underwater. *Vientos* (southerly winds) bring the fresh water from the Magdalena River and some fish from the continent. The water turns *color panela* (sugar cane color). El Caña cannot see underwater when the water is charged with sediment and turns *color panela*, but fishers like Tomasita extend their perception by feeling the weights of the anchor, the nylon line, and the bites of various fish (see chapter 1). *Mar de leva* (when the winds blow from all directions) is not safe for anyone. However, some fishers from Bocachica *cogen los vientos en un pañuelo* (trap the winds in a handkerchief, a kind of wind catcher). In this way, these fishers can go out fishing. Fishers in the Rosario archipelago know someone has trapped

the winds because the cloudy sky suddenly turns clear. This observation is relevant because the winds blow stronger after release.

Some *bajos* are named after *Tortugas* (turtles) and *Cherna* (a fish of the same family as the grouper), which were abundant in those places a few decades ago. Other names point to the relative location of the *bajo*. For instance, *Bajo del Medio* (*bajo* of the middle) is in the middle of Barú and Isla Grande. Some *bajos* have the names of fishers such as Horacio (a fisher from Bocachica) and Libinston (a fisher from the Rosario archipelago). In a *bajo* called *Bajo del Hombre* (*bajo* of the man), some fishers see the shadow of a man fishing. Another *bajo* was named Coca because some drug dealers used to hide cocaine in this place in the 1980s. Cosito, a fisher who travels where there is only *agua y cielo* (water and sky), told me that *bajos* like *Tortugas* are so big that many fishers can fish in that place and still be apart. *Bajos* are not kept secret, and anyone with the skill and courage can fish in those places.

Artisanal fishers learn to fish by seeing how other fishers catch fish. Seeing is more than a visual capacity. Sometimes it happens among kids in the harbors. Sometimes it happens among humans, *luganos*, and fish that reveal what they like when caught. Sometimes it happens through the stories of elders. Some elders do not speak anymore, but when they spoke, they talked about fishing. Some elders did not have to leave the shore to grab fish. Once Ignacio, a fisher from Ararca, told me with a bitter tone that the youth thought that he was not a fisher because he did not fish anymore. Some of the techniques have changed. For instance, divers go deeper with scuba equipment and fishers with nylon go to places where the islands and lighthouses disappear. However, learning how to fish is also more than learning how to dive in, how to throw a nylon net, and how to use scuba equipment. Elders like Ignacio listen to the winds. The winds are crucial in

artisanal fishing and the winds can work for and against the fishers. For instance, the winds can push away the sediments and ease paddling, but they can also flip the canoe and the motorboat.

Fishers (humans, fish, and birds) compose fishing ecologies, which are permanently in movement with the fish, the winds, and the daytime and nighttime light. They are made of various techniques modeled after different fish and their food preferences, techniques that train bodies in specific ways. *Bajos* are made of anchors that anchor human fishers and boats at the edge of *bajo-hondo* and buoys that are canoes tied to the waists of divers. For these divers, time underwater depends on their ability to tolerate the urge to inhale, the "glu" sensation in their throats, and diaphragm and thoracic contractions when holding their breath. Rather than growth and health, a relevant question might be, would I be able to find a specific kind of fish under these winds and the light in this location?

Bajos are composed of *piedras* of different sizes. According to Suar, an artisanal fisher and subaquatic eco-guide, lobsters hide in big *piedras*. Places with big *piedras*, such as Mongotes and Casinva, are good places to fish lobsters almost at any time because the lobsters can hide from the sun and the moon light in the *piedras*. In other places, such as Rosario, where there are fewer *piedras*, the lobsters move deeper when it is bright on the surface.

Tomasita, a fisher from Isleta, told me about the *piedras* she learned with her father when she started fishing thirty years ago. *Lapa* were used as material to build many recreational houses and hotels in the Rosario archipelago and the city. *Lapa* were the most abundant in shallow areas in the 1980s. Nowadays, fishers rarely see *lapas* anymore. The word *piedra* translates as stone into English. However, these *piedras* are not inanimate stones. The names of *piedras* speak of the ordinary ways that many islanders have made a living with them in the islands, and not only through fishing. The names point to the properties of the materials, what people do (or used to do)

with them, and what they do to people. According to Libinston, beside *lapa, risco, laja, pisa papel*, and *hueso*, other *piedras* are almost the same. They do not have names. Another fisher, El Lati, speaks of coral plants and trees that are more abundant in certain places. In addition to coral *piedras*, plants and trees, this sea is composed of *ollas* and walls that describe underwater shapes, a sense of orientation, and the livelihood of various fish.

Fishing lessons with El Caña

Fishers in the islands repeat that to learn about fishing, you must fish. El Caña, was my neighbor in Isla Grande. He and Miguel (also called El Tubo) were the first fishers who welcomed me in their canoes. I never heard El Caña's birth name. He is nicknamed after the cane, a tool in fishing, like Miguel, who is nicknamed after the tube. El Caña likes to call himself El Tigre (the tiger) to highlight his fierce character underwater. When I first met Miguel and El Caña, they used to fish together. Miguel was the partner of Damasita, El Caña's mother. They all lived together. Miguel specialized in snails and El Caña in lobsters and crabs. They stopped fishing together when Miguel started to become blind and decided to work at Lavinia's eco-hotel instead (see chapter 3). El Caña felt proud of having taught some of the best divers on the islands, such as Corozo and El Bompi. He has also taught some kids like Beckam and Jeffer. During my prolonged fieldwork, El Caña was in the process of teaching Eric, his five-year-old grandson, to fish for lobsters and crabs.

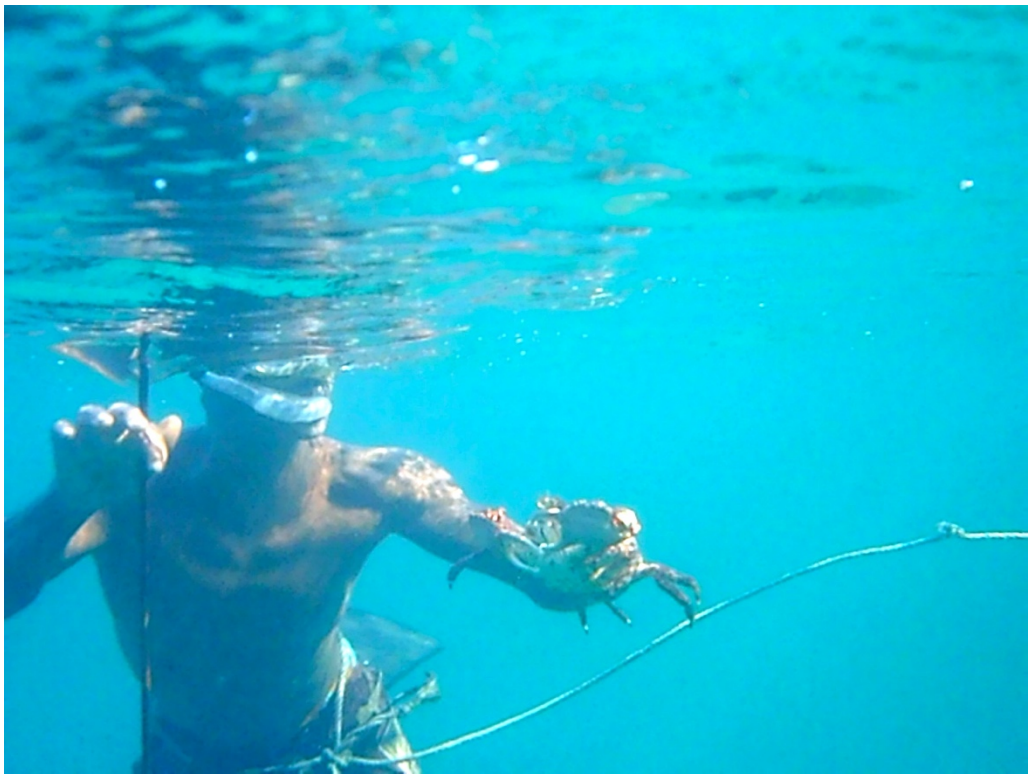
El Caña and I would meet at his house at 6 am. At that time, the sun was still in the horizon, the temperature was cooler than the rest of the day, and the seawater was more transparent. El Caña welcomed me with a cup of hot coffee. Depending on the winds, he decided if we could go fishing and where to go. From December to April, *brisa* (northerly winds) brought the jellyfish and the cool water from the deep ocean. The seawater looked like a color gradient of blues and greens from the surface. During the rest of the year, *viento* (the southerly winds) brought the rain,

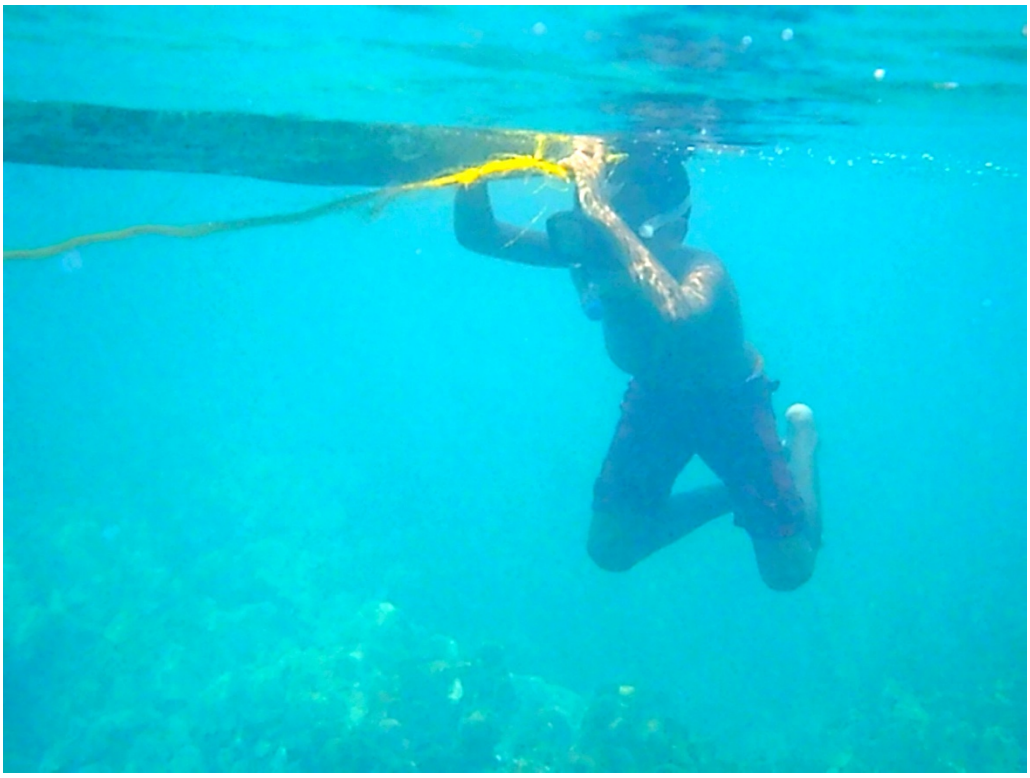
the warmer freshwater, and sediment from the continent. El Caña and I found the canoe, the paddles, the dipsticks, and the hooks hidden under rocks and in trees. Many times, Eric joined us. We paddled together and El Caña would decide where to stop. He and I prepared the flips, snorkels, and masks. He sharpened the dipsticks and tied the canoe using a 15-20 meter long string around his waist. I inhaled deep and immersed myself right after him. I followed him. If I waited longer, he would be returning to the surface on my way down. When I reached the surface, he would be somewhere else. He and the canoe were my buoys, and I did not want to be left behind while motorboats were crossing back and forth.

El Caña asked me to look for the lobsters' antennas coming out from *piedras*. He asked me to come closer and look inside. I imagined myself spying inside houses. To look inside and remain still, we would grab some part of the *piedra* with our fingers. El Caña knew his *piedras*, the ones where he would likely find lobsters inside. He could recognize them among many similar ones. His *piedras* are his because he has the skill to find them. This does not mean that he owns his *piedras*—the same *piedras* are also *piedras* of other fishers who could find them. El Caña's relationship with *his piedras* is one of skill, he can find them and he knows he will likely find lobster and crab in those places under certain conditions.

El Caña gazing inside his *piedras*. Rosario archipelago. August 2018.

The pace before El Caña grabbed the first crab or lobster was rushed and fast. Once he caught a crab or a lobster to sell and *la liga* (some meat for himself and his family), he calmed down. Eric remained in the boat paddling, pouring water outside of the canoe, and keeping an eye on the lobsters and crabs. The lobsters and crabs could otherwise find their way back into the seawater. Only when El Caña agreed, Eric would come into the seawater and test his swimming skills.





El Caña, Eric, and I fishing together. August 2018.

El Caña, Eric and I immersed ourselves in a perceptual system, in an enskilled ecology composed by *piedras*, canoes, lobsters, currents, winds, and specific questions. This skill demands that we wake up with the dawn and ask the winds if it is possible to fish and where to go. The tools take the form of the bodies of the *piedras*, *ollas*, lobsters, crabs, and other fish. It is important that the dipsticks are sharp, the string is a specific length to be able to reach specific *piedras*, and the lobsters and crabs cannot escape from the canoe. The materiality of these *piedras* is inseparable from the practice of closely looking inside and the rushed pace before the first catch. It is an ecology of clues about the lobsters, such as the antennas showing out of *piedras*. It is an ecology that asks of fishers more than proximity, it is an intrusion while looking very closely inside. If no one inside calls the attention of the fisher, he moves quickly to another place, to another *piedra*.

Sometimes El Caña, Eric, and I met other fishers in the water; some fishers with motorboats would pull us closer to more remote places, such as *Bajo del Medio*. Sometimes, El Bompi and Corozo took El Caña's lobsters and crabs to sell them for him in hotels. Sometimes, El Caña stopped by other small islands and exchanged fish for lentils, beans, and rice. Sometimes, El Caña checked some of his *nasas* (traps) to see if there were fish inside. Arriving on the island, kids and others approached to see the catch and to peel the fish. Not all fish had scales; some skins were very thick like ceramic and firm like leather. The guts were removed and thrown into the seawater. Some of the lobsters and crabs went into a trap near the shore.

After fishing, El Caña would go for *guarniciones*. He would pick a lemon from Simon's tree and buy plantain, potatoes, and onions in Angela's grocery store (his daughter's mother). Back at his house, he and Yira (his granddaughter) would cook a soup called *vivo de pescado* (see chapter 3). Yira and El Caña put the *guarniciones* to boil for around 40 minutes. They added the *carajuelo* (squirrelfish) towards the end. Finally, they added some drops of lemon juice on the plate. From that soup, his mother, grandsons, Miguel (his father-in-law), his neighbors, and sometimes I would eat. This soup is a material and relational continuation of the underwater sea to El Caña's life on the surface.

Most of the fishers I met would rather fish alone. Nonetheless, they stopped by the houses of others when the winds turned bad. They all shared food and stories—information relevant for life and fishing. Anytime that something happened to a fisher, many mobilized to help out. For instance, once El Caña lost his canoe to the winds overnight. He put the canoe close to the shore and could not find it the next morning. Another fisher found El Caña's canoe on another island and brought it back to him the following day. Another time, El Lati decided to go fishing with *mar de leva*, the winds blowing in all directions. He lost his nylons and his motorboat. He removed his

clothes and swam to Macavi, the closest island. When El Pachera and others from Isleta learned about what had happened to him, they traveled to rescue him and his boat. Enskilment to find *piedras* is more than picking up information imperceptible for unskilled observers, it is creating and maintaining mutual dependencies that sometimes mean being able to eat and having people do things for you when you need them. All these relationships enable fishing practices, and at the same time, these practices maintain and support these lifeways.

Bajos of fishing are not only a location, but they are deeply tied to conducting life in a place. *Bajos* are places described by the winds and underwater compositions as much as by embodied skills and fishing techniques. These are perceptual and affective where winds are a crucial question, and with the fish, fishing is permanently in movement. *Piedras*, plants, trees, *ollas*, and walls are lively. They can be *encantadores* (enticing), as described by Libinston. Within the marine ecologies entangled in artisanal fishing, it matters what happens to *piedras*, and this is non-dependent on its animality. In this section, I have emphasized how corals and *piedras* diverge in specific enskilled ecologies. In the following section, I will elaborate on the material co-incidence of these compositions. I will elaborate on how corals are also *piedras* and share their dissolution into sand in the last thirty years.

Co-incidental Dissolution into the Sand

Maybe sometime in your lifetime you have walked on a beach and watched some of the shells that the waves bring and uncover. Perhaps, you may have collected some shells and keep them at home. Some of those shells have been carefully crafted by mollusks in a process that biologists call biomineralization. Bivalve mollusks, such as oysters, create these shells following what Shanly Coneo, a malacologist friend, describes as the pattern of a species developed over more than five hundred million years. These shells are the exoskeletons of bivalve mollusks. Looking at a shell

of a bivalve mollusk, malacologists notice where the animal may have lived based on the marks of a leg, imagine a tiny flexible tube. The shells grow like trees from inside out. They draw growth bands in their bodies. For malacologists, these shells are an archive of marine changes. Some mollusks have grown their shells for hundreds of years.

Other animals such as snails, urchins, starfish, and some zooplankton also biomineralize shells. Hermit crabs recycle and make a home in the shells left behind by others. Some hermit crabs even dress the shells with little anemone and other shells. Other animals, such as some fish and octopus, wear shells as shields. Some birds use shells to build their nests. In the San Bernardo archipelago, islanders of Islote have created habitable surface with shells in a process they call *calzado*. In her ethnography, Andrea Leiva (2012) describes how people filled some aquatic places with rocks, wood, and shells. You may ask, what do shells have to do with corals and *piedras*? Coral skeletons, like shells, are the result of biomineralization processes. Corals too draw bands of growth in their skeletons and are marine archives of oceanic transformations. They also survived the fifth massive extinction around sixty-five million years ago. Like shells, corals and *piedras* are made of calcium carbonate. When the seawater becomes more acidic calcium carbonate slowly dissolves into sand.

In 2016, during my first preliminary fieldwork in Isla Grande, I attended a training called fishing for life. International scientists visited Isla Grande to teach islanders about transformations in the sea. I remember that Lina Barrios, a marine biologist, suggested an experiment—to pour some drops of lemon juice into a coral skeleton. I do not recall what happened to the coral skeleton in that brief exposure to lemon juice, but I remember Lina talked about the effects of more acidic mediums for calcium carbonate, especially, the dissolution into sand. I remember that people

around me started talking about places that disappeared in the last three decades, islands that used to emerge from the seawater when the tide was low.

As I was preparing to write this text, I decided to replicate the experiment using a coral skeleton of *Acropora cervicornis*, whose polyps were already eroded. Perhaps, you can replicate the experiment too with a coral skeleton, a shell, a bone, or a tooth. I put the skeleton in a bowl with lemonade. The first thing I noticed were the effervescent bubbles coming from the skeleton, perhaps as a chemical reaction to the acidic medium. The second day, I noticed some thin particles forming in the surface of the skeleton. The water turned milky after the white color of the material. The third day, the surface of the skeleton became flatter and softer. Some sand began to accumulate on the bottom of the bowl. After more than a week, I noticed that the skeleton reduced in size. Lemon juice is more acidic (pH of 2) than the seawater currently is (pH around 8). I wonder if the dissolution into sand for the existing shells and corals is a matter of time (maybe decades), or a matter of a dramatic increase in the acidification of their medium.

According to the Smithsonian Institute webpage,[26] the ocean has become 30% more acidic in the last two hundred years. Between 1960 and 2010, the pH of the oceans decreased from 8.33 to 8.13. These changes have been primarily attributed to the absorption of carbon dioxide in the atmosphere, but maybe other operations also contribute to the acidification of the seawater. As the seawater becomes more acidic, not only coral reefs may dissolve, but also the shells of a variety of animals and coralline algae that have managed to survive past extinctions. It is hard to anticipate what seas these oceanic changes may bring into existence. Perhaps, some of these shelled animals may evolve not to depend on the refuge of shells and corals. However, how long in terms of

[26] Available at: https://ocean.si.edu/ocean-life/invertebrates/ocean-acidification. Last accessed in March 2021.

evolutionary time might these lineages take to become others with other seas? Tiny zooplankton might be quicker to adapt, other kinds of shells such as those of lobsters, crabs, and shrimps might become stronger, and jellyfish may proliferate. All of these are scientific fabulations of the future oceans. Even with stronger shells, where might the lobsters and crab hide from the light? What may an increasing abundance of sand as emerging material do to lifeways in the Rosario archipelago?

In addition to acidification, other practices may transform corals and *piedras* into the sand at a faster rate. In 2016, the expanded Panama Canal opened to post-Panamax ships three times larger than the Panamax ships that crossed the canal before the modifications. The Cartagena Port[27] suggests that making the Cartagena Bay accessible to post-Panamax ships will make the Cartagena Port more competitive in the Caribbean. It would also contribute to the connectivity of the region. Accommodating for Post-Panamax ships means dredging 1,452,000 m^3 of the existing channel and 3.5 million m^3 of an alternate channel across the Varadero Reef. The Cartagena Port suggests that the alternate channel would be a solution to traffic congestion and will reduce the waiting time to enter the bay. A large ship would move the dredged material and drop sediment all the way to an unspecified open sea. Dredging may not only destroy the Varadero Reef, but it may also increase the charge of sand and sediments and drastically modify the underwater morphology.

Imagine the underwater sea as a medium in constant movement and the currents as winds that carry sediment and force. The currents crash underwater walls and mountains that slow down their force and shape their flows and movements. Now imagine those mountains are dredged. The Varadero Reef might also be a wall that protects corals of the Rosario archipelago from a more

[27] Available at: https://www.puertocartagena.com/es/bahia-de-cartagena/canal-de-acceso-y-canal-alterno. Last accessed in March 2021.

direct and strong flow of freshwater and sediment. When dredged, the dredged reef may add to the sand and sediment that asphyxiate living corals. *Salvemos Varadero*, with the participation of scientists like Valeria Pizarro, obtained the recognition for the Varadero Reef as a Mission Blue hope spot in 2018. Mission Blue is an alliance of two hundred conservation groups gathered around a dream of oceanographer Sylvia Earle to unite public support for a global network of marine protected areas, some of which are formally protected, and some, like the Varadero Reef, which do not have defined protection. Mission Blue promotes the conservation of hope spots through communication campaigns, documentaries, social media, Esri ArcGis cartographies, and scientific expeditions.

Mission Blue describes the Varadero Reef as follows:

> Varadero's Coral Reef off the coast of Colombia has what many consider to be a paradoxical existence, harboring high coral cover and rich biodiversity despite having poor water quality and sediments discharged during the last 500 years by the Canal del Dique, a 118 square kilometer canal connecting Cartagena Bay to the Magdalena River. The persistence of Varadero's Reef is currently threatened by a project to modernize Cartagena's port, not only by the direct damage produced by the dredging of a new shipping lane through the reef, but also by the deterioration of water conditions associated with the operation and maintenance of the channel. The local scientific community has been studying these reefs, and recent international attention brings conservationists hope that action can be taken to protect what is perhaps the only surviving ecosystem in the now-polluted Bay of Cartagena.[28]

[28] This description is available at: https://mission-blue.org/hope-spots/ Last seen in September 2021.

The hope in this specific spot for conservation advocates derives from the scientific documentation of the paradoxical existence and persistence of the Varadero reef. Valeria Pizarro thinks scientists can learn valuable information from this reef that may be relevant to prolong the lives of corals in other places too. The hope that this recognition by Mission Blue brings to *Salvemos Varadero* is that international and media attention might contribute to gaining state recognition and protection. The description in Mission Blue's website also obscures the connections between dredging, the port, and the petrochemical center development in the last three decades (see chapter 1 and 3).

Corals that are not only corals turning into a different material (sand) is not unique to the narrative and material transformations in the oceans due to climate change. I suggest that other activities, such as dredging, might be causing what I call *sandification* of the ocean at a faster pace. The following is a diagram that I created to illustrate the *co-incidence* of some corals and *lapa, risco, laja, pisa papel, hueso, papa,* and *montaña* that may be becoming sand based on my conversations with marine biologists and artisanal fishers. When corals dissolve, *lapa, risco, laja, pisa papel, hueso, papa,* and *montaña* dissolve too.

Acropora palmata
Lapa

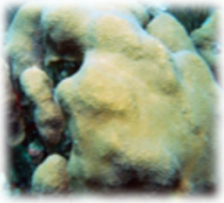
Acropora cervicornis
Risco

Agaricia tenuifolia
Laja

Favia fragum
Pisa papel

Millepora squarrosa (Hidrozoo)
Hueso

Orbicella annularis
Papa



Orbicella faveolata
Montaña

Octocorales
Plantas

Dredging for purposes of port expansion also seems to be *co-incidental* in various places in the Caribbean. In 2021, the dredging of the Varadero Reef has not yet been approved. *Salvemos Varadero* and other advocates try to find a model for the conservation of the reef within the existing model of marine protected areas and nature reserves, which may also impose more restrictions on the port expansion and on artisanal fishing. Paraphrasing Valeria Pizarro, the reef needs to be first listed within the Atlas of corals of Colombia, which has not happened yet. The José Benito Vives de Andréis Marine and Coastal Research Institute (INVEMAR) and the Ministry of Environment and Sustainable Development signed agreements in 2019 and 2020 to update the Atlas as an interactive website that will become part of the system of sea environmental information of Colombia (SIAM). The Atlas of Coralline Areas of Colombia website[29] states that updating cartographic information is slow and expensive. The cartographic information will appear as soon

[29] The Atlas of Coralline Areas of Colombia website is available at: https://areas-coralinas-de-colombia-invemar.hub.arcgis.com/ Last accessed in September 2021.

as it is available. It is unclear the criteria that these institutions use to prioritize the cartography of a reef over another. Meanwhile, reefs that do not exist in the Atlas may face legal challenges for their protection.

Some Openings for Coral Reef Restoration and Conservation

Isabelle Stengers (2003) develops the concept of ecology of practice as a tool for thinking the conceptualization of a new habitat for physics. In her words:

> Physics as a practice is in dire need of a new habitat, since from its birth as the first so-called 'modern science' its claims were entangled with its historical 'habitat'. Since then, however, the claims have survived, but not the habitat. As a result, the way physics presents itself now, the way it defines 'physical reality,' is by way of persistent but now freely floating theologico-political claims referring to the opposition between the world as understood from that an intelligible point of view (which may be associated with divine creation) and the world as we meet it and interact with it… As a result of defining 'physical reality' as the objective and beyond our merely human fictions, physics claims for itself an exclusive position of judgement over and against all other 'realities,' including those of all other sciences. It is a position that practitioners do not know how to leave, even when they wish to. It is indeed a question of 'habitat;' they feel that as soon as they leave the secure position of claiming that they 'discover' physical reality beyond changing appearances, they are defenseless, unable to resist the reduction of what they are producing to simple instrumental recipes, or to various human fictions. They become subject to the very same kind of reductive judgement they use against all other realities. (Stengers 2003: 183)

Like physics, conservation and restoration require a new habitat since, from the birth of conservation in the late nineteenth century, its claims are deeply tied to a historical habitat. Since then, some of the tools, especially the containment of delimited areas, have survived. Likewise, the way these practices present themselves today is by persistent claims about marine biology's authority to define coral animality and ecology. At the same time, juridical frameworks may also contain that authority within the borders of the nature reserve.

By defining a marine ecology, conservation biology claims for itself a privileged position of judgment over and against other marine ecologies, including the ecologies of *piedras* and *bajos*. It is a position that practitioners wish to leave through community participation but feel unsure about how to do it. For instance, co-management with Community Councils was a matter of discussion within the consultation of the marine protected area's new management plan in March 2018 in Barú. However, conservation delegates worry about the effects of giving up their privileged and authorized position because of financial and legal consequences for *Parques* within the reserve and in sensitive negotiations over the borders of industrial development in Cartagena. It is what Stengers (2003) refers to as a question of habitat.

Stengers (2003) speaks of the lessons of the science wars. In these wars, physicists feared that their environment was susceptible to deconstructivist descriptions and used their social power to equate these descriptions against all rationality. Conservation and restoration biologists are also right to be concerned, as their environment is a sensitive one. By developing the conceptual analysis of *co-incidental compositions in marine ecologies*, I expand the analysis of marine ecology as described by marine sciences to show how various ecologies co-exist, sometimes compete, and co-incide in some of their materials and transformations.

I have learned, working with marine biologists, that conservation and restoration are demanding and passionate endeavors. These biologists have their arguments and personal lives to speak of the seas that move and maintain their practices. But as they also worry about their habitat, they advocate for conservation of coral animals and reefs. If divergent marine ecologies are equally existent and legitimate, an ecology of practice implies addressing the specific questions that practitioners accept as relevant. *Co-incidental compositions* do not dissolve divergences, but they point to how different ways of sea lifeways that are simultaneously compromised in their existence.

For Stengers (2003), "an ecology of practice is a tool for thinking through what is happening, and a tool is never neutral…What is at stake here is 'giving to the situation the power to make us think,' knowing that this power is always a virtual one, that it has to be actualized" (Stengers 2003: 185). The ecology of practice entails the decision not to accept a trap to defend coral conservation/restoration, and to defend artisanal fishing's destruction alongside the destruction of corals that are also *piedras*. Instead, it is to challenge the situations in which these practices defend themselves through accepting and justifying others' destruction as a condition for something more substantial, such as saving coral reefs. An ecology of practice aims to imagine new possibilities and terms for discussion among coral biologists and artisanal fishers, and with respect to the borders of development that conservation biology also guards.

In this sense, I suggest that diplomacy, as it involves coral/coral reefs and *piedras/bajos* in the Rosario archipelago, requires taking risks in creatively addressing sea compositions, conservational and otherwise, and perhaps even something else that emerges through experiments among practitioners. Instead of a negotiation in which the basis is the need to defend themselves and redistribute the weight of sectoral claims, diplomacy proposes new terms for partial, strategic,

and otherwise improbable alliances across co-existing marine ecologies. Coral conservation/restoration and artisanal fishing do not need to be defended as if they were weak. This invitation is to foster their strengths, while also producing an experimental togetherness for becoming sea compositions that are not containable within managerial borders.

What may scientists learn on board fishing trips and what may fishers learn by moving slower and attending to the outer *piedra* surface, perhaps during a spawning? Marine researchers in Colombia describe their work as very difficult and expensive. Most of the time, marine research is based on expeditions and fieldtrips. The CEINER lab is unusual in that the field biologists, interns, and volunteers live on the islands. However, their pressing occupations leave them little opportunities to go on fishing trips with fishers. Also, many researchers cannot imagine how it might be possible to invite artisanal fishers to come and see the massive spawning, a time sensitive and expensive event for themselves. Scientists and fishers have come together multiple times, one of those examples is the Fishing for Life program. However, my impression is that these encounters have been primarily designed for artisanal fishers to learn from scientists and rarely for scientists to learn from artisanal fishers. Perhaps, for scientists and artisanal fishers to meet in other terms, what counts as research may also need to be open to it. Although this approach does not offer guarantees for coral animals and *piedras*, it may enable other terms of discussion other than antagonisms, resistance, and control. I will expand on these ideas in chapters 3 and 4.

INTERLUDE

What may seawater and marine individuals teach us about sea ecologies?

The nurse sharks show at the *Oceanarium*, San Martín de Pajarales Island, Rosario Archipelago. Photograph by Gabriel García. September 2018. Used with permission.

It is six in the morning. Emiro and Orlando sweep the floor. The dolphin trainers select food for the day. The pelicans and herons follow them around. Wallys walks with her tiny Pinscher dogs. Charlie, Jorge, and Daniela clean the aquariums, removing the dead and feeding the fish. The largest animals at the exhibition are dormant. The nurse sharks cuddle alongside and on top of each other. Around nine in the morning, everyone gets ready for a new workday. Tourists arrive from ten in the morning until one in the afternoon.

Around 30 people live on the island but travel back and forth from San Martín de Pajarales to Barú Island. Most of the workers have their homes and families in Barú. Rafael Viera also moves back and forth from the *Oceanarium* to his *Aviarium* (a zoo of birds) located in Barú. San Martín de Pajarales is a small island extended with wooden platforms from which tourists observe

animals in the sea (see chapter 4). The island (including the platforms) can be easily crossed by foot, which takes only a few minutes. The exhibition includes native species. The guide is in Spanish. Three guides and three dolphin trainers follow a script and impart their personalities in the narration. The guides feed the animals and describe the unique things they can do, as species and individuals. For instance, they tell the audience that *jurel* (jack fish) and *cojinúa* (barjack fish) are the fastest fish to catch a prey when it touches the water. *El globo* (pufferfish) puffs to make itself look bigger. *El ballesta* or *peje puerco* (tigger fish) can swim forward and backward. *El mero* (giant grouper) has *tremenda bocaza* (a giant mouth). *El sábalo* (shad fish) swims as a school, and they describe their undulatory movements.

The nurse sharks go up to a platform and receive fish from the guide's hands. Alex, one of the guides, trained the sharks only once decades ago. The little ones learn by watching others. Birds, who are not enclosed, are part of the exhibition. The guides feed the frigates. In doing so, the guides show tourists that frigates can be suspended in the same spot for a few seconds. Frigates, herons, and pelicans catch some of the fish that the guides throw to fish. Margarita, a white heron, keeps order during the show with sharks. If other birds come too close to the platform, she goes after them.

Most of the fish are born in the *Oceanarium*. Charlie catches a few small ones during his diving trips. The turtles arrive via fishers. The *Oceanarium* pays fishers for turtles, with food or money. Every July, the *Oceanarium* and *Parques* release the turtles to the open sea just before the nesting season from August to November. The guides tell tourists that plastic resembles jellyfish in the water, and turtles love jellyfish. The dolphin trainers describe the bottlenose dolphins as ambassadors of the sea. Dolphins can jump higher than the metallic nets that extend five meters

underwater. Dolphins say hi and bye with their fins and move their head from side to side asking tourists not to throw trash into the seawater.

Once the tourists leave, the guides and trainers eat and nap. The fish, turtles, and dolphins look for shade alongside the nets and under the platforms. Underwater, metallic nets surround and separate the large animals at the exhibition. The eye of the net is ten squared centimeters. Through the eye of the net, small fish can cross back and forth. Rafa says animals do not appear enclosed from the surface. They are under the sun, the moon, the rain and live in the seawater. The lionfish, stonefish, seahorses, octopus, lobsters, crabs, morays, and small colorful fish live in aquariums. Seawater also circulates through their aqueduct.

In the aquariums, Charlie recreates reefs and mangroves where small fish can hide, play, and settle. It is the case of the jawfishes, who spend hours digging holes into the sand and arranging rocks around with their mouths. Fish take part on decisions about their neighbors. Charlie observes signs of refusals in bites and shapes a tentative idea of who can be a good neighbor and how. Ordinary care includes installing little filters that prevent fish from being caught in the tubes, playing with light and aeration, and more broadly, attending to the lives of individuals. I remember a little turtle, Firulais. At first, she only received squid. Charlie and Daniela had to slowly teach Firulais to eat more things.

In the afternoon, the roseate spoonbill birds follow Manguito to their shelter for the night. Oso (a dog) runs through the platform and barks at the fish with Ocho (another dog). Oso used to visit Estefania (a dolphin) with me. I sat in the platform bare foot. Depending on the tide, it was easier for Estefania and I to reach each other. Estefania liked to be caressed with the feet, not with the hands. Oso scratched my hand asking to be spoiled at the same time. Unlike Rosi and Tursi (other dolphins), Estefania knew how to get closer and to direct the touch. Rosi and Tursi swam

next to each other. Sometimes Rosi brought algae in her right fin and opened her mouth wide in a smile. Sometimes Estefania closed her eyes and let the waves swing her body gently from side to side.

Before my life in this island, I never imagined that a caiman (Coco) or a turtle (Mónica) could direct their attention when they heard their names. Mónica, a *Caretta caretta* turtle, had buoyancy issues. As she spent long hours in the surface, algae grew in her shell, and she had permanently red eyes. Charlie moved Mónica to a tank so that giving her medicine would be easier for him. With a higher water level, Mónica was agile. With a lower water level, she hardly moved. Still, she tried to bite the broom we used to clean her tank. After a few days, we learned that she would rather be with the other turtles despite it making things harder for us (her human care givers).

The animals at the *Oceanarium* are not passive in their lives and conditions. I remember a morning when a grouper appeared misplaced. It was unclear how the giant fish of around 50 kilograms crossed the nets. Fredy caught the fish, who was stunned. Fredy moved the fish to the other groupers' enclosure and gently carried its weight from side to side to see if it responded. One by one the other groupers came closer, curious about the situation. Ordinary life at the *Oceanarium* is rich in stories of responsive animals, including seahorses who subtly rub each other and soft corals and grey sharks who negotiate space and food with a school of shads. The participation of these animals in the exhibition is negotiated and not guaranteed. For instance, for some time, Swani (a dolphin) did not participate in the show because she refused to follow instructions. Her decisions were personal and differed from those of other dolphins. Differences in personalities dictate a specific consideration for each animals' wellbeing. For instance, the trainers space the food of Tursi more because if he finishes his food first, he will not let Rosi eat.

The *Oceanarium* is part of the Colombian Association of Zoos and Aquariums. In the 1970s, Rafa was curious about fish and built some enclosures. Some recreational fishers approached him and paid to see what he had. At first, *Parques* did not approve the operation of his business within the Corals of Rosario and San Bernardo Nature Reserve (established in 1977). However, with little infrastructure on the islands, *Parques* saw Rafa as ally, and Rafa envisioned a new figure for the San Martín de Pajarales island. The *Oceanarium* became the Centre for Research, Education, and Recreation (CEINER) with conservation as its central mission. Wallys says that some of the enclosures were built to stop tourists from harassing the fish and dolphins. At least, Estefania showed that dolphins can jump the metallic net, refuse to come back, leave, and venture to the open sea.

As a zoo, the *Oceanarium* has inherited a history of zoos that goes beyond its own story. Many discussions around zoos today leave us only with two options: liberation or suffering. It is easy to assume that animals in captivity live a lesser life than their counterparts on the other side of the net. The *Oceanarium* takes this assumption seriously. Any detail out of context can be used to suggest mistreatment of the animals, discredit the *Oceanarium*, and perhaps close the business.

One of the contradictions in the stories of animals in captivity by liberation advocates is that the specific responses of the animals themselves are missing. Once, Tursi (a dolphin) bit a tourist who arrived drunk and wanted a picture with him. The tourist sued the *Oceanarium* and asked for millions in compensation. The lawyers asked Wallys to speak for Tursi. Wallys asked the lawyers to ask Tursi directly. Wally's response posed a challenge to lawyers who have not been trained to ask questions to nonhuman persons. In the end, the *Oceanarium* did not pay the compensation but had to include an announcement reminding tourists that dolphins are "wild" animals and that they may only take pictures with Tursi at their own risk. Maybe the word "wild"

in this announcement speaks more of a legislative incapacity to make Tursi accountable than to any inherent or defining quality of dolphins. Other animal individuals, including humans, may be wild too, and bite, and be mad.

In this brief text, I suggest that attending to the ordinary lives of individuals at the *Oceanarium* may be more relevant for these animals themselves and offer more opportunities to learn something new about our shared lives in this archipelago of archipelagos (see chapter 3). On both sides of the net, fish, turtles, and dolphins live in seawater. If there are traces of heavy metals in the seawater and food of these animals in enclosures, it is most likely that other animals, and people on the other side of the net, also bioaccumulate these metals in their flesh (see chapter 3). If seawater is shared and runs across nets and through aqueducts, where is the enclosure? Where and how is the mistreatment situated? What does mistreatment mean? Who is responsible for it? What does it mean to think in these terms?

I call this shared seawater condition, the one on both sides of the net, *the socializing sea*. Andrea Padilla (2019), a leading advocate of animal rights in Colombia, thinks that in the most progressive environmentalist accounts, animals appear as components of an ecosystem. Their value depends on their function in ecosystems that benefit a healthy environment (for some humans). Her concern is that environmentalist approaches suppress an obligation to animals as sentient beings, beyond their roles in ecosystems. I suggest that attending to the seawater quality matters not only for species in ecosystems, but for the wellbeing of individuals too. The enclosure affects the mobility of large animals. However, many other industries and activities in the archipelago and beyond affect seawater quality. It is impossible to separate the wellbeing of these animals from their milieu.

The guides remove the dead fish from the exhibition. The premise is that the decomposition of dead bodies in aquariums contaminate the seawater where others live. The dead are offered to the sharks, who are thought to have more resistant digestion than anyone else on the island. When a larger animal, like Monica (the turtle), suffers from a chronic condition, it is never mentioned to the tourists. I think, perhaps, no one wants to provide details that some tourists may use to blame the *Oceanarium*.

There is *no place* at the *Oceanarium* for most of the sick. The distinction between sick and disabled is ambiguous, especially with regards to fish. For instance, after an influx of sediment, algae, and fresh water coming from the continent during the rainy season (see *bombazo* in chapter 1), fish in aquariums died in large quantities. The *bombazo* infiltrated the aquarium's water system, and an infection might have spread through the aqueduct and enclosures. The enclosures may have increased the exposure for the fish, and at the same time, they made the situation evident. When the veterinarian[30] opened the bodies, it seemed as if they were burned inside. Some squirrelfish, grunt fish, and pufferfish survived, but the globe of their eyes increased notably in size. According to the vet, they became blind. Although the fish lived for two weeks in a tank, they could not go back to the exhibition. The vet put some fish to sleep with *Eugenol* and freed others in the sea, expecting that they would not last long because they were easy prey. The different procedures show the vet's doubts about what to do.

I remember being impressed by the *no place* for these fish in the exhibition. By the *no place* of the dead, sick, and disabled at the *Oceanrium*, I mean their removal from the display, the script used for tourists, and how these fish are killed and freed as the *Oceanarium* does not maintain

[30] The vet was an intern finishing her bachelor's degree. The *Oceanarium* had not hired vets before. Charlie and Wallys learned about animals from years of shared lives with them.

fish that cannot be in the exhibition. It is a kind of *no place* at the *Oceanarium* and a *no place* for some tourists that can only recognize suffering and perhaps exploitation in captivity, and who may have no means to admit the dead, the sick, and the disabled in the open ocean. The *no place* at the *Oceanarium* is also a place on the other side of the net where other fish might share similar and othered conditions. I was impressed by the euthanasia and liberation of these fish somehow justified in the medicalization of their bodies, the blindness that assumedly makes the fish easy prey and reduces their life expectancy in the wild. The freedom of these fish also frees the *Oceanarium* from accountability. Perhaps, some fish with googly eyes defeated the expectations of the vet by living longer. However, no curious writer witnessed their lives to tell the story. Sunaura Taylor (2016) tells the story of a fox with arthrogryposis, the condition Taylor was born with. A hunter killed the fox because "it had an abnormal gait and appeared sick" (Taylor 2016: 23). When opened, the fox had normal muscle mass and his stomach contained digested food implying that the limb deformity did not prevent this fox from hunting. This story may suggest that social understandings of disability affect the ways vets, tourists, animal right advocates, the law, and many others interpret animal wellbeing and act upon these interpretations.

Aesthetics of normal and healthy bodies have direct implications over the *no place* of certain fish in the exhibition and on the sperm and eggs of endangered animals to be used in assisted reproduction (depending on the lead biologist). Among the groupers, there is a grouper with a cleft lip. Every year, the lab biologists test the groupers to identify who presents eggs or sperm, which might vary from year to year. The grouper with a cleft lip has consistently presented eggs during the past years. For some biologists and veterinarians, the cleft lip is a non-desirable trait to be raised into the future of the species.

During my time at the *Oceanarium*, the lead biologists foresaw that animal welfare practices would become a condition for the business soon. Padilla (2019) describes these practices as anthropocentric humanitarianism. According to her, welfare maintains the instrumental role of animals in various industries but advocates for reducing "unnecessary suffering." Welfare is primarily veterinarian and zootechnic. This expertise for sea animals is rare in Colombia. Also, I think that animal welfare is constrained by allopathic medicine. What I have described as a *socializing sea* and *no place* are not localized in the bodies.[31] The *socializing sea* points to the binding quality of seawater across human and non-human individuals on both sides of the metallic net. The *no place* speaks of the multiple interweaving stories that make the exclusion of the dead, sick, and disabled from the exhibition almost an obligation for the *Oceanarium*.

During the COVID-19 pandemic, the nature reserve closed. The *Oceanarium* stopped receiving tourists, its main source of income. Without that income, the *Oceanarium* struggled to feed and maintain the animals. Most of the workers returned to their homes in Barú. The *Oceanarium* asked for donations and sold tickets in advance. One article in *Semana* (a national newspaper) reflected on the beginning of the end of zoos.[32] It said that a zoo in Germany made a list of animals that could be sacrificed to feed others. In Colombia, it is impossible because the state is the owner of fauna (including zoo animals).[33] Andrea Padilla explained that zoos in

[31] Irus Braverman (2021) argues that zoo vets who have conservation as their mission in the United States, Canada, and Europe balance multiple forms of health beyond individual bodies. For instance, these vets think of populations and ecosystems—the increasingly trending OneHealth approach advocates for further collaboration across human and nonhuman animal doctors. However, what I suggest here is different in that I point to a relational issue that OneHealth might not have the means to address.

[32] The article is available at: https://www.semana.com/nacion/articulo/coronavirus-zoologicos-enfrentan-problemas-financieros-por-la-pandemia/667425. Last accessed in May 2020.

[33] 2811 Law of 1974, National Code of Natural and Renewable Resources and the Protection of the Environment.

Colombia do not end because the victims of illegal trafficking have nowhere else to go. The illegal trafficking of animals is the third largest unlawful industry in the country, after drug dealing and human trafficking. The smuggling of animals and zoos share legacies that are hard to describe as other than cruel and exploitative. At the same time, some zoos inherit these legacies by becoming rescue and rehabilitation facilities for endangered animals (Braverman 2013) and animals whose lives have been permanently transformed by illegal trafficking.

The *Oceanarium* hosts endangered animals such as turtles, groupers, and corals (who do not count as animals in the exhibition). The national state claims the property of these animals, and the pandemic makes visible the fuzziness and constrains of this claim. Activists and scholars such as Andrea Padilla are opening a path for the recognition of animals as subjects of rights. However, if the discussion for the animals at the *Oceanarium* assumes that animals in captivity can only be freed, those rights might exclude a range of possibilities.

During my last visit to the *Oceanarium*, I met Sol and Kristal (two baby dolphins), daughters of Inti, Eva, and Swani. At that moment, Vida was still in Luna's belly. Wallys felt she only had fifteen more years to work and worried about the babies. Dolphins can live more than thirty years at the *Oceanarium*. Who would take care of Sol, Kristal, and Vida? For her, her life and those of these dolphins mutually depend on what she calls a visceral responsibility. It is a disposition and ability to imagine, learn, and anticipate the wellbeing for each one. This kind of personalized and corporeal understanding of wellbeing requires proximity and intimacy. It is a proximity of shared lives—distinct from the proximity of a single encounter.

One of the proposals in the media these days is to turn zoos into sanctuaries. In the United States and Colombia, sanctuaries are rescue places for disposable animals in industries, such as dairy. My impression is that animals, such as cows, sheep, and pigs, are not workers on sanctuary

farms. Some of these animals expose in their bodies and disabilities the cruelty of the industries they were part of. These sanctuaries fund their operations through donations, gift store sales, and volunteer work. It is unclear how marine sanctuaries might look and how they might differ from the already existing nature reserves and aquariums. What difference might marine sanctuaries make and for whom? How might marine sanctuaries inherit the legacies of aquariums? How might marine sanctuaries allow other ways to live with these animals? How may concrete animals at the *Oceanarium* become interested in sanctuaries? What would sanctuaries do to armed confrontations revolving around land and sea use and distribution? [34]

The *Oceanarium* could become a storyteller beyond in person encounters. By this, I mean that the *Oceanarium* could tell stories of various individuals whose lives deeply enmesh into coral reefs and challenge assumed boundaries that separate humans and other animals. The *Oceanarium* can make use of digital technologies and ally with public schools, radio stations, local channels, and governments. I imagine the dead, the sick, the ones with cleft lips and googly eyes having a place in those stories. These stories may become opportunities to think about the city and the ways that our lives are deeply entangled with each other. Many of the residents of the city of Cartagena have never visited coral reefs. I imagine that is one of the reasons *Salvemos Varadero* (see chapter 2) has struggled to mobilize people from Cartagena to sign a petition to protect the Varadero Reef from dredging. Only denunciating the suffering of captivity does not dismantle the shared and complex exclusionary ecologies that we (various animals including humans) live in Cartagena and many other archipelagos (see chapter 3). I suggest that guarding the assumption that equates

[34] Inge Helena Valencia (2015) elaborates on practices of governance in the Caribbean Sea. These practices imply militarizing and mobilizing fear in archipelagos by legal and illegal actors. In these places, the war on drugs overlaps with various administrative figures of conservation and multiculturalism.

captivity to suffering does harm. It silences questions and conversations that may also be pressing today, such as seawater quality and who we choose not to see in an aquarium, the sea, and reef futures.

CHAPTER 3

Intra-penetrating Restorations in an Archipelagic Place and a Technoscientific Milieu

Imagine a coral polyp, a jelly sac body with a mouth encircled with stinging tentacles that look like petals. The scientific name for the class of this marine invertebrate is *Anthozoa*, a word that comes from the Greek words *ánthos* (flower) and *zóa* (animals), flower-animals. Coral polyps usually extend their petal-like tentacles and eat in the absence of sunlight. They feed on plankton—tiny microalgae, animals, and suspended particles that move with the sea currents. Some of those particles include industrial pollutants and microplastics less than 5mm in size. Rotjan et al. (2019) suggest that some coral polyps may even prefer to eat microplastic beads over other food of the same diameter. Coral polyps eat plankton; some fish eat coral and algae; some fish, residents, and visitors in Cartagena eat fish, their flesh; and in part, what fish eat and the places where they live too. Coral polyps eat and drink Cartagena in each gulp.

The northerly and southerly winds push fresh and salty water away and into continental Cartagena, Karmairi in Karib. The water carries the sediment suspended in the sea curtain by dredging. Multiple substances leak and run off the large vessels, cruises, the oil refinery, and the sewer system and these substances wash out into Cartagena Bay. The Canal del Dique, an engineered branch of the Magdalena River, carries the pollutants collected while flowing through major cities. Microplastics, mercury, and insecticides, travel, penetrate, get stuck, and become part of emerging lifeforms. During the rainy season, the southerly winds explosively push sediments and industrial chemicals into coral reefs. *Bombazos* (the explosive pushes of fresh water that suspend matter in the reefs) are a lingering heritage of colonial and industrial developments.

In this chapter, I situate coral restoration in an archipelagic place and a technoscientific milieu. By an archipelagic place, I refer to Cartagena, an archipelago of archipelagos. Zooming in, Cartagena is composed of islands, some connected by bridges. Zooming in again, the roots of red mangroves (*Rhizophora mangle*) shape arches and tunnels of different heights and widths. The trees overlap one with the other to the point that it is hard to distinguish between trees. Stems, branches, roots are a dense network, a permeable fort that contains and distributes seawater through its channels. The red mangroves rest speed to the waves, divide into branches, open into salty and swampy lagoons inside islands, islands within islands. Different from other kinds of mangrove, the red mangrove can absorb high salinity levels. The red mangrove allows for other plants less tolerant of salt to thrive and grow on calcareous skeletons of coral. Some of those skeletons keep the shapes of coral polyps. As the coral polyp structures dissolve, they become sand. Soft sand and sediment penetrate the seawater turning it *color panela* (sugar cane color) and become wet with the flow of mixed water. Looking very close at the sand, there is no shore, no seawater/land division.

By a technoscientific milieu, I mean the climate science that informs the way coral restoration practitioners ask questions, think about time, and make assumptions about place. Coral restoration imagines reef futures while anticipating climatic stressors: warmer and more acidic superficial seawater (see chapter 2). It can be understood as an anticipatory practice to assist in the reproduction of a future with corals as it is imagined in the present. The time and place of reef futures is indeterminate: not now and not easily mapped into present reefs. Coral restoration carries a sense of urgency to repopulate more corals, and at a faster pace. I call reproductive futurism this specific form of anticipatory action that demands massive coral crops and fast.

In Colombia, coral restoration has taken the form of coral gardening for the remediation or rehabilitation of ecological functions in marine protected areas. Lina Barrios, a Colombian coral scientist, describes this kind of intervention as unthinkable in most traditional passive conservation methods of the 1990s. In the last decade, coral restoration has transformed conservation, and at the same time, conservation has shaped coral restoration too. The funding for coral restoration has partially come from *Parques*, from the fees that tourists pay to enter the nature reserve and the *Oceanarium*. Some funding has come through international cooperation, donations, and the collaboration with other coral restoration organizations, such as the Coral Restoration Foundation based in Florida. Some funding has come from concrete persons like Elvira Alvarado and Valeria Pizarro. Some funding has also come from compensation payments of offshore oil companies, such as Anadarko.

In addition to coral restoration programs run by *Parques*, other initiatives rely on payments made for in-person tourism fees and online citizen scientist trainings. Without much government financial support, some practitioners think that sustaining and scaling up coral repopulation in the Caribbean Sea may require securing investments and increasing profitability through architectural landscaping, payment for environmental services, and the commodification of some corals for aquariums and as genetic repositories. Today, some coral scientists imagine massive crops in undefined places.

In this chapter, I situate coral restoration through a conceptual analysis in which the sea eats the islands, mixed waters permeate bodies, perceptible and imperceptible realities shape archipelagic lifeways and technoscientific milieus, and non-innocent actors mess with clear-cut analyses of uneven power relations. I draw upon the work of Michelle Murphy (forthcoming) and Max Liboiron (2021), who characterize their approach as "with and against science." By this,

Murphy understands “refusing and dismantling, while also inserting invention into existence and making decolonial futures in relation to industrial chemicals” (Murphy forthcoming). Likewise, Liboiron asks: “How do we continue with science after the critiques of science?” (Liboiron 2021: 113). I share with Murphy (forthcoming) and Liboiron (2021) an approach that simultaneously dismantles and inserts invention into existence. One of such ways is by thinking “across” techno sciences: By introducing some critical discussions about chemical exposures in Cartagena, I reconsider coral restoration’s temporal horizons and reproductive urgencies. I suggest the concept of intra-penetrating restorations to point to indeterminate horizons and illustrate these restorations’ profound ties to shifting, mingling, and lingering properties of biochemicals. The text is organized in three parts. In the first part, I introduce Cartagena as an archipelago of archipelagos. In the second part, I dwell on Cartagena’s chemical exposures. Finally, I come back to coral restoration to speculate how it may also be viewed through the lens of critical chemical studies.

Cartagena: archipelago of archipelagos

Cartagena de Indias/World Heritage City: *Además de mágica ahora es sostenible* [In addition to being magic, it is now sustainable]. Holidays, Events, Sustainability, Cruises. Discover places of interest, squares, islands, monuments, and more. Quick guide: certificate service providers, medical services, tourist hotspots, tours, teaching centers. Events: learn about all Cartagena offers, Festival of the Cake, Ironman 70.3, the National Beauty Contest. Did you know that cruise passengers increased from 24,924 in 2006 to 359,519 in 2019?

Screenshot of a webpage from the Cartagena government office in charge of promoting tourism. January 2021.

A World Heritage City when the sea eats the islands

The World Heritage City materializes government decisions to make Cartagena more beautiful and accessible to "world" tourists. In that process, the government has evacuated, displaced, and emplaced some residents of the city. For instance, the local government evacuated Pekín, Pueblo Nuevo, and El Boquetillo in 1939 and Chambacú in 1971—settlements of artisanal fishers near Las Tenazas beach next to the walled city (García Ruiz 2017). Manuel Zapata Olivella

(1963) describes in his novel *Chambacú: corral de negros* (Chambacú: *corral* of blacks),[35] the slow and violent process of evacuation. Totó La Momposina, a bullerengue singer, sings in one of her songs: *Chambacú, la historia la escribes tú, la historia de las murallas, con sangre la escribió, la canalla, con la pluma del dolor, jurando la carne esclava, a lo lejos se ve la muralla, a san Pedro Claver con la saya* (Chambacú, you write the history, the history of the walls, written with blood, with the ink of pain, swearing the bodies of slaves, afar the wall, Saint Pedro Claver with robe). Manuel Zapata Olivella and Totó La Momposina tell a story of these evacuations as a continuation of colonial times and black racism. More recently, in 1978, the city government moved the public fish market from Getsemaní (part of the colonial city) to Bazurto (away and invisible from the wall) (García Ruiz 2017).

In the last two decades, the construction of buildings and hotels at the shoreline closed the pathways for some fishers to the sea—beaches in Colombia are public (art. 9 Law 9 of 1989), but not the private properties that fishers need to cross to reach the beaches. In places such as Barú and La Boquilla, hotels and the *Servicio Nacional de Aprendizaje*, SENA (National Training Service) sponsor the training of waiters, waitresses, bartenders, and masseurs. Some of the youth, sons, and daughters of older artisanal fishers feel that these are the only trainings available to them.

[35] *Corral* is the name of the housing for enslaved people in Cartagena. Pedro de Heredia conquered Karmairi in 1533. Cartagena de Indias became a military and inquisition fort and the main commercial and slave ship port for the Spanish kingdom in Nueva Granada. The slave ships came to Cartagena from 1533 to 1812 (two years after Cartagena's independence from the Spanish Kingdom). As smuggling was widespread, historians debate the estimated number of people who came to the continent through Cartagena (Gutiérrez Azopardo 1987). In 1851, President José Hilario López signed the abolition of slavery in Colombia. Palenques, towns of people who freed themselves from slavery, existed before the abolition. The Community Council of Islands claims the history of these Palenques and names Orika and Benkos Biohó, its town and main square in Isla Grande, after the names of the founders of San Basilio de Palenque.

Nowadays, non-industrial fishing is a practice enmeshed with tourism. Near downtown Cartagena, a few fishers gather early in the morning in Las Tenazas—men, pelicans, frigate birds, and women who sell fish at the Bazurto fish market. Around twelve men prepare the *boliche* net—six on each side. The men pull and close the net. The birds fly nearby. In about an hour, fishers dissipate—only to gather the next morning again. Fishers occupy the beach, daily, for a little more than an hour early in the morning. Most of the small fish caught with the nets go to the Bazurto fish market. Intermediaries sell them as a bait to fishers who catch more commercial fish with their nylons and sell their catch at the market. The commercial fish goes back to restaurants, hotels, and eco-hotels on the islands.

In February 2018, islanders from Tierra Bomba marched in downtown Cartagena. They said that *el mar se está comiendo la isla* (the sea is eating the island). According to the islanders, the northern and eastern winds meet in Tierra Bomba. The waves these winds create erode the shoreline. Part of the town of Tierra Bomba is already underwater—the locations of the crops and dance halls twenty years ago. The sea is flooding the cemetery. The bones and the clothes of the dead oscillate back and forth with the waves on the beach. Some islanders complain that the scientists who build protective walls do not listen to what they say about the winds and they end up building expensive walls that do not work. Walking across Tierra Bomba under the sun is harsh. Only a few trees provide shade and root the soil. The mangrove has been cut from the shoreline—which also contributes to erosion. People say that they need space to build. Most 25-year-old men already have many children. As the fish move away (see chapter 1), men from Tierra Bomba travel to the open sea to fish for months. The sea eats up some of those men too.

El mar se está comiendo la isla (the sea is eating the island), Tierra Bomba, March 2018.

The sea is also eating the Rosario Island (an intangible area within the nature reserve). Caves where *meros* from the continent used to come during the months of rain have disappeared (see chapter 1). Not only is the sea level rising, but the mangroves have been cut where the winds and waves meet, eroding the shoreline. Damasita, an eighty-year-old neighbor in Isla Grande, says that when she was young, her house was much farther from the shore. She says that she could walk to where the navigation buoys are currently located (200 meters away from the shore).

The tourist industry has reorganized and repurposed the physicality of the islands to fit increasing numbers of beach tourists and promises of wealth that come with them. In 2007, Carlos Durán published an ethnography called: *"¿Es nuestra isla para dos?"*[36] (Is our island for two?).

[36] Carlos Durán names his ethnography after a tropical song by Nano Cabrera. The song describes a small Caribbean Island as a paradise for two. It sings. *Voy a tejer un mundo a la medida, donde tú y yo seremos soberanos, una pequeña encantadora isla, de eternas primaveras y veranos. Bajo el ardiente sol de las pasiones, crecerá nuestro amor fuerte y risueño, y sin otras tareas y ocupaciones, velaremos por él con fe y empeño. La tierra del fuego será mimada por las aguas*

In his ethnography, Durán inquired about the dispute over tourism development on the islands. In 1984, the Colombian state claimed the islands as national property without recognizing the informal transaction of titles among black islanders and lighter skin newcomers that built recreational houses on the shorelines. In 2000, the state offered two alternatives to people with houses on the islands: pay rent or evacuate. The 2001 Territorial Ordering Plan of Cartagena included the project of a bridge across Canal del Dique and a paved road to Playa Blanca, Barú. These infrastructural projects aimed to incentivize tourism to a future resort complex. Islanders, who had sold their lands in the shoreline, organized and founded Orika,[37] a town in the middle of Isla Grande.

Around 2005, the anthropologists Lavinia Fiori and Carlos Durán accompanied and documented the creation of the first Community Council of Black Peoples of Islands to support the claim of a collective title—only recognized by the National Institute of Rural Development in 2014 over 100 hectares and 5,760 m² in Isla Grande. The Community Council and the collective title guaranteed the rightful permanence of black people on the island. An alliance of the nineteenth Community Councils of Islands is still claiming the legal recognition of collective *maritorios* that extend beyond the shore (see the introduction, chapter 1, and chapter 2).

---

del romance, y con el color de nuestros sueños, pintaré el cielo azul brillante. Y cantaremos. Eieieieia es nuestra isla para dos (I will knit a world to our measure where you and I will be sovereigns, a small and enticing island, of ever spring and summer. Under the hot sun of passions, our love will grow strong and smiley. Without any other tasks and occupations, we will look after our love with faith and effort. The land of fire will be spoiled by the waters of our romance, and with the color of our dreams, I will draw a blue and bright sky. And we will sing. Ey, ey, ey, ah, it is our island for two.)

[37] Orika was a maroon woman who fled from San Basilio de Palenque with his Spanish lover and former master. Her father, Benkos Biohó, captured Orika and her lover and killed them.

In 2007, *Parques* offered the administration of La Cocotera hotel, a recently expropriated recreational house, to the Community Council. From its beginning, the Council claimed a part in tourism development, primarily in the form of eco-/ethno- tourism. Some of the leaders, including Ana Rosa, built the first eco-hotels on Isla Grande. Ana Rosa built Las Palmeras eco-hotel with money she inherited from a woman who owned a recreational house that Ana worked in. Eco-hotels are primarily owned by the Council members and offer a lifestyle to tourists like that of islanders: no running water, no electricity, and limited connectivity. It is a lifestyle encouraged by *Parques* for purposes of conservation. It is also a lifestyle that prevents demand for infrastructural investment.

Murals at the entrance of La Cocotera Eco-hotel, Isla Grande, January 2018. The first mural portrays some of the leaders of The Community Council of Black Peoples of Islands. The leaders appear colorful, smiley, under an open sky, by the shore or perhaps in a boat, with a fishing boat in the background. The second mural portrays a slave ship. It shows the enclosure and bodies that take the shape of the crowded and confined space. The anchor ties the ship to a sea with coral, a place where people in the first mural smile under an open sky. It is unclear if the slave ship is on the surface or underwater (perhaps both). The mural of the slave ship does not have a clear horizon line or different colors that distinguish water or sky. The anchor is the only object in the mural composition that stands out. The anchor roots the portrayal of the slave ship to the island's ground, which is also the land where the Community Council claims an extension of the collective title on the surface and beyond the shore.

By 2019, ordinary life on the islands partially revolved around tourists. I lived in Palmar, one of Rafael Vieira's houses, in south Isla Grande. People who worked for the CEINER lab slept there. Deya, Tico, and their family lived in the house too. They took care of the house and offered lab workers dinner at night. During the day, Deya also worked for Lavinia, who built an eco-hotel next to Palmar. Around 6 am, the public motorboat picked people up at the harbors on its way to the Bazurto fish market in Cartagena. The eco-guides who worked at Lavinia's eco-hotel arrived early to bring seawater in buckets to flush the toilets. Miguel (El Tubo), El Caña, and many fishers

went fishing at 6 a.m. and returned to the islands around 10 a.m. to sell their catch in hotels (see chapter 2). Around 10 a.m., tourists started to arrive on the islands in various kinds of motorboats. Most of the tours were between 10 a.m. and 1 p.m. Mar Donalds offered lobsters to tourists in a motorboat, and many people from the Rosario Islands and Barú sold their handicrafts at the *Oceanarium* entrance and the big hotels. Around 1 p.m. most of the tourists came for a short stay in Playa Blanca (the largest beach in the nature reserve) on their way back to downtown Cartagena.

In the afternoon, Carmen, a fisher, sold her handicrafts in the Erizo hotel in Isleta. Damasita walked to the enclosed Bora Bora hotel to sell *cocadas* (sweets made with coconut). The eco-guides stayed in Lavinia's eco-hotel waiting for tourists to pay them as guides. Some tourists walked towards Playa Libre, the largest beach in Isla Grande. On that beach, people from the Rosario Islands and Barú offered food, handicrafts, and guides. Around 6 p.m., eco-guides and some tourists walked and canoed to the Enchanted Lagoon to watch bioluminescence.

In 2016, the northern part of the island had more fences than in other areas. The north is where big hotels and eco-hotels, the Enchanted lagoon, and Playa Libre are located. It is also the most touristic and remote part of the island, furthest from Orika. By 2019, I noticed that there were many more restaurants and businesses in Orika. I also saw more fences towards the South, including the one that enclosed Bora Bora, near Palmar. I heard the electronic music coming from Bora Bora Hotel all day, in contrast to the Champeta[38] music played with *picós* (peak-up speakers)

[38] Champeta is a musical style that derives its rhythm from *Terapia Africana* (African therapy music). Lizeth García Ruiz (2017) argues that Champeta music has been long associated with low-income neighborhoods in Cartagena and their residents called *champetúos*. Until very recently, the term *champetúo* has been used in Cartagena to refer pejoratively to "lower-class" people. It is unclear whether the genre takes its name from the knife used to scale the fish (*champeta*). However, no one denies its association to the Bazurto fish market, where the first *terapia* acetate disks circulated. García Ruiz (2017) argues that champeta has become more commercial in nightclubs in downtown Cartagena in the last decade, without these places being more welcoming

in *kasetas* (open and public) in Orika from Thursday to Sunday. The sound of Champeta mixed with the loud sound of the power plants.

Everyone benefits from tourism somehow, including people who are the most critical of tourism on the islands. For instance, El Gallo feels that tourists underwater mess with his fishing. If it was not because of the tourists, El Gallo could fish for longer. He complains because he does not see where the money the tourists pay to enter the reserve goes. According to him, the "big" benefits the most, whereas the "small" continues "small," making enough money to buy food and fresh water for another day. Although El Gallo identifies with the small, he also benefits from tourism. He sells some of his fish in La Cocotera, where his wife works as a cook. His son is a cook in Bora Bora Hotel. In addition to fishing, El Gallo (The Cock) takes his name after the cocks he trains to fight. In the afternoon, he sits under the shade of a Neem tree in the Benkos Biohó square to train his cocks. He earns a percentage of the bet when one of his cocks wins. The bet rises when the tourism business goes well.

Although *Parques* and the Community Council also benefit from tourism, the bridge and the paved road to Barú have made controlling of the number of tourists who visit the islands more difficult. Some delegates of the Corals of Rosario and San Bernardo Nature Reserve feel frustrated because the city government sells archipelagos as a beach, rather than as a subaquatic nature reserve. Ever de la Rosa, the Community Council's legal representative, also feels that the government of Cartagena promotes tourism without considering how the Community Council should respond to the increasing number of tourists. The Community Council has created tours

---

to *champetúos*. As opposed to *kasetas,* nightclubs in downtown Cartagena are enclosed and reserve the right to deny people's admission.

within the mangroves and walks across Isla Grande, but most tourists visit the islands looking for some sunny and paradisaic beach time.

With the increasing number of tourists moving back and forth in noisy motorboats, the big fish moved away. Other fish, such as small wrasse fish, learned to eat bread and limestone algae from the hands of guides and tourists. The colorful and safe parrotfish eats algae and poops beach sand. The fish at the exhibition and in the assisted reproduction program in the *Oceanarium* get fed with *ranfaña*, small fish trapped in fishing nets. The Community Councils claim more land, and many families ask for their right to build more houses (likely more eco-hotels) as the sea eats the islands and washes the beaches away.

Rebusque complicates fixed and bounded identities

Fishing with *trasmallo* (a net) in between Bocagrande and Tierra Bomba islands. The picture was taken from Tierra Bomba, high and white hotels rise in Bocagrande. March 2018.

Rebusque (searching again) is a local expression that names a way of making a living by working on multiple activities as they become available. *Rebusque* guarantees fast access to money, which is rapidly spent. *Rebusque* money buys food and fresh water, pays for doctors and universities in

the city, buys beer and bets in *picós* and cockfights, and pays for the materials to build an eco-hotel on the islands. Because *rebusque* money is rapidly spent, people need to look constantly for more activities to make money. In *rebusque* terms, no one is ever only a fisher, a tour guide, a motorboat rider, a cock trainer, a builder, a cook, a crafter, a gardener, a farmer, etc. Most of the people in the Rosario archipelago do multiple things at once. People do what they like, what they think they could do, and what offers the most reliability.

Some eco-guides describe guiding tourists as easier than fishing. According to some eco-guides and artisanal fishers, *uno no se desgasta tanto* (guiding tourists is harmless) whereas fishing under the sun or overnight can be exhausting. Although fishing may be more physically demanding than other activities, fishing *saca de mucha dificultad* (fishing takes you out of difficult moments). For this reason, some people prefer doing other things, and only fish as necessary. Some older fishers who cannot imagine themselves without fishing also do other things that bring them more stability. For instance, Cosito and Cidi take care of a recreational house in Isleta. Cosito fishes sometimes because their salary is stable but they need more money to send to their daughter who is studying in the city. They must constantly send her money for her tuition, rent, food, and transportation. In 2019, Libinston (one of the most renown fishers in the Rosario archipelago) and America (sister of Carmen and Tomasita) moved to Isleta to take care of a recreational house as well. Like Cosito, Libinston goes fishing only sometimes now.

Rarely a family lives only on one activity. For instance, El Lati fishes because he thinks that he cannot do anything else in his sixties, and La Cuca, his wife, works as a cook in the Erizo hotel. According to El Lati and La Cuca, the youth should not only fish. Fishing is not only hard under the sun and over the night. It is increasingly difficult with the conservation restrictions, fish moving away and dying off (see chapters 1 and 2), and cheaper frozen fish sold in the Bazurto fish

market (see chapter 1). At the same time, fishing may be hard, but it is a reliable option, especially when the tourists do not come, like during the COVID-19 pandemic.

Some of the subaquatic eco-guides have never entirely quit fishing. Some eco-guides are also builders and crafters. Some fishers fish, farm, and host tourists in their homes. Some people cook, clean, and do other things too. *Rebusque* is a way of making a living by doing one thing AND the other AND the other, AND AND AND. People who live doing *rebusque* do not rely on a single activity. Paraphrasing Suar, an eco-guide and fisher, people may always find a way of making a living doing one thing and the other and the other.

Although people do many different things, such as cooking, cleaning, training cocks, organizing *picós*, and fishing, these activities may be more profitable with tourism. Some of the skills and materials also transfer across these activities. For instance, many motorboat drivers are from Bocachica, the island of the most renown fishers who travel to the open sea on journeys of multiple days and weeks. Some motorboat drivers started moving tourists back and forth from the city to the Rosario archipelago with one motorboat and now they own dozens.

Some of the stories of black entrepreneurs carry underpinnings of anti-black racism and capitalist-driven distributions. As part of one of the school activities that I joined, senior students divided into small groups to trace the histories of the different sectors of Isla Grande. My group explored Boca Ratón—the location of Lizamar hotel, owned by La Negra Eliza. She said that a few decades ago, she tried to participate in Las Balleneras—a party in motorboats which is part of Cartagena's Independence celebration. No one let her in a motorboat because she was black. She is now an entrepreneur with dozens of motorboats and a hotel in Isla Grande. When the motorboats approach the San Rafael colonial fort, the guide usually tells tourists in a joyful tone that sharks

do not eat black people anymore, but foreigners. Then the guide asks some of the nationalities of people in the motorboat.

Rebusque is one of the ways that tourism development distributes its benefits. However, El Gallo's insights are also important. For some people, *rebusque* is a way to buy food and fresh water for another day. Not everyone on the islands can afford to buy a motorboat or the materials to build an eco-hotel. Not everyone has access to Booking.com or Airbnb to promote their eco-hotels to international tourists. As only some people's income improves, the differences in how people benefit from tourism development become noticeable within members of the various community councils.

Situating coral restoration in a specific place may contribute to slowing down the urgency of reproductive futurism to consider the process of restoring corals as more than coral repopulation. For instance, an anti-colonial and egalitarian practice of coral restoration may ask: How do we not perpetuate a logic of displacements and emplacements in the development of the World Heritage City under-water? How may coral restoration nurseries and outplants meet *maritorios* in a way that advances anti-black racism in the archipelago? How could coral restoration practioners listen to islanders who have ideas about walls that could work to prevent the sea from eating the islands? How may coral restoration involve and benefit those who only make enough money to save a day worth of food and fresh water? How may coral restoration benefit from the multiple skills of people who are never only artisanal fishers, but who are also builders, crafters, artists, farmers, and eco-guides? How may coral restoration become a school for eco-guides and for underrepresented black marine scientists? By asking these questions, I want to open a conversation about coral restoration as a technoscientific practice that is deeply informed by the histories of a place and its peoples.

In the next section, I will expand on socio-materials that intermingle and linger in the oceans and lifeways of coral, fish, islanders, and visitors. Food and drinkable water arrive at the islands packed in plastic from the city. Some plastics return in *bongos* (large ships), some plastics go to the mangroves, some islanders incinerate plastics in different spots across Isla Grande, and some plastics become handicrafts sold to tourists. As *bongos*, vessels, cruises, motorboats, and ships travel back and forth to seaports and to the Mamonal petrochemical center in Cartagena, various chemical substances leak, move, suspend, and precipitate in the sea curtain. Reef futures are hard to map into the present reefs and changing climates. Coral and other marine animals eat, drink, and live with biochemicals. Dwelling into imperceptible stressors for climate change science may open opportunities for coral restoration to imagine and actualize reef futures otherwise.

Across techno-sciences

Indeterminate temporal horizons and opacities of changing climates

In this section, I keep exploring and situating coral restoration in an archipelagic place, this time through the lens of plastics and other lingering chemical materials and their afterlives in the Cartagena Bay. I am interested in the lingering lives of these industrial chemicals as they travel, flow, penetrate, get stuck, leak, blow, are ingested, accumulate in trophic chains, block, injure, off-gas, and become part of the flesh of living organisms. I am also interested in their different decomposition temporalities that vary between decades and hundreds of years, which also means that their afterlives are unknown. I wonder how as these material temporalities come together, the temporal horizon of coral polyps ingesting industrial chemicals and the reefs that these polyps create remain undecidable. Perhaps, if microplastics block coral polyp's sac, these polyps may never reach reef futures. These industrial chemical realities maybe imperceptible through the lens

of changing climates. However, they are relevant to coral restoration's attempt of prolonging corals' lives into reef futures.

Valeria Jiménez Cárdenas, who was an intern at the CEINER lab during my fieldwork, studied plastic bioaccumulation in fish samples caught in the Rosario archipelago and sold in the Bazurto fish market. Jiménez Cárdenas (2019) points to some of the possible origins of the plastics and some implications for fish. The most abundant polymer is polyester (especially, Tencel). Polyester is part of the fiberglass resin used to protect motorboats from the humidity and Tencel is part of the fibers in textiles. Other polymers are PVC (used in various packages and coral restoration structures), PET (used in plastic bottles), and polyethylene (used in plastic bags and sterile and disposable materials in the lab.) These polymers linger, leak, and flow in the ocean from 40 years (in the case of PVC) to 450 years (in the case of PET and polyethylene). In addition to the various material temporalities, these materials shift properties, and they include a variety of toxic chemicals. Some plastics, such as PVC, endure less, but they are full of toxic chemicals.

Based on Jiménez Cárdenas (2019), the accumulation of mesoplastics, microplastics, and nanoplastics can have the following effects on fish. Plastics can accumulate, block, and injure gastrointestinal cavities, which can lead to malnutrition and starvation. In females, plastics can lead to ovulation delays and reproductive failures. In addition to moving away (see chapter 1), fish may be also dying off from plastic accumulation in trophic chains.

These descriptions are not that different from those of scientists who study coral's ingestion of microplastics. Rotjan et al. suggest that: "Although a wide variety of taxa have been documented to ingest microplastics, the consequences of microplastic ingestion have not yet been fully explored.… The consequences of microplastic ingestion evidenced by our study include retention of particles in the wild, preference for non-nutritive prey, potential limitation and inhibition of

feeding on nutritive prey, and potential for microplastics to vector novel or pathogenic microbes." (Rotjan et al. 2019). In addition to the evidence documented by Rotjan et al. (2019), the ingestion of microplastics may be doing more things on coral polyps and reefs that have not been yet studied and documented by coral scientists.

Kim De Wolff (2017) describes how plastics become part of the lasting sea biology as eggs, bacteria, and many plants and animals come to live, travel, and move together with plastics. In De Wolff's words: "the plastic fragments are not only superficially attached to their outsides or temporarily ingested through their insides. Stuck to soft bodies, like a grain of sand in a pearl oyster, plastic bits can be completely enveloped into gelatinous flesh." (De Wolff 2017: 29). Imagine microplastics becoming enveloped into the jelly flesh of coral polyps, coral spawn, fish, residents, and tourists.

Another intern, Maria Fernanda Rosas, came to the CEINER lab to work on a research project that looked at the possible traces of mercury in the fish diet of dolphins at the Oceanarium. She wanted to investigate the effects of the consumption of mercury in these dolphins. However, it was hard for her to methodologically design research she could pursue in the three months she was going to spend on the islands. Her research switched to study the bioaccumulation of methylmercury in the livers of ten species of fish widely caught and consumed in Cartagena, including the Rosario archipelago. Initially, we thought she could ask fishers to save the guts of their catch for her. However, that initial idea of collecting the samples directly from fishers was unsuccessful. Most of the fishers forgot and threw the guts into the water. Some fishers were not able to keep the guts frozen until Maria Fernanda could find transportation to pick them up. Also, Maria Fernanda needed more information for her study: the species, the size of the fish, a

description of the color and texture of the liver, the sex of the fish, and a picture. She needed to be present to collect not only the livers, but also the identifying data.

Considering this, Maria Fernanda and I thought that it could be easier to collect the samples in the Bazurto fish market (a strategy later used by Valeria Jiménez Cárdenas too). El Cosito, from Isleta, suggested reaching out to Robert, who buys the fish from fishers from the Rosario archipelago and sells fish at the Bazurto port. Robert introduced us to the people who scaled the fish with a *champeta* (a sharp knife), and in the same table where fish was scaled, Maria Fernanda took the measurements for her study.

Rosas Corona et al. (2019) found that the average concentration of methylmercury in the livers of the ten species of fish in the Bazurto fish market was superior to the permissible limit, according to the Joint FAO/WHO Expert Committee on Food Additives. According to the Joint FAO/WHO, this high concentration of methylmercury could produce neurological disorders, tremors, and muscular disabilities in humans. Rosas Corona et al. (2019) found that the fish family *Holocentridae* bio-accumulated the most methylmercury in the muscles. Based on my fieldwork, this fish coincides with *carajuelo* (long spine squirrelfish). This kind of fish is relatively more abundant, an easy-catch *liga*, and a noncommercial fish—which means that islanders more than tourists eat it in soups called *vivo de pescado* (see chapter 2). In other words, people who eat *carajuelos* as their *liga* may be more exposed to methylmercury in their food. This uneven distribution of chemical exposures is unintended by the fishers, the tourists, or the various polluters, but it represents an accentuated burden on islanders who eat *carajuelos* on a regular basis.

Most of the research on methylmercury emphasizes public (human) health. Research on the effects of methylmercury bioaccumulation on fish is rare and I have never heard of any similar

study on coral animals. In any case, fish are food for humans, and they are also the equivalent of pollinizers for coral reefs. Many scientists still debate whether fish can or cannot feel pain (Balcombe 2016). My interest is not to dig into those debates. For a moment, I invite you to embrace the idea that fish may suffer from tremors and muscular disabilities. What might it mean for fish, for coral, and for reefs too?

I borrow inspiration from Michelle Murphy's concept of alterlife to think through coral reefs in the process of restoration in a shared industrial milieu. In Murphy's words: "Alterlife names life already altered, which is also life open to alteration… Alterlife is a figuration of chemical exposures that attempts to be as much about figuring life and responsibilities beyond the individualized body as it is about acknowledging extensive chemical relations" (Murphy 2017: 4). Their concept of alterlife acknowledges chemical exposures as conditions for eating, drinking, and living. It is a concept that bursts open categories of individual organisms and calls attention to "a shared, entangling, and extensive condition of being with capitalism and its racist colonial manifestations" (Murphy 2017: 5). Industrial and chemical exposures are conditions for eating and living for contemporary coral polyps. Understanding these chemical exposures as a shared, entangling, and extensive condition for visitors and residents in Cartagena bursts open discrete categories of speciation in biodiversity accounts. It offers a view of species as groups without sealed borders. It unsettles human/non-human, organic/non-organic, perceptible/imperceptible distinctions. Furthermore, based on my fieldwork, I have learned that the lingering life of industrial chemicals in Cartagena is an unevenly shared condition. The unevenness of the exposure may be only partially intended by capitalist and racist designs, as it is also mediated by different fish's bioaccumulation processes.

Bio-industrial altered ecologies include plastics and chemicals inseparable from flesh. The United Nations reports unprecedented and accelerating species extinction rates since gas emissions have doubled in the last four decades.[39] While around one million animal and plant species are threatened with extinction within decades, the temporal frame of biochemicals exceeds the anticipation of extinction in the next decades. Biochemicals leak and do things far beyond the moment they are dumped into the water. They may become more easily perceptible as islands of trash (the afterlife of certain modes of consumption). Trash underwater is also food whose evidence some scientists and artists find in open dead bodies.[40]

It is perhaps odd and more difficult to imagine how these materials become part of contemporary coral lifeways. Various temporal materials may endure in warmer and more acidic seawater, surpassing the temperature threshold for corals and humans. Perhaps, temporal undecidability may urge us to reconsider an orientation in coral restoration, from numbers of fragments to colonies, growth rates (see chapter 2), and how to grow corals in specific places where living with industrial chemicals is a shared condition.

Suspending risk-assessments and damage-centered research

Artisanal fishers, who do other activities too, are more frequently held responsible in risk-assessments for what some do (such as blast fishing) and for things that go far beyond what they do (such as the bioaccumulation of methylmercury in some fish more than in others). In Cartagena,

[39] A summary of the United Nations report is available at: https://www.un.org/sustainabledevelopment/blog/2019/05/nature-decline-unprecedented-report/ Last accessed October 2021.

[40] An example of this is *Albatross*. This film, released in 2018, is an open access documentary by the director, writer, and editor Chris Jordan. *Albatross* documents ocean plastic pollution on a tiny atoll in the North Pacific Ocean. Chris Jordan and his team photographed and filmed thousands of birds dead on the ground, their stomachs filled with plastic.

fishers have been held responsible for fish, not only in terms of their biodiversity loss in the nature reserve, but also as food, as artisanal fishers commercialize fish for human consumption. While fishers are constantly held responsible, the responsibility of the petrochemical center is erased. Neither artisanal fishers nor I claim innocence from artisanal fishing's techniques and catch. Rather, I am interested in how technoscientific frameworks that inform policymaking shape socio-material relations in Cartagena through studies and recommendations.

El Gallo goes fishing early in the morning. He takes his canoe and nylon lines and travels as far as his canoe and winds allow. El Gallo prepares a plastic bag—smaller than the size of his hand. He packs gunpowder. He inserts a little plastic straw, rolls everything together, and ties the ball with a green string. As he gives shape to the ball, he says that he disagrees with the fact that *los que tienen porque son quienes son, se sienten con la autoridad de tirar un poco de turistas al agua y dañar la pesca* (who have because of who they are, feel authorized to throw many tourists into the water and to screw fishing). Briefly, after saying this, in a shallow sandy area, he throws the explosive. Only a few seconds after, I hear the blast and see the silvery bodies of sardines floating to the sea surface.

Quietly, El Gallo uses his worn-out fins and mask and enters with a mesh into the water. He carries the fresh sardines into the boat, he asks me about what I do at the *Oceanarium*. As I talk, he rolls the nylon line, ties two hooks, and puts three sardines on each hook. He passes the nylon roll to me. The string unrolls until it hits the sea bottom. The first time I pull the nylon line, it gets tangled in the boat. He corrects my position. As I pull the nylon, the line should fall towards my right side as a right-handed person. El Gallo reads the tension in the string and offers instructions. I do not remember seeing a fish of a size longer than my hand. El Gallo says it might be because it is around the full moon, and the bigger fish hide in the deep. At one point, I feel a

strong pull. El Gallo helps me, and he says that it must be a *mero* (a giant grouper). The line entangles in a rock, the fish eats the bait and leaves.

Many times, when I talked with El Gallo, I felt he repeated himself. He would say: *El grande sigue siendo grande y el pequeño pequeño* (the big one continues big, and the small one small). It seems to me that he identifies as the small—as those who sell their motorboats to afford health care in Cartagena. Back in Palmar, Tico said that if *Parques* caught me with El Gallo in his canoe, I would be in trouble. Chiqui, 15 years old at the time, offered to teach me how to fish with a nylon line without gunpowder. Not all artisanal fishers use gunpowder to catch sardines, the primary bait in nylon fishing. Some fishers fish their sardines with nets (a technique that is also not allowed within the nature reserve) and others buy frozen sardines in the Bazurto fish market (some of which were caught with *boliche* nets in Las Tenazas near downtown Cartagena). Some fishers buy the sardine because gunpowder can be dangerous and many fishers have lost their hands and fingers while manipulating the explosives. I find that El Gallo narrates a story of himself that in part aims to legitimize his doings. Tico's fears and Chiqui's judgements of El Gallo's fishing is harsher than anything I heard of them as it regards to any other activity. These judgements are not only Tico's and Chiqui's, as I heard them multiple times on the islands. These harsh judgements are the judgements of *Parques*, coral restoration practitioners, and many islanders.

When Maria Fernanda asked me to introduce her to some artisanal fishers who may collaborate with her on her project, I first thought of Damasita, the partner of Miguel, mother of El Caña, and grandmother of many fishers. Damasita was a fisher herself when she was young. But as soon as Maria Fernanda explained her research, Damasita turned defensive. She said that if the fish that islanders had eaten for all those years was bad, they would have been sick or dead

already. She said that similar studies had been used against artisanal fishing in Cartagena and she was not interested in participating in something like that. Maria Fernanda and I had to reframe her project for fishers to consider it. The first time we visited Robert in the Bazurto fish market, he also asked about our employers and what we would do with that information. We had to emphasize that we were students and that the research was exclusively a biological study.

My father, who worked with fishers in the Cartagena Bay in the 1970s, helped me to find some of the studies that Damasita mentioned. I found that studies of public (human) health have overly emphasized artisanal fishing as the source of fish for human consumption. At the same time, industrial connections have disappeared. Cartagena is not only a leading tourist destination—it is also the most important commercial port and petrochemical center of the country in the Caribbean.[41] Until recently, the debates about pollution in the Cartagena Bay have focused on preventing the human consumption of fish caught by artisanal fishers rather than holding the polluters responsible and discussing how to remediate the sea.

In 1975, a retired Captain of the Navy noticed a strange behavior in gannet birds that fished in Bocagrande. They crashed against the walls. He sent samples of the dead gannet birds to a lab to find out what might be happening to them. The study showed that these birds had high concentrations of mercury in their bodies. The retired Captain alerted the Colombian environmental government agency and the Ministry of Health. Further studies showed high concentrations of mercury in fish and mollusks. The national government banned artisanal fishing and the commercialization of fish products. One of the concerns of many artisanal fishers was how

[41] According to Ripoll Echeverría de Lemaitre and Báez Ramírez (2001), the Cartagena petrochemical center in Mamonal developed around the first industrial port and oil refinery around the 1920s. The oil consortium fostered the urban development of Bocagrande (where many hotels are located) and the expansion of Cartagena towards Pasacaballos (Barú Island).

to make a living. They said they would rather live polluted than die of starvation. Artisanal fishing became increasingly difficult because of the precautionary measures that have not stopped fishing, but rather have contributed to its stigmatization.

In 1981, the National Association of Fishers sued Alcalis de Colombia, a state company based in Mamonal (the petrochemical center in Cartagena), for leaking mercury into the Cartagena Bay. Only in 1999, the Supreme Court ordered the company to compensate 187 fishers from Tierra Bomba, La Boquilla, and various neighborhoods in the city (including El Bosque, Torices, and Getsemani). The indemnification to individual fishers by the company had a clause that maintained a condition of deferral of seawater bioremediation for a few decades. Similarly, in 1989, Fundepúblico law firm sued the Dow Química company for leaking Lorsban in the Cartagena Bay. Lorsban is a large spectrum insecticide, which means that it is used to control a large variety of diseases in different crops, such as cotton, corn, and coffee. In 2015, the Constitutional Court (T-080/15) ordered the company to pay the Cartagena government and the local environmental agency (CARDIQUE) for the remediation of the Cartagena Bay. The idea of remediation is quite different from "cleaning up" because these industrial chemicals endure over time. They cannot be eliminated, shuffled, or fully captured.

In Damasita's refusal to participate in another study about mercury in Cartagena, she references her body as a measure of the "badness" of fish, based on her perception of her health and her long life in the aftermath of the studies in the 1970s. Perhaps, she measures her health in comparison to what those studies describe as sickness based on traditional linear models of exposure. According to those models, the symptoms consistently get worse as the exposure increases. Then the symptoms become reference to exposure and managers determine a permissible level of pollution. Other models offer other analytical tools to think of chemical

exposure and symptoms. For instance, Theo Colborn's endocrine disruption hypothesis suggests a U-shaped dose-response curve implying that a peak of responsiveness may occur at a low exposure, as it increases, the feedback system shuts down and adverse effects increase again at higher exposure (Wylie 2018: 61). In this alternate model, Damasita's health may deteriorate as a response to an indeterminate increase in exposure. Maybe she would have a different perception of her health and the "badness" of fish if she had other models of chemical exposure in mind, or if those models accounted for people like Damasita, who are willing to endure more damage.

Damasita claims no innocence. She knows her catch is polluted and that artisanal fishing and tourism contribute to pollute the seawater with plastics and other chemicals too. In the 1970s and today, polluted beaches and fish may not be appealing for tourists. This information does not appear in the webpage of Cartagena de Indias, World Heritage City. It is also not of interest of Damasita to contribute more information about it. No one pays Damasita for her silence. Damasita knows that those studies could harm fishing and tourism too. Likewise, Damasita has never suggested that the seaport and petrochemical storage and shipment should cease until the remediation of the seawater and fish is completed.

I embrace Michelle Murphy's (forthcoming) invite to think of industrial chemicals as extensive relations. By this, they mean relations that are systematically harmed by chemicals and demand chemical exposures as conditions for eating, breathing, drinking, living. I would add that these relations demand exposure and pollution too, as in the case of artisanal fishing. I think of these chemical relations as they build upon and literally penetrate socio-material relations in Cartagena. Industrial chemicals become imperceptible in studies that prioritize climatic stressors as an analytical lens to think through coral reefs. Chemicals disappear from the anticipation of stressors and the actualization of reef futures in the nurseries. This imperceptibility fails to account

for more than climatic stressors that may compromise coral restoration's attempt to prolong coral lives in the oceans. The imperceptibility of chemicals in coral lifeways prevents other research questions and demands on coral repopulation.

Despite the differences "across" chemical studies and coral restoration, these technoscientific studies converge in risk assessments in which artisanal fishing turns into a manageable risk. In contrast, the petrochemical center appears inevitable within what Max Liboiron (2021) calls a "permission-to-pollute system." In the case of coral conservation and restoration, the damage that artisanal fishing could cause on coral reefs is overly emphasized as other connections do not appear. Coral bodies can only be blasted and razed, but not blocked, injured, and altered from inside out. In mercury studies, the bodies of birds, fish, mollusks appear polluted and damaged. Biomedical and public health research present a similar idea about the bodies of artisanal fishers, who also carry the burden of their catch and consumption as a risk for humans. According to those accounts, fishers should stop fishing cast out food. I say food because food is the target of concern more than fish', mollusks', and birds' lifeways.

Drawing from Indigenous feminist Unangax scholar Eve Tuck, Michelle Murphy calls for "suspending damage" by refusing to participate in risk-assessments and damage-centered research (Murphy forthcoming: 16). Murphy asks how to refuse these habits in technoscientific research and calls for alternate types of research. Infused by these reflections, I imagine how coral restoration could suspend damage-centered diagnostics and policy recommendations. Also, how it could experiment with an alternate type of intra-penetrating restoration made to affirm artisanal fishing, hold polluters responsible, and embrace coral polyps', mollusks', fish's, birds', and people's lives with industrial chemicals. How might these intra-penetrated lives ally and remediate

a shared livelihood? Maybe, we can start by challenging the inevitability of petrochemical centers and industrial pollution.

To end this section, I invite you to immerse with me in the seawater of Cartagena. Jump in. With the winds, feel how mixed water and sediments penetrate through our porous skin. Dive in. With each push of fresh water and suspended matter, feel how multiple substances leak, runoff, mix within, and get encapsulated into our flesh, becoming us. Feel how we penetrate the water as the seawater eats us, the islands, and the sand. Once more, imagine a coral polyp's permeable tissue constantly becoming otherwise. Imagine yourself, suspended in the sea curtain: Could you envision coral restorations with, against, and across techno sciences in a sea with an unknown future and no worse moment to arrive?

Intra-penetrating restorations

When I hear some coral restoration practitioners talk about large crops, I imagine enclosures and further regulations on the mobility of people. I wonder if those massive coral crops may naturalize the logic of evacuation and restrictions on the land access and underwater spaces. I wonder if securing investments and increasing profitability may also naturalize the little public funding for coral restoration and reef futures as only possible through the blue economy.[42] Who may pay the costs of the next generation of bio-synthetic corals? With the concept of *intra-penetrating restorations*, I play with the idea of restoration and intra-penetrating to suggest that coral, and other

[42] Blue economy is a concept coined by the World Bank. It refers to the profitable "sustainable use of ocean resources for economic growth, improved livelihoods and jobs and ecosystem health." It encompasses fisheries, aquaculture, marine biotechnology and bioprospecting, extractive industries, desalination, renewable off-shore energy, maritime transport, waste disposal management, ocean monitoring and surveillance, ecosystem-based management, carbon sequestration, as well as financial mechanisms, such as blue bonds, credits, and markets (World Bank 2017).

socio-material relations, may need to go through a process of restoration. By which, I mean that coral restoration may need to consider co-enabling conditions for edible, drinkable, and lively coral reefs. It may imply bursting open coral restoration so that it becomes a shared and extensive restoration work through colonial and industrial developments.

In this regard, I find the reflection of the Métis feminist scholar Max Liboiron on the method-ethics of the Civic Laboratory for Environmental Action Research (CLEAR) in Newfoundland provoking. Their work pushes me to ask how coral restoration practitioners could work against scientific premises of universality, which assume a right to massive coral crops when so much scientific training is based on authorizing knowledge? Liboiron suggests: "Every morning when I put on my lab coat, I have decisions to make. How will we do science today?" (Liboiron 2021: 113). Liboiron and researchers at CLEAR focus on process-oriented protocols. In science, protocols are scripts to keep experiments replicable and findings testable. In ceremonies, protocols are guidelines for conduct. Liboiron puts these ideas together and conceives of CLEAR's protocols as open enactments of their values and guiding principles on how to know, how to teach, and how to learn. CLEAR studies plastic pollution in fish as food for human consumption. Some of the guidelines in CLEAR's protocols include paying full attention and respect to fish samples, from manipulating the fish's bodies to showing curiosity for where they came from. These modes of engagement and respect imply that "You don't have to be kin with fish (though some of us are), but neither should you be thinking of the fish primarily as a scientific object" (Liboiron 2021: 123).

There is no such thing as waste; guts go back to the water, which means not using chemicals that require hazardous disposal. CLEAR thinks hazardous waste is antithetical to their attempt to mitigate pollution. It assumes access to Land as a sink. The decision not to use potassium

hydroxide (KOH) to dissolve shells limits their ability to study bivalves, crustaceans, and other invertebrates for plastic ingestion.

CLEAR suspends risk-assessments and damage-centered research to foster alternative research. Liboiron cites O'Brien suggesting that instead of asking, "How much hazardous waste can be burned without raising the cancer risk to nearby residents by more than one in a million, or one in a hundred thousand, or perhaps one in ten thousand?... One could ask (instead), What alternatives do we have to the industrial use of chlorine, which results in the placement of dioxin in an unborn embryo's tissues? What alternatives are available to reduce toxics use and generation of hazardous wastes and eliminate the making of cements by burning solvents and other toxics?" (O' Brien 1993, as cited in Liboiron 2021: 132-133).

CLEAR thinks of incommensurability throughout their protocols, which means that things do not share a "common ground for judgment and comparison" (Liboiron 2021: 136). It leads Liboiron to ask: "If anticolonial sciences eschew universalism in favor of place-based methods, where does that leave the ability for knowledge to work outside of the place of its creation? How do we make a nonuniversal science trustworthy and useful in more than one place? Sometimes it simply does not happen and that's fine—even good" (Liboiron 2021: 152).

Protocols are an ordinary tool at the CEINER lab. They are already enactments of values and guiding principles on how to know, how to teach, and how to learn. I have witnessed the attention and respect of coral scientists towards their fragments, colonies, and spawn. Dead fragments, unused spawn, and coral recruits go back to the sea. Something I think can be worked on more during the training of marine biologists is a sense of curiosity for the place where the samples come from, which is different from a location. The idea of place I have covered in this chapter speaks of the living pasts that shape the physicality and social relationships in the

archipelago today. Within living pasts, I include lingering and enduring industrial chemicals. Conservation advocates do not need to share other sea compositions (although some do) (see chapter 2), but it would do well to acknowledge and show curiosity for diplomatic purposes in the archipelago. Perhaps, attending to place may help coral restoration practitioners to perceive more connections implied in coral reefs in Cartagena, including in industrial developments.

Coral restoration scientists could suspend risk assessments and damage-centered research to allocate resources and energy to alternative assessments. For instance, instead of asking, how much has coral coverage decreased in a year? Or how many hundreds of coral colonies are ready for outplants? One could ask, what alternatives do we have to the industrial use of polyethylene and PVC in the coral restoration lab? What alternatives do we have to challenge the inevitability of offshore exploitations, petrochemical centers, and industrial pollution? What alternatives do we have to the logic of evacuations? How do we advance anti-black racism through coral restoration protocols? How do we grow permeable walls that welcome the seawater flow without eating the islands? How may coral restoration benefit from the multiple skills of islanders? How could coral restoration become a school for underrepresented black marine scientists? These questions might, in turn, limit the ability of the CEINER lab to scale up coral repopulation fast. I do not think that the lab as it currently works can eliminate polyethylene or PVC with the funding available. However, by working on these questions, the lab could experiment with alternatives and test how coral restoration can also be otherwise.

Liboiron thinks that incommensurability in place-based research eschews the ability for knowledge to travel. For them, sometimes nonuniversal science is not useful in more than one place, and "that's fine—even good" (Liboiron 2021: 152). As much as I agree that place-based research might not travel, some of the alternatives may raise curiosity about how things can be

done otherwise. For instance, if CLEAR, another marine biology research lab, can find alternatives to the industrial use of chlorine, what are those? Could those be tested in our lab? What other alternatives can be found that are appropriate to our lab's values?

The concept of *intra-penetrating restorations* takes the idea of restoration as used by coral scientists in the archipelago. My understanding of this concept is that it names a rehabilitation or remediation of ecological functions more than a rehabilitation of past coral reefs. In other words, it is a process to restore ecological functions instead of replicating reefs. I remember scientists at the CEINER lab did not talk of restoration alone, but they added "process of" before. This emphasis on the process implies that restoration does not end in an increasingly stressed sea.

Although the word restoration might be deceiving, I think the word follows a genealogy in forest restoration. One of the main tools across forest and coral reef restoration is the nursery, which is the place that facilitates conditions for growth. *Intra-penetrating restorations* allow me to converse directly with coral restoration scientists about the specificity of place and technoscientific milieus. I have attempted in this chapter to permeate coral restoration with questions about knowing, teaching, and learning how to grow corals in nurseries. In the next chapter, I turn the nursery into a progressive verb, nursery-ing. By doing so, I continue a reflection of intra-penetrating archipelagic lifeways and technoscientific milieus. In a way, the next chapter speculates what kind of nursery-ing can foster place-based and process-oriented coral restorations across aquaculture and other practices of growing fish and plants in the archipelago.

INTERLUDE

A Reflection on Personhood and Punishment in the Rosario Archipelago

Through the Lives of Dog Islanders

My eyes touch and bark,
our steps are not only of feet.

With dogs,
all guardians,
some friends,
I have
run and swum.

Partners of houses,
pathways,
and seas.

With you,
I dream societies,
in which disobedient persons
are not condemned to death traps

Societies,
where killing to destroy,
it is impossible
because of unthinkable.

Societies,
where you are welcome to assemblies.

With you,
perhaps,
we learn other ways.

We have spoken many words.

July 2018

***

Búscalo, Tommy, and Booking, Palmar, Isla Grande. Photograph by Maria Fernanda Rosas. March 2018. Used with permission.

Deya, Lavinia, and I are women. Deya calls her dog Búscalo, and Lavinia calls her dog Booking. I do not have any dog to claim as my own on the islands. For Deya, Lavinia, and I, Búscalo and Booking are domestic dogs in different ways. I had learned about domestic dogs with my pets Pepe, Benitín, Lady, Luna, and Muñeca in Bogota. We shared shelter and bed, but dogs ate dried food that my parents bought in grocery stores. Búscalo and Booking are outdoor dogs, but Booking is not only an outdoor dog. Lavinia, who is also from Bogota, raises her dogs indoors and outdoors. It is part of what Deya identifies as a problem for Lavinia's dogs in Isla Grande. While Búscalo only knows outdoors and eats the food that Deya cooks, Booking wants to be indoors and eat "special food" (other than what is prepared by Deya).

Deya, Búscalo, and Booking watch over Rafa's property in Isla Grande, Palmar. To some extent, they also guard Lavinia's business (El Hamaquero eco-hotel). Booking is supposed to prevent robbery at the eco-hotel, especially at night, but many times he would rather hang out with

friends in Palmar and venture around. It becomes a problem for Lavinia if there is a robbery in the eco-hotel and Booking does not bark. It is also a problem for the neighbors when Booking runs after hens, pigs, and begs tourists for food.

Deya and Lavinia expect dogs to stay at home. Even without fences, people are defensive of borders that dogs, pigs, and hens cross. Dogs must learn these borders. Their owners call them back if they try to leave and they yell and throw rocks next to dogs if they want them to follow. Dogs also learn boundaries from other dogs who bark at them and neighbors who yell death threats at them, which are also threats to their owners.

Sometimes the same neighbor puts poison in food, and multiple animals, including dogs and cats, die. Deya, Lavinia, and I know this too well. During my preliminary fieldwork, Drago and Nativo died in less than two weeks. Drago, Deya's dog, died from weakness and vomiting in a few hours, and the corpse of Nativo, Lavinia's dog, was found decomposing in a mangrove after a few days of being missing. One day, Booking crossed Palmar running and throwing up and Búscalo ran after him. Deya held Búscalo, who briefly got sick and died after tasting Booking's vomit. No one ever found Booking's body. Everyone knows who killed the dogs. She does not feel shame in it. Although these deaths sadden Deya, she would not change her friendly relationship with her neighbor. Deya and her neighbor would still party together, and Lavinia, the Community Council, and Parques would not do anything about it. This situation moves me to inquire about the lives of these dogs and how they become (no) persons within a nature reserve, a Community Council, and within current animal rights legislation.

We (women and dogs) are the products of a vast genetic mixture and diasporic journeys (Haraway 2008). These dogs have no traceable ancestors. Deya and her neighbor identify as black afro-descendent islanders and speak strong and firm. Lavinia and I are lighter skin mestizas,

cachacas (in-landers), and anthropologists. Lavinia has worked and lived on the islands for over two decades. She worked with Parques first and after with the Community Council. Following the participatory action-research method (Fals Borda and Rahman 1991), her voice and authorship have merged with the Community Council over the years. I am an anthropologist in training in a Ph.D. program in California that requires single authorship of a written dissertation. I inhabit this training with a broken language that goes beyond my English as a Second Language. My voice is slow, soft, and sometimes insecure. Some islanders make fun of it.

Being less than four years old, Búscalo and Booking were young. I do not recall older male dogs on the island. Deya and Lavinia are in their fifties. At my age during fieldwork, my early thirties, they had already had kids. For many islanders, I was old not to have kids like Sofi (a female dog), who had not been pregnant before she was even one year old. On the islands, we all inherit the consequences of our living pasts (see chapter 3) in our flesh and voices.

We all lived together by the sea on the same colonized land where we were all settlers. However, our modes of occupation also differed and entangled in colonial and industrial development, conservation, ethnic politics, and animal rights in Cartagena. Our flesh keeps records of the meals Deya cooked for us. We imprinted marks in each other voices. Búúúúscalo, Deya would say stretching u vowel. Búscalo replied, barking in the same tone. Deya and Búscalo learned how to express affection to each other together. Perhaps, as I write these words, Deya makes fun of my conversations with dogs and the tone of my voice. I learned to recognize her making fun of me as an expression of affection. My skin regenerated to welcome the scars Búscalo's nails left in my legs, and who knows what he took with him, making a mess of discrete categories: Deya, Booking, island, mangrove, Sofia.

Sometimes, Chiqui, Deya's youngest son, said that in-landers (like me) thought that islanders mistreated the dogs. Deya also provided explanations, even if no one asked. For instance, Princesa, a female puppy died under unclear circumstances. Deya explained to me that it happened while Chiqui was sick in Barú, and she was taking care of him. Tico also censored himself when talking about dogs in front of in-landers. Once he said he would kill the females and keep the male dogs. When he saw I and other in-landers were at the table, he rephrased what he said, leaving an ambiguous taste in our mouths.

I cannot say Deya, Chiqui, and Tico do not care for the dogs. They know that if dogs do not eat Deya's food, and search for "special" food elsewhere, they might be poisoned. They know that the safest place for dogs is home, although it also means yelling and throwing stones next to them if they try to leave. There is not a veterinary clinic on the islands. Tico provides primary care for dogs and birds in the process of relocation to the *Aviarium*, Rafa's bird zoo in Barú. Going to a vet is as expensive as going to a doctor in Cartagena. It is unaffordable for many islanders. In Palmar, male dogs of identifiable breeds (such as Brazilian Mastiff and Rottweiler) get vaccines first—sterilization comes last on the list of priorities.

Deya and Tico knew the dogs came when I called. I imagine that dogs thought I could not yell or throw stones at them. Tico asked me to carry puppies indoors during their first nights in Palmar. Otherwise, they cried all night outdoors. Tico decided when it was a good idea for the puppies and I to sleep separately. Tico and Deya called a puppy Sofi after me because we were soft-skin criers. Tico came with me to search for Princesa when she was sick and missing in the mangroves. I went with Princesa and Diodon (also called El Negro) to Deya's cousin's veterinary clinic in the city and Tico paid the fees. We all cared for these dogs in the best way we knew and could.

The way the lab interns (mainly in-landers) and tourists (many foreigners) behaved with the dogs was a problem for my host family and Lavinia. *A los perros les gustan los cachacos* (dogs like in-landers). Paraphrasing an eco-guide, dogs feel they can do what they want because they feel supported by *cachacos*. Many dogs would follow us around the island. Dogs are more likely to bark at islanders than tourists. Dogs also know *cachacos* come and go. One leaves and another one comes. When male dogs leave the house, it becomes a problem for Deya and Lavinia because male dogs are supposed to guard the house and eco-hotel.

Negro (Diodon), Tommy, Linda, and Princesa. Palmar, Isla Grande. August 2018.

New puppies come from Turbaco and the city. Deya names some puppies after some of her beloved dead dogs, such as Búscalo, Tommy, and Aquiles. At first, I found this naming practice weird because I assumed some individuality linked to the name. However, some of my close relatives also name their siblings after beloved ones. Lavinia has her picture with Nativo as her profile picture five years after his death. Now, I think the puppies fill the position of guardians of household and business while their names extend an affective relation with the dead, mourned in silence.

Tico says: dogs are only dogs. He repeats this statement anytime a dog dies, and Chiqui cries about it. I imagine Tico means that other puppies can come, but on a small island, neighbors would still be neighbors. “Dogs are only dogs” delineates a boundary that separates owners and their dogs. While dogs watch over households and businesses, their killing does not disrupt friendly relationships with relatives and neighbors. In the case of dogs like Booking, the underlying assumption is that he was partially responsible for his death because of his disobedience. El Caña once taught me: here, we are all relatives. If someone looks for a fight with an islander, they cannot imagine their trouble. The grandmother of the killer says poisoning dogs is wrong. However, the killer is her granddaughter. She is also a daughter, sister, wife, mother, and neighbor.

Deep in me, I keep Booking’s memory. He always had a fresh wound on his left ear, the marks of the wires he crossed to chase hens. He used to go after pigs, iguanas, and cats. His attitude was more playful than aggressive, but he did sometimes bite. One of the neighbors yelled she would ask her husband to kill him. Booking had bit the testicles of her pig. I only saw Booking scared two times. First, when he followed us (lab workers) one time when we went snorkeling. After a while, he felt tired and reached out for help. A friend carried him in his canoe. Second, when he taught me that dogs live on even smaller islands on the island. Once I left walking, and he followed. I tried to leave him behind, but he was faster. He crossed through the mangrove and met me after. Together, we reached the half-way point of the island. He seemed insecure, but I continued walking. A group of dogs barked and ran after him. I yelled at the other dogs and Booking and I turned around. He ran and did not let me touch him for a while. I imagine him thinking “I told you, and I did not know you could yell!”

Booking swimming, Rosario archipelago. Photograph by Edwin Styben Uribe. November 2017. Used with permission.

It must be hard to be an adventurous dog, like Booking, with little interest in watching over a business on a small island. Búscalo seemed more at ease with it. In the end, Booking and Búscalo found personal interests in their jobs and the island. Given the persistent threats to Booking's life, a friend and I suggested that Lavinia enclose the eco-hotel to control his mobility. She wanted Booking (and perhaps the eco-hotel) not to be enclosed. It is an attitude that neighbors share in regards to hens and pigs. Everyone takes risky choices. I keep the memory of pigs and piglets sitting down in front of the seawater. I do not know what they enjoyed, but they seemed genuinely pleased.

One time, Lavinia called me out in a meeting of the Community Council at *Casa de la Cultura* (House of Culture). *Casa de la Cultura* is a big kiosk at the Benkos Biohó square in the middle of the Orika town (see chapter 3). It does not have walls. It is paved and raised from the ground one step. Booking followed me, and Búscalo followed him. Other dogs were at the meeting too, including Pogo, the dog of Diego Duque from *Parques*. At one point, a dog barked. Lavinia

made clear to me and others that if I could not join without dogs, I should not participate. It was disrespectful to *Casa de la Cultura*. Diego suggested that he and I stepped out from the paved ground and Pogo, Booking, and Búscalo followed. It did not seem to be a big deal for many, but some agreed that dogs were distracting. Dogs are not welcome at *Casa de la Cultura* (at least for some), but they are indispensable on the island. If it was not because of robberies, people might not feel the need for dogs at home. Dogs (especially male dogs) are supposed to guard households and businesses. But that kind of job is learned and consented to rather than natural. What if some dogs are not interested?

Stray dogs, like Callejero (literally stray dog), are not welcome in Palmar. Callejero appeared briefly after Booking and Búscalo died. No one claimed him as theirs. He would hang out with other dogs like Tommy, who passed very quickly from being the puppy to becoming the eldest in the house. Callejero also played with Linda, the eldest female dog who adopted all puppies. Sometimes Tico and Deya yelled at Callejero. They were worried that others, including the new puppies (Princesa, Sofi, and El Negro), might learn bad manners from him. Callejero reminded me of Booking. Over time, the same neighbor poisoned him too. I felt Callejero died once and Booking died twice.

Callejero, Princesa, Linda, Tommy, and Sofi. Palmar, Isla Grande. September 2018.

Sometimes I daydreamed about taking some of these dogs to adoption centers in the city. However, why would a potential longer life be necessarily better for these dogs? Living in the city did not offer adventures by the seawater, mangroves, these other dogs, and this family. No, these dog islanders' lives are not less full than the lives of domestic dogs in the city and elsewhere.

Conservation and animal rights, on different authorities, watch over specific animals, and only some lives have personhood. During my fieldwork, I felt accompanied and wanted to care for these dogs in the terms I learned with other dogs elsewhere. It is unclear if the intensity of my feelings goes beyond our dog-ness. It is not an accident that dogs are my entry point into these stories of personhood on the islands.

Some people assume that giving dogs food, shelter, company, and care may guarantee a vigilance for their private properties. Some dogs seem interested in everything but becoming a guard. Deya, her family, and her dogs watch over Palmar, including birds that are targets of conservation, such as *paujiles* (*Pauxi pauxi*). Deya and Tico teach dogs that they should not go

after these birds. This learning process is ordinary, but not always a harmonic exchange with dogs. Dogs can bite, and birds can peck. It seems Princesa died in one of those risky encounters with a *paujiles* (helmet curassow) and people. Why would dogs (or any other animal) on the authority of their species be granted exceptional rights to play in ways that might become harmful to *paujiles* (helmet curassow), peacocks, hens, pigs, cats, and iguanas?

Owners of businesses and dogs watch over their property. Conservation officials look after coral reefs. Some dogs enroll in conservation too. For instance, Diego Duque and Pogo (dog) trained together to identify turtle nests. Diego says that different from any human-machine, human-dog can find the turtle eggs without breaking them. *La Guardia Cimarrona* guards the collective territory of black peoples. A police inspector visits the island occasionally; however, no one would accuse a relative and/or neighbor. Watching over private property in Isla Grande needs a different party whose lives are "only dogs' lives."

Andrea Padilla (2019) advocates for the rights of animals. She suggests that these rights are the most progressive juridical approach to recognizing all animals as sentient beings and not things. She analyzes various decisions in Latin American countries where lawyers and judges experiment within existing frameworks to introduce animals (other than humans) as subjects of rights. Most of the cases do not affect significant industrial interests and are designed to prevent unnecessary pain and suffering. According to Padilla, one of the main challenges within the existing frameworks is to portray the intrinsic value of all animals without a direct reference to their function in an ecosystem or human well-being. In Colombia, 1774 Law of 2016 recognizes animals as sentient beings, and the state has an obligation to protect them against pain, mistreatment, harm, and cruelty. The law establishes sanctions, which include prison, closure of businesses, and fines.

I suggest that this ethics of animal rights build on certain premises about personhood, and we need to think together about what an alternative to a punitive system may be. Ticktin (2017) includes animals (alongside children) within the classic figures of innocence that occupy political imagination in humanitarian terms. She argues that innocence understood as free of knowledge, wrong, and guilt, structures and maps political and ethical possibilities and obligations. Personhood on the grounds of innocence has pacifying effects on advocates of the "good" and introduces a hierarchy on the concept of suffering. It is as if only the suffering of the innocent counts as matter of ethical-political concern. Her provocation is to think beyond innocence. She suggests that innocence as an organizer of political imaginations in Euro-America can be traced only to the last century. Animals have previously had legal personalities and accountability in courts. Ticktin's (2017) insights are relevant as I simultaneously think of the noninnocence of dogs and the woman who poisons them.

If it is not on the grounds of dogs' innocence and this woman's guilt, how can we imagine an ethics-politics that does not become a death trap for disobedient dogs? How do we imagine dogs' lives as anything other than "only dogs' lives"? What else can dogs be on the islands in addition to guardians of houses and businesses? How do we create social and legal spaces where conflicts can develop without the suppression of one of the parts through death or immobilization? How do we dwell on the profound ways "only dogs' lives" are ingrained in ordinary lifeways in Isla Grande? How do we respond to the killing of these dogs without resorting to the police?

The lives of these dog islanders serve to make us reconsider ethics-politics beyond the punitive and penitentiary system. Ruth Wilson Gilmore (2020) makes a case for the abolition of police and prisons in the United States and internationally. She points to a collective and deep feeling that punishment is the first resource to address a situation deemed unjust. Gilmore explores

the idea that the immediate response to a "problem" is to discipline, incapacitate, inflict fear, and kill. The ground of her argument is not innocence, but that harm and violence cannot do the work of enabling the societies she wants to see flourish. In the case of animal rights advocacy, punishment does not bring the lives of these dogs back. It does not deal with how poisoning dogs is an accessible and consequence-free answer to solving dogs' disobedience in Isla Grande. It does not dissolve the sorrow that Deya, Lavinia, and I carry because of dogs' deaths. It does not erase fear within friendly relations among neighbors and relatives. Punishment does not ask, Why do black islanders stand for each other in front of any form of police? Abolition helps me think of the non-disposability of life and the possibility of less violence without a punitive system. For abolition, someone does not need to be innocent or obedient to be a person.

In the United States, the framework of transformative justice and community accountability builds on the experience of many indigenous, black, and undocumented peoples, among others, who cannot call the police for fear of prison, harassment, and deportation. Similarly, *La Guardia Cimarrona* in Isla Grande is an institution that understands the police as a site of violence towards black islanders. My provocation is to extend this framework beyond black persons. How could *La Guardia Cimarrona* respond to robbery in ways that not only address the incidence of robbery, but transform the conditions that allows it to occur? What would it take to not only to respond to the poisoning of dogs, but to end it? What do people who steal and poison dogs need? What kind of kinship can create more safety, understanding, and accountability for harmful and abusive behaviors?

We need to think together about alternatives to punitive systems for human and non-human persons. Instead of allocating resources and efforts that inflict harm, could we enhance spaces for the development of conflicts that do not result in death and incapacitation traps? Destruction takes

time and work. That time and work could be reallocated to collectively conceptualizing societies that we want to see flourish. Inspired by Ursula K. Heise (2016), I suggest ethics-politics can be about how to learn to become better neighbors with dogs and other animals. How can we collectively design accountability for animals (including humans) who cross property lines and other invisible boundaries? How do we raise interns' and tourists' awareness about these issues on Isla Grande? How might we domesticate ourselves so that the various dogs' behaviors become welcome rather than harmful? Maybe dogs' disobedience is more an issue of uninterested dogs. How do we learn about what each animal is interested in and find a place for it in the archipelago? What does it take to make dogs interested?

Maybe, there are not persons in conservation frameworks, but innocent and endangered species (long evolutionary lineages in slow and accumulative processes of massive deaths). The individual lives of dog islanders are not part of the lives that conservation cares for or has authority over. In other words, conservation cares for animals as endangered species with specific functions in an ecosystem rather than as individual persons. Conservation meets animal rights advocacy by identifying and disabling risks and threats. Sometimes those risks and threats coincide with the lifeways of black islanders. For some of these people, conservation works as a form of police (see chapters 1, 2, 3). For some fish, like the lionfish, a non-innocent invasive species, conservation promotes its destruction. This approach is in tension with animal rights advocacy that sees in individual animals, innocent sentient beings.

The reflection on personhood through the lives of dog islanders helps me to raise questions not only about animal rights, but also about conservation. If it is not on the grounds of endangered species' innocence and artisanal fishers' guilt, how do we imagine an ethics-politics that does not become a surveillance trap for black islanders? How could coral conservation and restoration

respond to corals by transforming shared, entangling, and extensive conditions that allow for coral destruction? What kind of societies can create more safety for corals and communal accountability for harmful behaviors without the resources of prohibition, vigilantism, and punishment?

CHAPTER 4

Nursery-ing: A Proposition for Nourishing Observatories, Nurseries, and Gardens Throughout the Archipelago

Oceanarium at the San Martín de Pajarales Island, Rosario archipelago, Cartagena. Photograph by CEINER—*Oceanarium* Islas del Rosario, 2021. Used with permission.

Scientists at the CEINER lab call the place where they grow coral by different names. They call the place an observatory, a nursery, and a garden. Observatory describes the underwater enclosure where seawater flows through the eye of metallic nets. At the same time, the enclosure allows for what scientists call "semi-controlled conditions," which I describe as a place without motorboats, tourists, and fishers crossing. In this place, researchers make daily observations about physical-chemical seawater patterns (temperature, salinity, and oxygen saturation), the PVC-coral forest, and fish that participate in the assisted reproduction program. Interns clean the PVC structures monthly and the lead field biologist takes measurements to estimate coral growth (see chapter 2).

Researchers call the PVC coral forest *guardería*, and coral restoration literature widely names this place/structure nursery. In Spanish, the *-ería* ending refers to a place where the action of *guardar* occurs. *Guardar* means to keep, to look out for, to watch over, and to protect. It is a word that also describes the place of child daycare. The word nursery carries a horticultural connotation for seedlings as well. In coral restoration, the nursery is the place and structure where researchers watch over coral fragments as they grow to suitable size for outplanting.

Likewise, researchers call this place *jardín* (garden) and *jardinería* (gardening) the activity that makes this place. The word *jardín* (garden) is interchangeably used with *guardería* for children and plants, while *jardinería* is used exclusively for plants and coral (in coral restoration). My impression is that *jardín* and *jardinería* carry some landscaping connotations at the CEINER lab. For instance, I have heard Rafa talking of *jardín* as a place design with a particular aesthetic, composition, and assemblage of coral and other animals in the enclosure. That design is not always functional. It also responds to who Rafa would like to see in the garden, for instance, dolphins.

Retrospectively, I notice some similarities with plant gardening. Gardening requires proximity and frequent check-ins. Sometimes watering plants every other day is about the water, but it is also about visiting, noticing changes, and responding. Checking in requires discipline that is not always comfortable. Sometimes restoration practitioners would rather stay indoors and dry, but coral gardeners dive into the water daily, as a decision. Gardening also aims for beneficial relationships between certain plants and corals. Those relationships are more beneficial for some than for others. For instance, I spray water with garlic in plants to repel certain insects, and coral restoration gardeners clean the PVC structures to wipe away algae and sponges. No matter how much the gardener looks over their plants, sometimes ashes fall over the leaves and dry them out;

in the case of coral gardeners, the seawater turns sugar-cane color with sediments, and the currents spread with them new diseases.

Coral restoration is only one of the interweaved processes in this place that is simultaneously observatory, nursery, and garden. In addition to the coral nursery, there are fish nurseries, enclosures within the enclosure. Fish, too, are part of the garden. At least in this lab, coral restoration does not only draw from forest restoration but also aquaculture. Both in coral restoration and aquaculture, researchers seek the massive reproduction of coral and fish. Within the nature reserve, this reproduction has repopulation purposes and potentially commercial interests in fish.

In this chapter, I explore the multiple ways that nurseries and gardens are currently done in the Rosario archipelago to elicit a vocabulary and explore aquaculture researchers' imagination of how a coral and fish observatory, a nursery, and a garden can also be at the CEINER lab. While so doing, I encounter multiple ways in which scientific practices do *guardería* (nursery), and I go back to Max Liboiron's (2021) question: "How will we do science today?" (Liboiron 2021: 113) (see chapter 3). This exercise generates possibilities for other ways of living, relating, and doing aquaculture in the Rosario archipelago.

Drawing from this exercise, I develop the concept of *nursery-ing*, which holds functionalist and affective underpinnings about the doings that create nursery places. I understand these functionalist underpinnings as elements whose value within an ecosystem is derived from the function that they play within it. By affective, I mean a personal inclination towards something/ someone. That inclination is drawn from a passion, from a feeling of curiosity for something/someone, and from a feeling of obligation about being involved in something on an ordinary basis. While substitutable elements might equally fulfill functions, affective intimacies

carry a sense of affectionate connections that sustain the labor that maintains lifeways. The chapter includes four sections named after sometimes overlapping places: mangroves/seagrasses/coral reefs, the aquaculture research center, fish harvests, and edible and medicinal forests. After these sections, I expand on the proposal of *nursery-ing*, and end with openings.

Mangroves, Seagrass, and Coral Reefs

Red mangrove (*Rhizophora mangle*) forest, Isla Grande, 2016.

Scientists and other islanders say that mangroves, seagrasses, and coral reefs are *guardería* (nursery) of fish. Various scientific and policy reports speak of nurseries providing "services" and "functions" associated with the nourishing of juvenile fish. While conservation scientists work to maintain ecosystem functions, their labor also draws from and cultivates affectionate relations through bodily and immersed engagements. The word nursery holds both functionalist and affective connotations without provoking a strong opposition among scientists. By directing the attention to *guardería* (nursery) as a nourishing place, I aim to expand on nursery as not only providing "services."

Red mangrove enables lichens to digest coral skeletons and create a predominantly sandy texture with some clay and a bit of silt on the surface. These conditions turn into hospitable soils for papayas, *mariamulata* and *sirirí* birds, iguanas, opossums, and more inhabitants of the archipelago. Mangrove forests create a sort of womb; they are humid, warm, and contained. These forests smell like sulfur. The mangrove forest is swampy. It is possible to walk through it, but it is easier for bipeds to navigate in canoes. The mud allows for the long and tubular seeds to germinate when they fall. *Los bogas*, who paddle, move the canoe through undulatory meanders. These meanders feel like tunnels that can be narrow and low. They can also open into salty lagoons, within the mangrove, on the islands, as islands within islands. *Parques* says the Rosario archipelago includes 28 islands, and islanders think there are many more islands within islands connected by the mangrove, describing a different and yet coexisting archipelagic geography.

During the nights, especially around the Black Moon, towards the mangrove's roots, fluorescent lights shine with the movement in the seawater. The biologists say that little planktonic beings called dinoflagellates shine. Bonie Blasser (2009) suggests that bioluminescence is an expression of quorum sensing, a form of intra-species communication. The dinoflagellates shine only when sensing large amounts of their same type. These small animals capture carbonate dioxide, decompose organic matter, and feed the juvenile fish. Fish, such as *mero* (giant grouper), grow in the mangroves. Some fishers say that *mero* does not only grow in the mangrove, they *like* the mangrove. Mangrove forests are refuge for fish and fishers, such as pelicans, frigates, and herons who spread mangrove seeds with their movement and feces.

The roots of seagrasses stabilize the sediments improving the clarity and quality of the seawater. They anchor the plants in the seafloor reducing erosion. The roots also distribute nutrients throughout the seafloor and into the seawater. Seagrasses also capture substances leaking

from the land. These plants photosynthesize and spread, sending up new shoots. The most abundant seagrass in the area is *Thalassia*. Its leafy canopy shelters small invertebrates, crustaceans, mollusks, fish, algae, anemones, urchins, rays, and green turtles (named after the green color they get from eating seagrass). The smallest animals hide under the rocks and deep in the sand. For instance, the shovel snail (*Lobatus gigas*) spends its first year deep in the sand, invisible for divers to find. Jaime Rojas, the director of the CEINER lab, tried to reproduce these snails. He assumed snails instinctively knew how to hide in the sand for a year. It did not happen in the lab, and the researchers could not figure out how to teach them. Somehow, the seagrass teaches the snails how to hide deep in the sand.

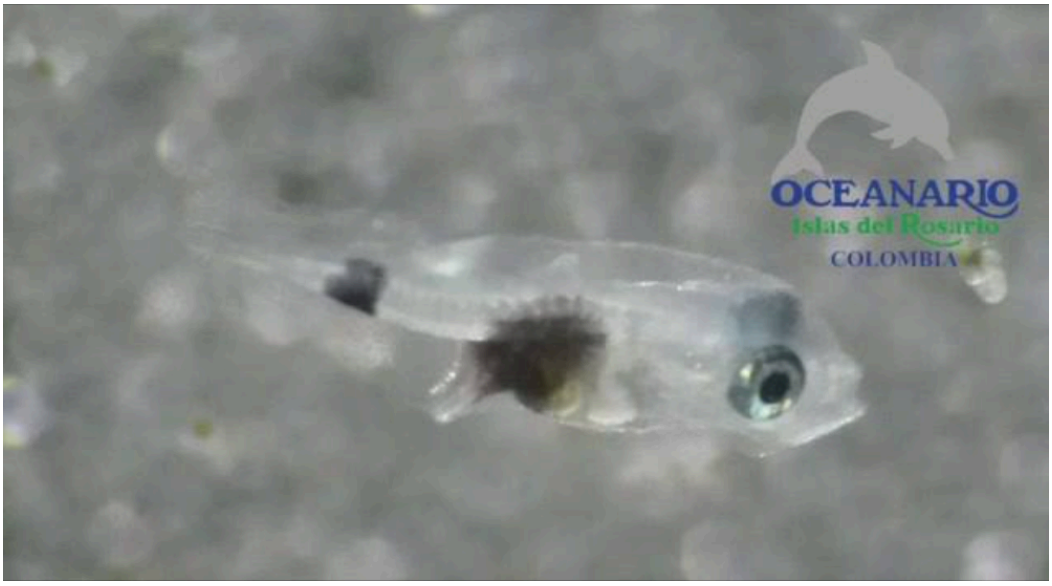
Hexacorrallia names a coral with six-fold symmetry. This hexagonal shape allows for the largest number of coral polyps to grow on surfaces, such as calcareous algae, PVC, bamboo, and metal. Inside these reef building corals, also *piedras* (see chapter 2), El Caña's lobsters change their shells once per year around October. Imagine. How many years does a lobster need to grow a few centimeters? How many fortunate occurrences happen for El Caña to find a one kilo of lobster? By fortunate occurrences, I mean all the things that happen, all the things that coral *piedras* and lobsters do not necessarily mean for El Caña, but as all those things that occur, they become fortunate for El Caña.

Guardería (nursery) names conditions that include the availability of food and shelter and the pleasure and joy that fishers like Libinston call *encanto* (enticing). Coral researchers and other islanders are not only in the archipelago to think with and profit with, but also to "live within" this sea. If mangroves, seagrasses, and coral reefs are *guardería*, who are the guardians? This specific form of *guardería* (nursery) is more than a human capacity because it relies on entangled ecologies

of human and nonhumans and it exceeds any scientific attempt to fully comprehend the complexity and actors of its doings (see chapter 1).

In the following section, I will introduce the nursery of *cultivo* in aquaculture within the Corales del Rosario and San Bernardo Nature Reserve. This kind of *cultivo* assumes cultivo could only happen under certain conditions. *Cultivo* is a Spanish word used for crops—for cultivated microscopic beings in laboratories and for fish bred in aquaculture labs. By looking at *cultivo* in the aquaculture research center, I will delve into some of its underlying assumptions.

The Aquaculture Research Center



Epinephelus itajara larvae, seventh day. Photograph by CEINER—*Oceanarium* Islas del Rosario, 2020. Used with permission.

The CEINER lab started as an aquaculture research center. It operates under the same rules and regulations as the nature reserve. For instance, it cannot raise fish for commercial purposes. The CEINER lab *cultiva* (grows) endangered animals (such as *Epinephelus itajara*) for repopulation purposes. In addition to this, Rafa, the director of CEINER lab, has always envisioned a technology

that can be transferred to artisanal fishers (see chapter 1). He imagines fish farming in enclosures for the purposes of local food security and a commercial alternative for artisanal fishers. Until now, the lab has experimented with assisted reproduction techniques and has not yet reached a phase of repopulation and technology transfer.

Jaime, the lab's scientific director, traveled to Thailand to learn how to assist in the reproduction of *Epinephelus sp*. The Thai experience transferred to the Rosario archipelago, because for aquaculture purposes, *Epinephelus itajara* is not fundamentally different from their *Epinephelus sp*. cousins. The CEINER lab grows microalgae and rotifers of different sizes all year long. The microalgae feed the rotifers that may become food and live stimulus for fish larvae. During the reproductive season, the scientists test whether or not the fish in enclosures show semen or eggs. If the scientists find a male (with semen) and females (with eggs), the researchers move these individuals to a tank for a few days. If the fish mate, the fertilized eggs float to the seawater surface, where scientists collect them. These aquaculture scientists grow larvae and juveniles under close supervision. The reproduction of *Epinephelus itajara* was successful in 2015, but most juveniles died during their first year. In September 2020, the CEINER lab successfully reproduced with some of the survivors from 2015, "closing the circle of reproduction" of *Epinephelus itajara*.

The CEINER lab has also assisted in the reproduction of *cobia* or *bacalao* (*Rachycentron sp.*). The lab imagined that artisanal fishers and researchers could grow this fish using similar methods to those used with *Epinephelus itajara*. The fish had a promising international market. The lab foresaw potential commercial benefits in this fish—if regulations eventually permitted. Because it was a breeding experiment, it complied with the existing regulation in the nature reserve. Artisanal fishers and researchers together built two large and enmeshed enclosures for the cobia fish at the *Oceanarium*. The enclosures kept the fish under seawater. The lab researchers

obtained the seeds by assisting the fish in mating, collecting their fertilized eggs, and assisting their larvae growth. Together, artisanal fishers and scientists grew the fish from seeds (an expression used to refer to the juvenile fish in aquaculture). After a few months, most of the *cobias* died. Some fishers resent that no one told them what happened to the fish. The fishers say they also invested time in this project. The researchers say the problem for both *meros* and *cobias*, and any other fish in the lab, is food.

Adrian, a field biologist at the CEINER lab explains the situation as follows. The pellets for marine fish vary in size and protein percentage. The CEINER lab has used pellets made up of 45% protein from the Nicovita lab, based in Peru and Ecuador. The CEINER lab tried to reduce costs by experimenting with a lower percentage of protein, but the fish got sick, grew slower, and did not successfully mate. According to Adrian, the fish's commercial value does not compensate for the cost of the pellets. By the commercial value, I imagine that Adrian refers to the commercial value of the fish if it could be sold in international markets. This calculation makes most of the fish repopulation and farming projects at the lab inviable. Nicovita is part of Vitapro S.A. multinational, a wholesale company. In Ecuador, Nicovita's annual production surpasses 100 thousand tons of food. Adrian says that because there are no mariculture farms of Nicovita's scale in Colombia, there is no cheaper substitute to Nicovita's pellets.

Although aquaculture-raised fish is commercially unviable in cost-benefit analyses, the CEINER lab has creatively sustained fish reproduction. It is a repopulation strategy for conservation purposes and views food farming as a substitute activity for artisanal fishers within the nature reserve. Aquaculture is field research inspired by intensive, industrial-scale farming. Ever since the green revolution in the 1980s, the blue revolution has expanded in the North Atlantic and the South Pacific. According to Marianne Lien (2015), "by 2009, aquaculture supplied half of

the total fish and shellfish for human consumption. By 2012, aquaculture was among the fastest growing food-producing sectors in the world (spearheaded by farmed salmon) and expected to eclipse the global production of beef, pork, or poultry by the next decade" (Lien 2015:11). Lien's attention to husbandry and domestication processes in farms in Norway lead her to inquire about salmon as becoming biomass, objects of capital investment, and sentient beings in welfare legislation simultaneously. In the case of the Rosario archipelago, Rafa feels that raising fish more than corals can interest fishers because of the potential financial benefits. Rafa does not dream of the intensive production farms in Norway, but something that can respond to the needs of the islanders. Rafa heartfully thinks that the sea will be a better place when fishers' kids can decide to become someone else, perhaps an aquaculture farmer, or an entrepreneur. My impression is that Rafa thinks that less artisanal fishing in the archipelago may contribute to the partial recovery of fish populations and that aquaculture farming may also offer better living conditions for islanders.

Lavinia and I do not understand why these fish cannot eat other locally available food. She has heard that feeding fish with locally available food has already been made possible at the Guajaro dam. Lavinia has in mind a potential substitute food for fish, made with the guts of fish taken from the Bazurto fish market. She imagines that women could sell the guts to the scientists. Unlike Rafa, who imagines fish farming as a substitute for fishing, she envisions fish aquaculture as an opportunity to diversify artisanal fishers' activities. It does not mean that artisanal fishers would stop fishing, but that they may have other sources of income. Lavinia says that she needs the expertise of an aquaculture scientist to fundraise money for this project, but Jaime Rojas is already too busy with the existing projects at the lab. She is also very busy with what she calls pure activism, advocating for Community Councils. No intern at the CEINER lab studying aquaculture engineering at Universidad del Nariño has shown enthusiasm about the idea. The

students I have met are much more interested in microalgae, rotifers, and commercial projects with already standardized and certified products and protocols.

A viable alternative for local food for fish elsewhere is made impossible in the Rosario archipelago by a cost-benefit analysis, as those mentioned by Adrian, as well as by safety requirements. Lavinia's dream requires that the guts of fish from the Bazurto fish market become standardized and certified with protocols that the Colombian Agropecuary Institute accepts as safe for fish and human consumption. This kind of work requires much more than an engineering and productive approach and more time and resources than undergraduate interns. The materialization of Lavinia's dream needs the collaboration of students, professors, sponsors, women selling guts in the Bazurto fish market, and the aquaculture scientists' belief in the project's possibility, which is still unclear for the field researchers. It may also require a commitment to experimenting with local and available food with and without funding through development projects.

Deeply ingrained in aquaculture training is the idea that *cultivo* occurs in tanks and enclosures in the aquaculture research center and that the commercial value of fish dictates cost-benefit analyses, even for repopulation purposes within the nature reserve. This *cultivo* inherits some of its ideas from industrial-scale fish farming and (inter-) nationally recognized standards and certificates. The aquaculture *cultivo* makes the possibility of local and available food for fish a sort of non-trustable possibility and non-worthy experiment. At the CEINER lab, which operates within this framework, pellets represent a challenge for fish repopulation and for alternative commercial activities for fishers and the scientists. Fish farming appears less destructive to fish and coral than fish grabbing, although the production of pellets leads to an intensive extraction of plants and fish from a different place.

Nicovita's ingredients include fish flour, fish oils, flour of oleaginous fish, cereals, soy, sodium phosphate/potassium, calcium carbonate, sodium chloride, preservatives, minerals, vitamins, and amino acids. The massive production of pellets depends on the steady supply of fish oil and meal. According to Lien (2015), "aquaculture's share of the global use of fish oil and fish meal more than tripled from 1992 to 2006. As a predator in the marine food chain, farmed salmon have a key role in this global rechanneling of marine resources from human consumption to animal feed and from terrestrial husbandry to marine husbandry" (Lien 2015: 4). In the case of soy, Law and Mol (2008) argue that the soy used in pellets could be "perfectly suitable to feed the rural population of Argentina or elsewhere" (Budiasmunti 2020; Law and Mol 2008: 140). For me, the question is also about the intensive production of soy and what it does to the places where it grows. In the concrete case of Nicovita, it is not easy to trace vendors online and it is uncertain how the ingredients entangle with concrete places and peoples somewhere else.

In the following section, I pay attention to the ways that conservation advocates have created the impression that *cultivo* is an exclusive ground for aquaculture scientists in the sea. I reconsider *cultivo* as a usually neglected ground for artisanal fishers who are also fish harvesters and farmers. With this, I want to expand on the many more ways that *cultivo* is currently in the Rosario archipelago.

Fish Harvests

Miguel and El Caña fishing together, Rosario archipelago, March 2018.

Aquaecology is a concept that claims agroecological scientific grounds. I have heard of it through literature, but not on the islands. However, I find it useful to re-create a feeling of strangeness towards what appears quite familiar in the Rosario archipelago. Alana Mann (2020) situates the concept of aquaecology as kin to food sovereignty, La Via Campesina, the World Forum of Fish Harvesters and Fish Works, and the World Forum of Fisher Peoples. In Mann's (2020) words, "like agroecology, aquaecology actively supports food sovereignty, 'the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems'" (Mann 2020: Loc 4250).

As conceptualized by the World Forum of Fish Harvesters and Fish Works and the World Forum of Fisher Peoples, aquaecology emphasizes the right of small-scale fishers to fish. It conceptualizes ocean-grabbing as the legal exclusion of fishers from fishing areas which benefits "powerful economic actors." One form of ocean grabbing is the "blue growth" that turns the

conservation of wetlands into a commodity in the carbon markets. These "elite solutions" legitimize continued emissions somewhere else, and support profit-driven ecotourism over customary practices, such as fishing. Like agroecology that claims the concept of farming otherwise, aquaecology creates a vocabulary to speak about harvests and forages as an ecology that includes fishers, not only the outcome of fish farming. According to the World Forum of Fish Harvesters and Fish Works and the World Forum of Fisher Peoples, aquaecology insists on food as a common good and pushes against the dependency on large corporations.

The concept of aquaecology extends the claim for food sovereignty to the sea. It offers a language to speak about the small-scale fishers as not only extracting resources and destroying the sea. It broadens an understanding of food sovereignty beyond agriculture and promotes the independence of harvests from large corporations, such as Nicovita. Independence, rather than production, seems to be the main question and challenge. In a way, aquaecology redistributes priorities, questions, and complicates conservation's accounts of care. The tone of aquaecology may feel as moralistic, but no less than conservation's accounts.

Aquaecology introduces more ways to imagine *cultivo* by offering other grounds to think about dependency in corporations, food, damage, and traceability. It situates harvests in an open sea, understood as a common good for fish harvesters (artisanal fishers and aquaecology scientists). It inquires about how conservation can become ocean grabbing and how the exclusion of small-scale fishers from fisheries might benefit industrial fishing, industrial farming, and "blue growth" commercially. Being a figure of multilateral advocacy, aquaecology emphasizes rights, and at the same time, it erases a discussion about controversial techniques among artisanal fishers. In the Rosario archipelago, the fishers I met prefer to be called artisanal fishers to differentiate themselves from industrial fishers while also stepping away from the small/survival adjectives.

Placing the emphasis only on food might erase that many artisanal fishers are also interested in fish's commercial value.

Aquaculture and aquaecology may meet in the Rosario archipelago in Rafa's dream of food security for islanders. However, they may also diverge in Rafa's dream, as he thinks of aquaculture as a substitute for artisanal fishing, while aquaecology recuperates fisher's right to fish. Likewise, I anticipate some conservation advocates may say that fishers are different from farmers. I remember someone telling me that it might be easier to teach aquaculture to a farmer instead of a fisher. According to this person, farmers are disciplined, patient, and hard workers, unlike fishers who grab what they find when they find it. Underlying this story is the idea that *cultivo* is something exclusive to farmers. But based on my fieldwork, fishers regularly visit certain *bajos* and *piedras*. Fishers assess the day or night conditions and decide where to go without knowing if they will catch fish or not. However, they do anticipate that they will likely find fish in those places under certain conditions. As in the farmers' case, fishers' harvest partially depends on their attentive observation of fish flux over time. Perhaps, *cultivo*, as practiced at the CEINER lab, might be hard to grasp for some fish harvesters for other reasons different from essentializing stereotypes about fishers, such as their lack of discipline, laziness, and lack of patience.

These stereotypes depart from a presumption of an essential fisher characterized by fixed attributes and fundamental motivations. Many fishers are also farmers, but conservation advocates hardly refer to them as such. Many conservation advocates confer unity and stability on people who are otherwise more than one of their activities. *Rebusque* describes a common way of making a living in the city and in the islands by doing multiple things. Rarely does someone do only one

activity (see chapter 3). The description of particular people as fishers is only possible by emphasizing fishing and de-emphasizing other activities.

Don Hernando says his father fished in the morning and *cultivaba* (made *cultivo*) in the afternoon. He grew yuca, watermelon, squash, beans, and sugar cane. When Don Hernando was a child, the rain was abundant. Now everything tends to dry without rain. His parents prepared the soil in April at the beginning of the rainy season. By August, fruits were ripe. Less rain falls these days. However, this seasonal routine is not that different from the practice of some fishers today. For instance, Jairo Julio fishes *a pulmón* (freediving) in the morning and grows edible plants in the afternoon. He likes growing plants the most. He grows some of the plants that Don Hernando's father grew too. Only, he stopped growing watermelon because the iguanas ate them all, and he did not want to have a hostile relationship with them. Like Don Hernando's father, Jairo Julio follows an order and timing for fishing and farming.

Farmers, some of whom are also fishers and more, live across Isla Grande. Damasita (El Caña's mother) lives in the south, and Máximo, Don Blas, Inelda, Carlos, Teófilo, El Gallo, and Ramiro live in Orika. Don Hernando (El Negro) lives in Boca Ratón, and Francisco, José San Martín, and Paito live in Petare. Jairo Julio, his brother Santander, and Pampé live in the north. By reclaiming the word *cultivo* for fishers who are also farmers, I am recuperating previously neglected grounds for artisanal fishers in the Rosario archipelago.

Some fishers do not just extract fish from the sea; they *crían* (raise) fish. El Caña keeps a cage for lobsters and crabs under the seawater in front of his house. He does not sell it all in the same day. He keeps some for the days that he does not fish any. In Isleta, Cosito, and Arismel, each has an enclosed pond in the mangrove shore. *Criar* is different from the assisted reproduction of fish because *criar* means that Cosito and Arismel capture the juvenile fish and feed them in the

ponds until they grow. Assisted reproduction, the practice in the lab, is oriented to massive reproduction for repopulation and commercial purposes. However, *criar* (raising) and assisted reproduction both require a *guardería* (nursery) for the juvenile fish, in the forms of *criadero* and *cultivo* of microalgae, rotifers, and fish. Arismel says he has *robalitos* (little sea bass). They eat anything he gives them. They even come to the surface with their mouth wide open when it rains. Luis, Tomasita's son, wants to raise *tilapia* (a commercial fish) in tanks. Although *tilapia* is a freshwater fish, which might be hard to raise on the islands, Luis is interested in becoming a fish farmer. The word *criar* in Spanish is frequently used to describe raising children while *cultivo* is primarily used for plants, microbiological beings, and aquaculture-raised fish (and corals). *Criaderos* are domestic and more modest than aquaculture's attempt to reproduce large numbers. *Criar* is also different from aquaecology in the open sea, as *criaderos* are enclosures in the fisher's backyard. Some fisher peoples in the Rosario archipelago are open sea harvesters and fish farmers.

Arum Budiastuti (2020) offers an approach to traditional catfish farming in Indonesia. One of the characteristics that make these practices traditional is that they are in ponds in houses' backyards. No one would notice these practices if they were not intentionally looking for them and/or being invited inside people's homes. In interactions with aquaculture practitioners, some farmers have learned to look down on farming in ponds. Also, some fish consumers say these pond fish are dirty (nonhalal) and disgusting. Some farmers make of their practice what Budiastuti (2020) calls an economy of plenty. In his words: "while urban catfish farmers often complain about the rising price of industrial fish feed, traditional catfish farmers flourish as they work based on the economy of plenty. They make use of whatever is available in their surroundings to feed the fish and avoid waste at the same time" (Budiastuti 2020: Loc 2762).

In Budiastuti's (2020) farms of plenty, catfish do more than produce food. Catfish cleanse the water and prevent eutrophication. The fish eat enriched minerals and nitrogen that might induce excessive algae growth and oxygen depletion. Traditional farmers eliminate any odor associated with domestic effluents in the fish by having the fish quarantine in freshwater before their sacrifice. In these practices, farming is tied to a place, to the pond in the family's backyard, and to practices described as the "sacrifice" of fish that become food.

Catfish farming in ponds in backyards is more relatable to *criaderos* in the Rosario archipelago. Fish harvesting in the open sea as much as plant and fish farming requires discipline, patience, hard work, assessments, decisions, anticipation, attentive observation, and experimentation. These skills are not exclusive to technosciences. As far as I know, fish raised in *criaderos* are not commercial on the islands yet, but I can see fishers being interested in these fish eventually becoming so. Perhaps, aquaculture researchers and fish farmers can mutually benefit from collaborations, but how may those collaborations become possible if we are not intentionally looking for them?

In the next section, I will introduce a last example of nursery in the archipelago, *vivero*. Coral restoration claims its roots in forest restoration and aquaculture in industrial agriculture. Perhaps, these genealogies also account for the references to trees and seeds in coral restoration and aquaculture. I constantly hear marine scientists advocating for a non-direct translation from the land to the underwater, although the inheritances of certain terrestrial practices persist in submarine concepts, as illustrated in this section. Aquaecology shows that other concepts can build upon agroecology science and advocacy. What may the CEINER lab learn from *viveros* of edible and medicinal forests?

Edible and Medicinal Forests

Don Hernando (El Negro), *sabedor de plantas* (who knows the plants), Isla Grande, 2018.

The first time I met Don Hernando (El Negro) was at the cooperative in Isla Grande. Likely, it was during one of the trainings for subaquatic eco-guides. Don Hernando is thin and tall, his hair and beard are white, and he looks older than his age. He lives with a dog named Chispita and his nephew, Jeffer, who he adopted as a son. Don Hernando, Chispita, and Jeffer live in a cooperative of fishers. When they occupied the house, it was abandoned. He says that he will return the house when fishers ask him to. Behind the cooperative, Don Hernando grows a *huerto*, an orchard and an edible garden. He loves plants and Jeffer enjoys fishing. In this way, they gather *las guarniciones* (garlic, onions, potatoes, yuca, plantain) and *la liga* (the meat) for their meals. Sometimes Don Hernando works as a gardener at the Isla del Sol hotel and Casa Lola eco-hotel.

He receives some money *para lo que se necesite* (for whatever is needed), including a beer from time to time.

In front of the cooperative, on one of the walls of the Lizamar hotel, a mural composition includes Don Hernando's face, a book, and some plants, perhaps a hobo fruit. From the cooperative, following the main path of Petare, crossing Angela's *tienda* (grocery store), *El Vivero los Hobos* is located. *Vivero* is a word in Spanish that refers to *guarderías* (nurseries) of plant seedlings. The word *vivero* comes from the Latin *vivarium*, *vivus* (alive), and *arium* (a place for something). *El Vivero los Hobos* is an enclosed area of dry tropical forest, which includes coconut, totumo, anon, papaya, noni, ricino, lemon, and almond trees, among others. There is a bench in front of the entrance and a giant billboard in wood with the name of the nursery. *El vivero* has big doors that can be locked. Coconut shells draw the pathways inside. There is a shadow where Don Hernando says that handcrafters will sell their products to tourists someday. Further along the path, there is a house with a lock. Inside, Don Hernando keeps some bicycles to rent to tourists and books and games for children. Some afternoons after school, children go to the *vivero* to play.

El Vivero Los Hobos is a specific kind of *guardería* (nursery) where Don Hernando guards seedlings, children books and games, handcrafts and bicycles. The seedlings may be later rooted in (eco-) hotels (see chapter 3), and books, games, handcrafts, and bicycles bring together children, their families, professors, tourists, handcrafters, and eco-tourist guides in one place. Under the shade of hobo trees, the *vivero* is fresh. In August, the pathways in Isla Grande turn orange with the round hobo fruits, a little smaller than prunes. Behind the house, there is a composting station and a pond to harvest rainwater. Don Hernando emphasizes that freshwater is a challenge for growing plants on the islands, especially when it is raining less. Small black bags with plants lay on the ground. I recall some *veranera* plants. Don Hernando sells the plants to the (eco-) hotels.

El vivero is relatively new. The research group of chemistry of drugs at Universidad de Cartagena funded the construction, and Don Hernando has worked on it with and without payment.

The first time I asked Don Hernando about the *vivero*, I imagined he would respond saying something about food as some of the plants he grows are edible plants. It is the case of garlic, níspero, anon, guanabana, lemon, papaya, and aromatic herbs such as oregano and lemongrass. Unlike what I thought, he emphasized that medicinal plants are disappearing. Medicine is the primary purpose of the nursery. He mentioned other plants, such as *totumo, toronjil, mejorana, guásimo, escobilla, pata de vaca, soldado, indio en cuero, pita, morrial, moringa, venenito, hierba hedionda, siempre florida, mano de Dios,* and *pasiflora*. He dreams of a revival of medicinal plants.

Some of the people I previously described as farmers are also medicine people on the island. The research group of the chemistry of drugs from Universidad de Cartagena collected some of the traditional uses of plants by people like Don Hernando, Francisco (Siquito), Imelda, Paito, and Damasita in a book (Grupo de Investigación en Química de Medicamentos 2018). The book describes the names of the plants and their uses. Some plants, like garlic, papaya, and lemon, are food and have healing properties that range from reducing inflammation to protecting from the evil eye. Medicine people cook and mix plants. They recommend ingesting some, using others in *compresas* (heating pads), and others in baths, for instance, to prepare women for labor during childbirth. In *el vivero*, Don Hernando keeps the book about plant medicine as a treasure.

When Don Hernando and I met, he invited me to join him and the students from Universidad de Cartagena. I arrived early to his house a couple of times, and he said: not today, tomorrow. It used to be frustrating for me. With time, I understood it was not personal. The students did not come and he had to work at the (eco-) hotels. Something required attention today,

and there was always a tomorrow to get together. As I insisted, he invited me to join him in the (eco-) hotels, children's activities, and cleaning journeys. Then, I realized that his *vivero* was not only a location, but the work he does in hotels, eco-hotels, with children, families, professors, tourists, handcrafters, and eco-tourist guides.

Once, I joined Don Hernando in cleaning *Abuelo* Nispero, an old Nispero tree in one of the entrances of Orika. *Abuelo* means grandfather in Spanish, and it is the word Don Hernando and other islanders use to speak of the tree. Don Hernando feels a special affection for this tree, his relative. He says his elders used to visit it when they wanted to rest and think. For him, medicine is not only the plant that he and others prepare for ingestion, heating pads, baths, and protection. Medicine is the tree, the act of visiting it, the feeling of wellbeing, the opportunity to think, and the memory that Don Hernando keeps of it.

Under the shade of the *Abuelo* Nispero, we found plastic (see chapter 3). Some people burn trash in this place and many other places on the island. I think that Don Hernando's dream can contribute to reducing the consumption of hardly decomposable materials. What if handcraft and plant medicine people met to create decomposable packages for edible and medicinal plants grown on the islands? What if these products were the best they could be because they were for islanders? What if islanders could access those in many more ways than monetary, for instance, bartering time and other goods and gifts? Perhaps, these plastic free goods may also be interesting for some tourists precisely because they are not only a souvenir.

Growing edible and medicinal plants requires freshwater. A few people in Isla Grande have ponds to harvest rainwater. Most people gather rainwater leaking from their roof and buy drinkable water from the city. Lavinia and other members of the Community Council insist on a desalination plant, which may make drinkable water available to more people. Plants capture water and they

accept more qualities of water than humans do. Swales, terraces, ponds, and coconut lines perpendicular to the water flow could slow down and catch rainwater before it reaches the seawater. Some filters could make the water used in cleaning apt for some plants. Soil, mycorrhizal fungi, and vegetation on the surface and underwater can immobilize some toxic compounds. My impression is that deep in Don Hernando's memory is the idea that plants can call back the rain under which edible and medicinal plants grow and the sea births (see chapter 1).

Trees offer shade from the sun for people and the soil and the root networks hold the ground in place, preventing erosion. Plants (and corals) intake carbon dioxide to build their bodies. They release oxygen and exchange sugar for nutrients with various microbes and fungi that make soils rich and fertile. Some people on the islands say that dwarfs live around the plants. During my fieldwork, some people saw dwarfs playing around places like *El Vivero los Hobos* and *Abuelo* Nispero. No one knows for sure who they are—maybe they are related to the elders who liked to visit those places.

After Don Hernando, other people, and I finished cleaning *Abuelo* Nispero, we met and ate with more people in the Benkos Biohó square. We shared a *sancocho* (a soup) that some women cooked for us. Today, I think of these gatherings around food as critical to Don Hernando's dream of a revival of plant medicine. Taste can create a relationship with plants and seeds for food forests. A stove is a place to remember the plants' properties and qualities, to experiment and create flavor that people can meet around and long for. What might a hobo marmalade taste like? Cooking makes all the difference between plain food and *vida sabrosa* (a tasteful life).

Natalia Quinceno (2016) develops the concept of *vivir sabroso* (joyful living) for the *Afroatrato* river, on the Pacific coast of Colombia. *Vivir sabroso* is knowing how to walk, move, and navigate in an entanglement of relationships in the Atrato River. *Sabroso* is not necessarily a

gastronomic adjective, although it is also part of preparing edible and medicinal plants. *Sabroso* is coextensive to interweaved relationships of kinship, plant bodies, dead, saints, the forest, the river, and defending life from armed actors. *Vivir sabroso*, as described by Quinceno (2016), is very specific to black lifeways in the Atrato river and the anthropologist's observations. Different from Quinceno (2016), I want to use *vida sabrosa* (flavorful life) to refer to the act of cooking and all that revolves around tasteful meals together. Taste here is not a natural property of the food, but rather a situated relational cooking in the stove and eating together.

Some islanders cut trees to build their homes and eco-hotels (see chapter 3). The metallic net surrounding *El Vivero Los Hobos* prevents people from occupying *el vivero* and cutting the trees. Don Hernando feels deforestation is enclosing *el vivero*. If some people cut the trees around, *El Vivero* will become warmer with less shade. All the people I met respect Don Hernando as an elder, a *sabedor de plantas* (someone who knows the plants), and a leader of the Community Council. Although, he is part of *El Vivero* and the Community Council, *el Vivero* is his personal investment, as he works there with or without payment. The distinctions between his work with plants and his unquestionable support of the Community Council are blurry for some islanders. I remember the day we cleaned *Abuelo Nispero*; he was furious at some point. He invited some people to join, and they said the Community Council only invited them when there was not money. Don Hernando said some people do not understand how important accomplishing the collective right to land had been. Although Law 70 1993 is the result of political demands made by black afro-descendent peoples living in Colombian pacific riverine areas, the Community Council of the Rosario Islands was the first Council to translate these political claims to the Caribbean Sea.

The rightful permanence of black residents on the islands is the result of the advocacy of the Community Council. Despite this, some people feel that a few people in the Council have

benefited more than others (see chapter 3). Don Hernando has never addressed that concern. His income has not improved by being part of the Council. He wants to remind people of something else. Living in edible and medicinal forests is not entirely granted by the law. Edible and medicinal forests are a co-creation of medicine, the plants and their use, the shade under trees, the memory of the places where the elders used to think and rest, the gatherings around tasteful food, and the creation of memories to long for. These forests need to be sustained by cleaning, networking, dispersing, and pollinating seedlings throughout the island.

El vivero is a welcoming and inviting *guardería* (nursery). Don Hernando facilitates this by strategically eliciting in the place the interests of children, tourists, eco-guides, and handcrafters. He also moves and plants seedlings across the island and organizes gatherings around memory revival through cleaning relatives, cooking, and eating together. Although *el vivero* is enclosed, this does not make plants captive as their seeds are freely dispersed in the feces of birds and other animals, through spores moving with the winds, through underground root networks, and seedling dispersals in eco-hotels and hotels. The enclosure keeps seeds and seedlings only partially safe from deforestation, as they do not protect seedlings from losing the shade from trees on the other side of the metallic net.

Nursery-ing

The nurseries of this text are places of coral, fish and plant rearing, specific practices of care. I borrow from Maria Puig de la Bellacasa her understanding of care as doings that maintain (Puig de la Bellacasa 2017: 5). The emphasis on the word doing points to the uneventful connotation of a process. I inherit from feminist discussions of care attention to neglected and devalued doings as productive, and as living potentials to open other questions and possibilities surrounding corals,

islands, and islanders. Nursery-ing localizes care in the Rosario archipelago and examines the co-maintenance of vital conditions for sea births (see chapter 1).

Nursery-ing offers an alternative language to resources. In that sense, this proposal meets Maria Puig de la Bellacasa's (2017) matters of care in more than human worlds. For her, care offers an imaginary to think-feel worlds in other terms different from the provision of "services" and "functions." The stories of "services and functions" as much as "care" are of human making; however, "services and functions" are usually more accepted as less anthropomorphic and more objective than those of "care," especially in scientific reports and policy documents. Puig de la Bellacasa's (2017) proposal is speculative, by which she means that her proposal is a provocation that exposes care as impure and exposes ordinary involvements rather than normative obligations. She also intentionally fosters ecologies filled with affectionate obligations. She needs speculative thinking to create a vocabulary for those ecologies.

Nursery-ing happens equally in the tanks' design, in the daily feeding practices, in the permanent attention to microalgae and rotifers, in the demanding season of reproduction, and in considering mutual benefits for the youth and the sea. It also happens in opening a further understanding of an equally real reality and making available other terms of discussion and possibilities for fish harvesters and farmers, the fish, and the sea. It occurs in minding the mangrove ponds as nurseries to fish, and fish as nurseries to the mangrove ponds and to the farmers as well. It also occurs in the arts of reviving the memory of disappearing edible and medicinal plants and calling back the rain.

I insist on bringing all these practices together under the name of nursery-ing because it helps me to show commitment, curiosity, different needs and knowledge distributions across nurseries. Nurseries are both places (enclosures and open harvests) and practices (assisting the

reproduction, raising, growing, planting) that already happen in not opposing ways. Bringing together diverse practices and places under a name helps me to show that subtle variations do matter and enact different kinds of fish, forests, and seas.

In the Rosario archipelago, many conservation and restoration advocates tell stories of oppositions. Some of those include artisanal fishers who destroy corals and fish and scientists who dream of the end of fishing. This opposition is a powerful constituent of coral saving efforts, offering notions of substitutive activities. The oppositional analysis reinforces binary ways of thinking in conservation and restoration. However, the relations among islanders in the archipelago are not only oppositional. Rafa grew up among fishers and as a fisher himself. Multiple times researchers at the CEINER lab and other research institutions have worked together with fishers. I can name at least two projects that occurred during my fieldwork on the islands: fishing for life and the training of subaquatic eco-guides (see chapter 2). There are some relations of friendship and companionship too. In the everyday life, these scientists and fishers share more than other people living elsewhere.

The oppositional discourse about fishers and coral researchers reappears continuously in the name of conservation. Some coral restoration practitioners worry that fishers do not understand that corals are indeed animals, not *piedras* (stones). *Piedras* do not need to be animals to be valuable for fishing purposes. Without *piedras*, there is no lobster, no crab, no fish. Furthermore, *piedras* can also be enticing for fishers. The fishers I met do not see the divergence between coral animals or *piedras* as an impossibility for collaboration (see chapter 2). For instance, Libinston (a fisher) says he is willing to volunteer time to restore not only the small (*Acropora*) but the big corals that are also *piedras*, to revive the seascapes that he remembers as *encanto* (enticing). He has not told this to any researcher. Perhaps, no one has asked him. In the end, why does it matter

if corals are animals and *piedras* when there is a shared sense that joyfully living in enticing seas is profoundly tied to the presence of coral and fish?

Thinking in non-oppositional ways can expand how researchers conceive collaborations with fishers. *Entre pescadores nos entendemos,* we (fishers) understand each other. This is an expression I borrow from Lavinia's work with artisanal fishers. When I was on the islands, I heard many fishers saying that *trasmallos* (big fishing nets) were a problem. Fishers who use *trasmallos* usually come from the city. However, some fishers would follow up by saying: what can we do? They are fishers as we are. A few times, I also heard fishers in a canoe, asking fishers with *trasmallo* for *liga* for their families. Lavinia describes that fishing with *trasmallos* and gunpowder has intensified during the pandemic, and artisanal fishers in the Rosario archipelago have lost some of their *piedras*. Lavinia and some fishers are making videos to explain to other fishers how breaking *piedras* affects artisanal fishers in the Rosario archipelago. Some collaborations among fishers and scientists may be less about researchers doing things, but more about researchers supporting fishers' initiatives by giving those more visibility and credit.

Coral restoration and aquaculture already co-exist with more forms of nurseries in the Rosario archipelago. Some artisanal fishers have simultaneously engaged with aquaculture-raised *cobias* in enclosures at the *Oceanarium* and *robalitos* (little sea bass) in their domestic enclosures. These practices co-exist while also enacting different realities. Aquaculture scientists address a production challenge in a world of cost-benefit calculations, standards, protocols, international markets, large and centralized structures, and industrial pellets. *Criaderos* make use of what is available in fishers' houses and backyards.

Perhaps, Rafa's dream of contributing to food security on the islands is more feasibly tied to the fishers' domestic ponds. Many farmers/fishers prefer flexible collaboration. Often, I hear

islanders repeating that they do not like to receive orders and attend meetings, which some scientists and policy makers may think speed up decision-making and activities. In the past, farmers/fishers have gathered to create councils and cooperatives and to work with researchers. However, some people suspect that those gatherings have benefited some more than others. Today, farmers/fishers would rather do something else with their time. In that sense, the actualization of Rafa's dream might also require that aquaculture researchers convince farmers that working with them is worth their time.

Perhaps, instead of concentrating activities at the *Oceanarium*, farmers and fishers may be more willing to collaborate as networks and scatters, as patterns that cannot be self-replicated. Assisted reproduction may still happen at the *Oceanarium*, and *criaderos* may receive juvenile fish raised at the lab. This experiment may offer no guarantees. Scientists may have less control over *criaderos*, fish, food, and labor. Researchers may have to learn with *criaderos* and fisher farmers in the process, and experiment with legible translations for the Colombian Agropecuary Institute, other aquaculture researchers, and sponsors. It may be an experiment in food sovereignty, fishers farming, and aquaculture science.

Nursery-ing can push more implications of redistributive politics than the right to become a black entrepreneur where not everyone can become so (see chapter 3). Redistribution may also be of water and filtering systems, edible and medicinal gardens on the surface and underwater, nurseries of corals, plants and fish seeds, and schools that teach gardening, cooking, and medicine. A large amount of money circulates on the islands each year through projects. Rephrasing the words of some people on the islands, the money of projects quickly disappears. Perhaps, islanders may imagine ways to capture and slow down the flow of money across the islands as coconut lines may slow down the flow of rainwater before it drains into the seawater.

The Community Council of Islands has reached out to the Community Council of Bahía Málaga in the Pacific of Colombia for inspiration. In the archipelago of La Plata, Bahía Málaga, the Community Council created a community association called *Ecomanglar*. The Association has set a limit to the number of tourists that can visit the island at any one time. Also, it distributes the tourists in different eco-hotels each time so that everyone benefits from the visits. Tourists stay in one place and eat in another, and other islanders provide tours. Bahía Málaga in the Pacific coast is less accessible than the Rosario archipelago. A tourist must take a flight to Cali, drive to Buenaventura, and take a motored boat to La Pata archipelago, Bahía Málaga. However, if many people in the Rosario archipelago start thinking that a similar approach to tourism can be made possible on the islands, perhaps, at some point, it will be possible.

As a speculative proposal, nursery-ing offers coral restoration and aquaculture an approach to more fish and plant growing practices and vocabularies. It adds more existing possibilities to what is predominantly conceived as possible. As a proposal, nursery-ing cannot be imagined once and for all, it is rather an experimental and creative process. Sometimes the feedback may come in the form of refusals and approvals of fisher/farmers, scientists, snails, floods, draughts, guilds, and flavors. This feedback may become confirmations and invitations for variations in nurseries that create conditions for different seas, conceptually, and materially.

Openings

Like plants in farming, fish in aquaculture are seeds and crops. Like plants, insects, birds, corals, fish, and many others can make, pollinate, and disperse gardens. These expressions of what fish and coral can also be are deeply tied to place-based practices and technoscientific genealogies and inheritances. Holding together various *guarderías* (nurseries) side by side helps me to trace those genealogies and inheritances and call for more mingling across the nurseries (see chapter 3). How

else can we do coral restoration and aquaculture today? The idea of "difference without opposition" helps me to imagine that coral restoration science can be done in multiple ways by adding more interests and *guarderías*. For instance, the lab can still assist in the reproduction of fish and work with *criaderos* and fish farmers to raise fish. In this experiment, the ways of doing assisted reproduction and *criaderos* may be transformed too, by experimenting with different forms of food and abundance.

With respect to the reef futures of coral restoration scientists (see chapters 1, 2, and 3), I suggest that there are already more futures that are not guaranteed and can be nourished too. The rain and medicinal plants are disappearing alongside coral and fish, but many more *guarderías* (nurseries) are doing things to revive memories and relationships to call them back. These other ways *guarderías* (nurseries) currently flag possibilities and vocabularies for reef futures aside from productive economies. What might a revival of edible, medicinal, and enticing coral reefs be like?

Guarderías (nurseries) are the location and the relations that sustain them. Edible, medicinal, and enticing coral reefs might be the coral and fish, the joy of diving in, the creation of memories, and flavors to long for. I think coral restoration scientists might add more allies to their coral gardens by openly acknowledging that many islanders are lured by coral, and not only because of their services and functions. Coral observatories, nurseries, and gardens may explore ways to become more welcoming and inviting to children, fishers/farmers, tourists, handcraft people, and eco-guides. How could coral nurseries elicit the interests of all these people in a place while also moving and dispersing seedlings throughout the archipelago? Maybe fish farmers could also become coral *criadores* (raisers), farmers, and gardeners near their homes and habitual places. Maybe the scientists could outplant in fishing *bajos*, creating a coral corridor for the migration of fish and fishers (fish, birds, and humans) (see chapters 1 and 2).

What kind of animal and ecology is coral?

Juan Camilo cuts a fragment of *Acropora cervicornis* from the CEINER nursery. An abundance of some sort of white seed makes him think that corals are about to spawn. CEINER lab—*Oceanarium* Islas del Rosario. Photograph by Juan Camilo Zárate. August 2018. Used with permission.

In the absence of sunlight, coral, the flower-animal, extends its petal-like tentacles and eats plankton. Among those planktonic beings, coral captures a variety of particles agitating and settling into the seawater. Microplastics, sedimen, and other industrial matter dissolve, suspend and travel with the currents and the seasonal *bombazos* of freshwater coming from the continent with the southerly winds. Before spawning, coral bundles accumulate within the skeleton where it is hard to distinguish between individual polyps. It feels more like an animal with millions of mouths. During the nights when the sea births, coral spawn massively and synchronically moves as plankton under storms. Coral larvae free swim towards the sound of the reefs. Coral, who is a polyp, spawn, and larvae, may be moving deeper and into the open ocean. The scene of coral migration reframes planetary accounts of destruction and calls attention to the specific relationships from which coral may becoming elusive. In their move, coral becomes out of reach for researchers and artisanal fishers in the Rosario archipelago.

Coral does not precede the tools, questions, and training of their researchers and conservation advocates. Coral is simultaneously conceptualized and conceptualizing skilled ecological perceptions. Coral restoration's technoscientific milieu implies an anticipatory approach to warmer and more acidic seawater futures. Coral milieus, watery and conceptual, narrate stories of competition and fragility under climatic stress. I suggest that intra-penetrating technoscientific milieus might elicit slightly different ecological perceptions and perhaps stories in which coral may not only lose.

Throughout my dissertation, I have told stories of coral scientists who actively speculate when confronted with things they cannot explain with the tools currently available to them. Speculation is a way of giving rise to possibilities, which are not yet authorized knowledge. In a way, speculation is the edge of epistemic limits and illustrates the demand for clarity and certainty in science. In addition to this kind of limit, there might be other kinds that technoscientific practices may not perceive. These epistemic limits may not be a matter of time and further experimentation. Whereas the condition for speculation might be knowing the limitations of existing knowledge, the second limit implies not knowing what is unknown. For example, coral researchers in the archipelago do not have the means to know fish migration and other co-incidental marine compositions, such as corals, that are also *piedras* (stones), and ecologies, such as *bajo-hondo*. Unlike coral restoration scientists, fishers know of this migration because they follow fish farther and deeper into the ocean and constantly move across the concepts relevant to artisanal fishing and conservation within the nature reserve.

Adriana Vergés (2021), Associate Professor at the University of New South Wales, Australia, suggests that climate change drives migrations towards higher latitudes, deeper depths in the oceans, and the poles. Not all species move at the same rate, but phytoplankton and fish

seem to be leading the way. In collaboration with researchers in Japan, Australia, Brazil, and the Mediterranean, they study the migration of voracious herbivore fish. In the last twenty years, they have observed a tropicalization of temperate reefs. The increasing presence of herbivore fish has changed the composition of temperate reefs from seaweed-dominant to coral reefs. Kelp has declined alongside fish associated with kelp. In those places, Vergés suggests restoring kelp with potential diminishing effects for coral.

Drawing from Vergés' studies, I want to point to various things. First, coral is deeply entangled with coral fish. Second, the perception of migration in this study is possible through collaboration with researchers located in various places. In a way, these scientists move through collaboration. Third, coral bloom in temperate reefs shifts the terms of destruction explored in this dissertation. Coral flourishes with herbivore fish and diminishing kelp. Kelp restoration is not only investing in the restoration of a species. It aims for the partial recovery of situated lifeways with kelp and kelpfish. Some strategies to enhance temperate reef resilience include fisheries focusing on herbivore fish, which is analogous to how coral conservation advocates the promotion of fishing the invasive lionfish in tropical reefs. Coral, not necessarily an invasive species, may disappear too from these places as kelp grows. Some intriguing proposals in kelp restoration include the assisted evolution of "super kelp" and the "assisted migration of coral into temperate reefs."

In addition to climate change, concrete industrial operations such as dredging, fishing, and offshore explorations and exploitations can destroy situated reefs faster than the slow and cumulative deaths of extinction. These industrial operations may not kill species but will kill situated reefs and their entangled relations. In that sense, the defense and restoration of situated reefs might not be the same as a defense of a species from extinction (even if it also is)—it is rather a defense of place-based lifeways.

Coral is an animal that grows like a plant in subaquatic PVC forests. I find that the insistence on the animality of coral by their scientists carries an affective underpinning. An underlying assumption may be that animals are more deserving of conservation than plants and rocks. Coral scientists I have met constantly repeat that coral is an animal and imagine that fishers may destroy coral out of ignorance of their animal condition. Coral is also plant and rock in artisanal fishing. However, these plants, rocks, and animals may not share the same hierarchy as they do for these coral scientists. Artisanal fishing can kill coral animals, plants, and rocks. However, without coral having to be an animal, fishers find fish in coral reefs, and some fishers describe these places as enticing. Coral animality may not be necessary for partial, strategic, and otherwise improbable alliances and collaborations among coral researchers and artisanal fishers.

With seawater acidification, reef-building coral, as well as shells and surfaces over which islanders claim legal rights, are dissolving into the sand. Likewise, corals (animals, plants, and stones) become sand in dredging, trawling, and drilling. The sand lifts into agitated seawater and settles into living coral, drowning it. This process of *sandification* may be a slow and accumulative process in which the sea erodes the shore and washes out beaches and islands. Further research can explore what lifeways are becoming while more sand is suspended and moved in seawater.

Animal rights advocates emphasize individual sentience over other environmentalist approaches to species with a functional role in the ecosystem. Thinking of coral's individual sentience might be challenging, as coral never has been one. Coral is a polyp, spawn, larvae, colony, reef, and coral-coral fish. Coral is also capable of massive and synchronic spawning. Coral researchers elicit the thought of intra-species communication in the name of chemical/environmental cues. As I mentioned in chapter 1, "chemical/environmental cues" usually appear when there is a limit in the ability of scientists to explain something. Like for other marine

animals, coral's health is inseparable from seawater quality. In Florida and other places, coral vets have a veterinary and zootechnic approaches to coral's welfare. By writing this ethnography, I have learned that social scholars may need to do more work to address how historical and situated ideas about bodies and health shape technoscientific ways of caring for coral (and other marine animals).

By thinking with some artisanal fishers, who are also farmers, I have learned that coral has disappeared alongside the rain and medicinal plants. It may not be an accident that coral spawns under seasonal storms. Perhaps, calling back coral might require calling back the rain by growing medicinal plants. Maybe, coral restoration could draw inspiration from other ways of farming in addition to forest restoration. How would a revival of edible, medicinal, and enticing coral reefs look? What might be their practices of dispersal and cross-pollination? Perhaps, coral restoration gardeners may better work with coral raisers to nourish the corridors for the migrations of fish and fishers (fish, birds, and artisanal fishers) on their way back to the shore. Perhaps, in the process of partially recuperating those corridors, together, coral researchers, artisanal fishers, sea ethnographers, coral, and fish may become other with each other.

Finally, the word ecology in this dissertation points to different ways of conceiving relationships, not only in biological sciences. By writing this dissertation, I learned that conservation biology includes different ways of thinking about ecological relations. For instance, biodiversity accounts list all different kinds of species and key species accounts concentrate on key kinds for maintaining ecosystem functions. Political ecology interrogates the distribution of costs and benefits across sectors and groups. This kind of distribution of political claims is different from Stenger's (2005) ecology of practice. For Stengers, this ecology is a question of habitat for physics, describing historical and political claims about a privileged position of judgment. With

this concept, they simultaneously acknowledge the questions and concerns of physicists and challenges the situations in which physicists defend their practices by legitimizing the destruction of others. By doing this work, Stengers opens new possibilities and terms of relations between physics and other practices, including witchcraft. Drawing from Stengers, I claim that coral ecology described in conservation and restoration biology needs a new habitat. By exploring co-incidental marine compositions and ecologies, I acknowledge divergence and multiplicity. While recognizing that some ecologies compete, I also point to their co-incidence in material transformations that mutually compromise their existence. Social scholars still need to do considerable work to fabulate and create new habitats for experimental, partial, and strategic collaborations among scientists and other islanders and visitors.

References

Appel, A. 2012. Oil, modularity, and the how of capitalism in Equatorial Guinea. *American ethnologist,* 39 (4): 692–709.

Balcombe, J. 2016. *What A Fish Knows. The Inner Lives of Our Underwater Cousins.* New York: Scientific American Press.

Bassler, B. 2009. *How bacteria "talk."* Available at: https://www.ted.com/talks/bonnie_bassler_how_bacteria_talk?language=en

Braverman, I. 2021. *Zoo Veterinarians: Governing Care on a Diseased Planet.* New York: Routledge.

Braverman, I. & E. Johnson (Eds). 2020. *Blue Legalities: The Life and Laws of the Sea.* Durham and London: Duke University Press.

Braverman, I. 2018. *Coral Whispers: Scientists on the Brink.* Oakland: University of California Press.

Braverman. 2013. *Zooland: The Institution of Captivity.* Stanford: Stanford University Press.

Budiastuti, A. 2020. Catfish: Halal, Green, or Disgusting? Investigating Practices of Traditional Farming and Care in Indonesia. Probyn, E.; Johnston, K.; & N. Lee. *Sustaining Seas: Oceanic Space and the Politics of Care.* London and New York: Rowman and Littlefield International.

Cárdenas, Vanessa. 2020. *Construcción del territorio-maritorio en Isla Grande (Cartagena): Tejido de relaciones, tensiones y acuerdos alrededor de la conservación ambiental.* Trabajo de grado para optar por el título de: Antropóloga. Universidad Externado de Colombia. Facultad de Ciencias Sociales y Humanas. Área de Procesos Sociales, Territorios y Medio Ambiente.

Consejo Comunitario de Islas del Rosario. 2015. *Plan de Vida del Consejo Comunitario de Islas del Rosario.* Available at: https://www.youtube.com/watch?v=avUS3bzld74

De Wolff, K. 2017. Plastic Naturecultures: multispecies ethnography and the dangers of separating living from nonliving bodies. *Bodies and Society*, 23 (3): 23-47.

Despret, V. & M. Meuret. 2016. Cosmoecological Sheep and the Arts of Living on a Damaged Planet. In *Environmental Humanities* 8 (1): 24-36.

Despret, V. 2016. *What Would Animals Say If We Asked the Right Questions? Translated by Brett Buchannan.* Minneapolis and London: University of Minnesota Press.

Despret, V. 2017. Afterword: It Is an Entire World That Has Disappeared. Translated by Matthew Chrulew. In B. Rose, T. Van Dooren &; M. Chrulew (Ed.) *Extinction Studies: Stories of Time, Death, and Generations.* (pp. 217-222). New York: Columbia University Press.

Durán, C. 2007. *¿Es Nuestra Isla Para Dos? Conflicto por el Desarrollo y la Conservación en Islas del Rosario.* Bogotá: Uniandes-Ceso.

Fals-Borda, O. & Rahman, M. A (Eds). 1991. *Action and Knowledge: Breaking the Monopoly with Participatory Action-Research.* New York: The Apex Press.

García-Ruiz, L.P. 2017. *Champeta: Espacialidad Geográfica y ALteridad de lo Negro en la Ciudad de Cartagena de Indias (Colombia).* Tesis para la obtención del título de Magíster en Estudios Culturales. Universidad Nacional de Rosario.

Gilbert, S. 2017. Holobiont by Birth: Multilineage Individuals as the Concretion of Cooperative Processes. In *Arts of Living on a Damaged Planet: Monsters.* Pp. M73-M90.

Gilmore, R. W. 2020. Ruth Wilson Gilmore makes the case for abolition. *Intercepted Podcast.* Available at: https://theintercept.com/2020/06/10/ruth-wilson-gilmore-makes-the-case-for-abolition/

Gómez González, J. 2020. *Figuraciones de la orilla: Investigaciones espúreas desde el "aquí y ahora" de la pandemia.* Online discussion with Jorge Díaz. Organized by Colectivo Comunitario Contextos, Ruta de Artes y Mujeres de la Periferia y la Escuela Feminista Antirracista Comunitaria de Cartagena.

Grupo de Investigación en Química de Medicamentos. 2018. *Flora y Fauna de Isla Grande—Cartagena.* Cartagena: Universidad de Cartagena.

Gudynas, E. 2015. *Extractivismos: Ecología, Economía y Política de un Modo de Entender el Desarrollo y la Naturaleza.* Bolivia: Centro de Documentación e Información Bolivia.

Haraway, D. 2008. *When Species Meet.* Minneapolis and London: University of Minnesota Press.

Haraway, D. 2016. Tentacular Thinking: Anthropocene, Capitalocene, Chthulucene. *Staying with the Trouble. Making Kin in the Chthulucene.* Durham and London: Duke University Press.

Haraway, D. 2017. Symbiogenesis, Sympoiesis, and Art Science Activisms for Staying with the Trouble. In *Arts of Living on a Damaged Planet: Monsters.* Pp. M25-M50

Hayward, E. 2010. Fingeryeyes: Impressions of Cup Corals. In *Cultural Anthropology. Special Issue: Multispecies Ethnography*, 5(4),577-599.

Heise, U.K. 2016. *Imagining Extinction: The Cultural Meaning of Endangered Species.* Chicago and London: The University of Chicago Press.

Helmreich, S. 2016. How Like a Reef: Figuring Coral, 1839-1910. In *Sounding the limits of Life: Essays in Anthropology of Biology and Beyond.* Princeton: Princeton University Press. Pp. 48-61.

Helmreich, S. 2016. *Sounding the limits of life: Essays in the Anthropology of Biology and Beyond.* Princeton and Oxford: Princeton University Press.

Ingold, T. 2000. *The Perception of the Environment: Essays on Livelihood, Dwelling and Skill.* London and New York: Routledge.

Ingold, T. 2011. Four objections to the concept of soundscape. *Being alive: Essays on movement, knowledge and description.* London and New York: Routledge, Taylor & Francis Group.

Jiménez Cárdenas, V. 2019. *Bioacumulación de Plásticos en Peces de Arrecife de Coral y Manglar, Isla Grande, Caribe Colombiano. Tesis para la obtención del título de ecóloga.* Facultad de Estudios Ambientales y Rurales. Pontificia Universidad Javeriana.

Jordan, C. 2018. *Albatross.* Available at: https://www.albatrossthefilm.com/

Law, J. & A. Mol. 2008. Globalisation in Practice: On the Politics of Boiling Pigswill. *Geoforum* 39 (1): 133-43.

Leiva, A. 2013. Apropiación del territorio y espacialidad en el Islote (Caribe colombiano). *Geopolítica(s). Revista De Estudios Sobre Espacio Y Poder*, Vol. 3 (2): 293-328. https://doi.org/10.5209/rev_GEOP.2012.v3.n2.40151

Liboiron, M. 2021. *Pollution is Colonialism.* Durham and London: Duke University Press.

Lien, M. 2015. *Becoming Salmon: Aquaculture and the Domestication of Fish.* Oakland: University of California Press.

Lillis, A; Bohnenstiehl, DW; Peters JW; & D. Eggleston. 2016. Variations in habitat soundscape characteristics influences settlement of a reef-building coral. *PeerJ*, 4: e2557; doi: 10.7717/peerj.2557.

Lorimer, J. 2015. *Wildlife in the Anthropocene: Conservation After Nature*. Minneapolis: University of Minnesota Press.

Mann, A. 2020. The Protection of Small-Scale Fisheries in Global Policymaking through Food Sovereignty. Probyn, E.; Johnston, K.; & N. Lee. *Sustaining Seas: Oceanic Space and the Politics of Care.* London and New York: Rowman and Littlefield International.

Mann, D.A., Locascio, J.V., Coleman, F.C. &; C.C. Koening. 2009. Goliath grouper Epinephelus itajara sound production and movement patterns on aggregation sites. In *Endangered species research*, 7 (3): 229-236.

Márquez Pérez, A.I. & S.D. Crawford. 2016. A contact zone: the turtle commons of the Western Caribbean. *The International Journal of Maritime History,* Vol. 28 (1): 64-80.

Márquez Pérez, A.I. 2014. Catboats, lanchs, and canoes: apuntes para una historia de las relaciones de las islas de Providencia y Santa Catalina con el Caribe Centroamericano e Insular a través de la construcción y el uso de embarcaciones de madera. *Passagens. Revista Internacional de História Política e Cultura Jurídica,* Vol. 6 (3): 480-508.

Márquez Pérez, A.I. 2018. Acaparamiento de Territorios Marinos y Costeros: Dos Casos de Estudio en El Caribe Colombiano. *Revista Colombiana de Antropología,* Vol. 55 (1): 119-152.

Mogollón Vélez, J. V. 2013. *El Canal del Dique: Historia de un Desastre Ambiental.* Bogotá: El Áncora Editores.

Moore, A. 2018. Working Together to Restore the Reef: Naturalizing Corporate Forms of Coral, Labor, and Responsibility. In *Editors' Forum: Theorizing the Contemporary. Society for Cultural Anthropology.* Available at: https://culanth.org/fieldsights/working-together-to-restore-the-reef-naturalizing-corporate-forms-of-coral-labor-and-responsibility

Murphy, M. 2017. Alterlife and Decolonial Chemical Exposures. *Cultural Anthropology, 32 (4): 494-503.*

Murphy, M. Forthcoming. Reimaging Chemicals, with and against Technoscience. In *Reactivating Elements*, Edited by M. Puig de la Bellacasa, D. Papadopoulos and N. Myers. *Reactivating elements.* Durham and London: Duke University Press.

Niño, N.; Acosta, A.; Díaz-Granados, M.C.; & O. Laverde-R. 2017. Escuchando arrecifes de coral. Un método novedoso para el estudio y monitoreo de los ecosistemas marinos. *Innovación y Ciencia,* 24: 66-72.

O'Brien, M. 1993. Being a Scientist Means Taking Sides. *BioScience,* 43 (10):706-8.

Padilla, A. 2019. *Los animales al derecho. Nuevas concepciones jurídicas sobre los animales en América Latina: de la cosa al ser sintiente.* Tesis para optar al título de doctora en derecho. Universidad de los Andes. Colombia.

Pauwelussen, A. & G.M. Verschoor. 2017. Amphibious Encounters: Coral and People in Conservation Outreach in Indonesia. *Engaging Science, Technology, and Society,* 3: 292-314.

Peters, J.D. 2015. Of Cetaceans and Ships; or, The Moorings of Our Being. *The Marvelous Clouds. Towards a Philosophy of Elemental Media.* Chicago: University of Chicago Press. Pp. 53-114.

Puig de la Bellacasa, M. 2017. *Matters of Care: Speculative Ethics in More than Human Worlds.* Minneapolis and London: University of Minnesota Press.

Quinceno, N. 2016. *Vivir sabroso: luchas y movimientos afroatrateños, en Bojayá, Chocó, Colombia.* Bogotá: Editorial Universidad del Rosario, Escuela de Ciencias Humanas.

Ripoll Echeverría de Lemaitre, M.T. & J.E. Báez Ramírez. 2001. *Desarrollo industrial y cultura empresarial en Cartagena, 1920-2000: La Andian National Corporation y la Refinería de Mamonal.* Bogotá: Universidad Jorge Tadeo Lozano.

Rosas Corona, M. F.; Giraldo Alzate› A. J.; Rosas Monge, C.: & M. B. Rendón López. 2019. "Bioacumulación de metilmercurio en el tejido hepático de peces marinos provenientes del Parque Nacional Natural Corales del Rosario y San Bernardo, Colombia." *Academia Journals,* 11 (2): 2552-2560.

Rose, D.B. &; Van Dooren, T. (Ed). 2011. Unloved Others: Death of the Disregarded in the Time of Extinctions. In *Australian Humanities Review*. Issue 50.

Rose, D.B. 2011. *Wild Dogs Dreaming: Love and Extinction*. Charlottesville: University of Virginia Press.

Rose, D.B., Van Dooren T. & M. Chrulew (Ed.). 2017. *Extinction Studies: Stories of Time, Death, and Generations*. New York: Columbia University Press.

Rotjan, R.; Sharp, K.H.; Gauthier, A.E.; Yelton, R.; Baron Lopez, E.M.; Carilli, J.; Kagan, J.; & J. Urban-Rich. 2019. Patterns, dynamics and consequences of microplastic ingestion by the temperate coral, *Astrangia poculata*. *Proceedings of the Royal Society of Biological Sciences*, 286 (1905). https://doi.org/10.1098/rspb.2019.0726

Sacks, O. 1997. *The island of the color blind.* Sidney: Picador.

Stengers, I. 2005. Introductory Notes on An Ecology of Practices. In *Cultural Studies Review*, 11 (1): 183-196.

Taylor, S. 2017. *Beasts of Burden: Animal and Disability Liberation.* New York: The New Press.

Ticktin, M. 2017. A world without innocence. *American ethnologist,* 44 (4): 577-590.

Trouillot, M. 1995. An Unthinkable History: The Haitian Revolution as a Non-event. *Silencing the Past: Power and the Production of History.* Boston: Beacon Press.

Valencia, I.H. 2015. Multiculturalismo y seguridad fronteriza en el Archipiélago de San Andrés y Providencia. En Observatorio de Violencia y Gobernanza. Fundación Friedrich Ebert Stiftung. Análisis, No. 6, septiembre, ISSN 2422-0663.

Van Dooren, T. 2014. *Flight Ways: Life and Loss at the Edge of Extinction*. New York: Columbia University Press.

Vergés, A. 2021. Underwater forests in temperate latitudes: climate change impacts and restoration solutions. *John & Mary Louise Riley Bodega Marine Laboratory Seminar Series.* Available at: https://video.ucdavis.edu/media/BML+-+Dr.+Adriana+Verg%C3%A9sA+%22Underwater+forests+in+temperate+latitudesA+climate+change+impacts+and+restoration+solutions%22/1_ffix4rmo. Last consulted on October 2021.

Vermeij, MJA; Marhaver, KL; Huijbers, CM; Nagelkerken, I.; & SD Simpson. 2010. Coral Larvae Move Towards Reef Sounds. *PLoS ONE,* 5 (5): e10660. doi:10.1371/journal.pone.0010660.

Westerkamp, H. 1989. *Kits Beach Soundwalk.* Available at: https://www.youtube.com/watch?v=hg96nU6ltLk. Last accessed in September 2020.

Wylie, S.A. 2018. Methods for Following Chemicals: Seeing Disruptive System and Forming a Disruptive Science. *Fractivism: Corporate Bodies and Chemical Bonds.* Durham and London: Duke University Press.

Zapata Olivella, M. 1963. *Chambacú: corral de negros.*

Zarza, E.; Vargas, A.; Londoño, L.; Pacheco, A. &; Duque, D. 2014. Ensayo preliminar y de crecimiento de fragmentos del coral amenazado Acropora cervicornis en una guardería colgante y experiencias piloto de transplante en el Parque Nacional Natural Corales del Rosario y de San Bernardo, Caribe Colombiano. In *Biota Colombiana*, 15 (2), 102-113.