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Corals in the city: cultivating ocean life in the Anthropocene

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ABSTRACT

Ocean life is often portrayed as antithetical to life in the city. Drawing on interviews with coral hobbyists and aquarists, my article focuses on the emergence of the coral aquarium hobby within the urban home. I depict the recent fascination of city dwellers from around the globe with corals, explore the history and contemporary characteristics of those who propagate them as well as their reasons for doing so, and examine the urban coral industry. I also argue that corals reveal the problems with existing regulatory modes of classifying animals. The corals who live in urban tanks are not exactly wild, nor are they domesticated; they are not exactly pets, nor are they plants or ornaments; and since they are clones, it is hard to determine where one individual starts and another begins – and what death even means in this context, in which production and consumption are intertwined. Finally, while tropical corals are dying at alarming rates in the oceans, their numbers in the city are on the rise. Instead of heading to tropical islands to experience corals up close, coral enthusiasts are transplanting themselves into the city as their corals require careful attention to survive in the urban environment.

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Maybe the corals are saying, *we want to be out of the ocean, since the ocean is going to kill us*. [By contrast,] there is a very good chance that a coral in a tank will live forever. That's twenty-first century domestication for you!

—Foord, coral hobbyist, interview.

Ocean and city in the Anthropocene: an introduction

Ocean life is often portrayed as antithetical to life in the city. Yet, one need not be fully immersed in sea water to directly experience ocean life. Focusing on scleractinian, or stony, corals – symbiotic animals who¹ build a hard skeleton and belong to the phylum Cnidaria – this article will describe the emergence of an intimate relationship between humans and corals in urban spaces. The article will start by depicting two current forms of coral life in the city: opportunistic hybrid corals who thrive in highly impacted environments on the city's edge and aquarium corals thriving in home tanks and in public aquariums. Corals exist in at least two additional categorical sites: in ocean farms and nurseries for mariculture and conservation purposes, and within the ocean. I wrote about these two categories elsewhere (Braverman, 2018) and will therefore focus my attention here on

corals in the city. One must keep in mind, however, that the various categories and sites of coral existence are interconnected in myriad ways and should be treated as fluid, rather than fixed, constructs.

Much of urban animal geography (Wolch, 2002) and more-than-human urban geographies (Barua & Sinha, 2019; Hinchliffe, Kearnes, Degen, & Whatmore, 2005) has attended to warm-blooded familiars. There are some exceptions (e.g. Ginn [2014] on slugs and Gandy [2013] about plants), but these, too, have to do with terrestrial life. Following in the path of Bear's work on *Agelica* the octopus (2011), this article suggests that exploring marine invertebrate life, and doing so in the city, can make more visible what existing terrestrial work doesn't quite get at – the fluidity between air and water, for instance, and the precarity of so many other terrestrial classifications.

This article will focus on the emergence of the coral aquarium hobby within the urban home. It is a direct extension of my five-year long research on coral biologists, which drew on interviews with more than one-hundred coral scientists and managers and culminated in the book *Coral Whisperers* (2018). Despite the book's focus on scientists in the field, it also included interviews with, and perspectives by, coral aquarists and hobbyists, which proved so stimulating that I decided to follow up on some of the issues they had raised. This article thus relies on the insights garnered from the book, yet pushes them further through in-depth skype and e-mail communications, mainly with Foord of Coral Morphologic and Sprung, conducted between November 2017 and May 2019.² A marine biologist in his formal training, Foord pushes the limits of science and art and challenges the scientific approach toward corals as a pioneer of avantgarde coral macro-video-graphy. Sprung is a prominent aquarist and the coauthor of *The Reef Aquarium* – a 3-volume book series.

Specifically, the article will depict the recent fascination of city dwellers from around the globe with corals, explore the history and contemporary characteristics of those who propagate them as well as their reasons for doing so, and examine the urban coral industry. The article will posit that corals reveal the myriad problems with existing cultural and regulatory modes of classifying animals in the city. The corals who live in urban tanks are not exactly wild, nor are they domesticated; they are not exactly pets, nor are they plants or ornaments; and since they are clones, it is hard to determine where one individual starts and another begins and what death even means in this context, in which production and consumption are intertwined. Finally, while tropical reef building corals are bleaching and dying at alarming rates across the planet's oceans, their numbers in the city are on the rise. Instead of heading to tropical islands in the Pacific Ocean to experience corals up close, coral enthusiasts from various corners of the world transplant themselves into the city, as their corals require constant and attentive care to survive in the urban environment.

Urban corals in the New Atlantis

Miami is known for being 'the only place in the world where a living tropical coral reef lies adjacent to a large urban center' (National Parks Traveler, 2008). Situated a few miles south of Miami, where it encompasses all but the northernmost part of Biscayne Bay, Biscayne National Park is one of the largest marine national parks in the United States. In 2004, the National Parks Conservation Association placed Biscayne on its annual list of the

Ten Most Endangered National Parks (National Parks Traveler, 2008). In the heavily polluted waters of Biscayne Bay, garbage, sewage, oil, thick algae blooms, and even nuclear waste abide.

Yet within this polluted urban environment also resides one of the hardiest, and perhaps most hopeful, coral that scientists have come across thus far: the Caribbean *Acropora prolifera* (Figure 1). The *A. prolifera* is a hybrid of the two threatened *Acropora* species in the Caribbean, *A. cervicornis* and *A. palmata*. The only widely accepted coral hybrid species in the world, scientists have been fiercely debating the meaning and significance of this taxa (Braverman, 2018, pp. 211–216). Fogarty of Nova Southeastern University in Florida is the prime expert on the *prolifera*. Referring to herself as Lady Hybrid, Fogarty explained in our interview that,

We've been so focused on trying to [artificially] restore those threatened *Acropora* species, that a lot of people totally missed out that they're being restored naturally by the hybrids. They are beautiful corals and are doing phenomenally well, especially considering the poor state of their parent species.

Fogarty also predicted that 'we are going to see them more and more as the conditions in the water change' (interview; see also Braverman, 2018, p. 211; Figure 2).

Foord is cofounder and codirector of Coral Morphologic, a Miami-based underwater media-science endeavour. Foord's current work, like Fogarty's, focuses on the hopeful role of coral hybrids for the planet's Anthropocenic future. While the recent severe bleaching events killed off large coral populations around the world (NOAA, 2018), it also

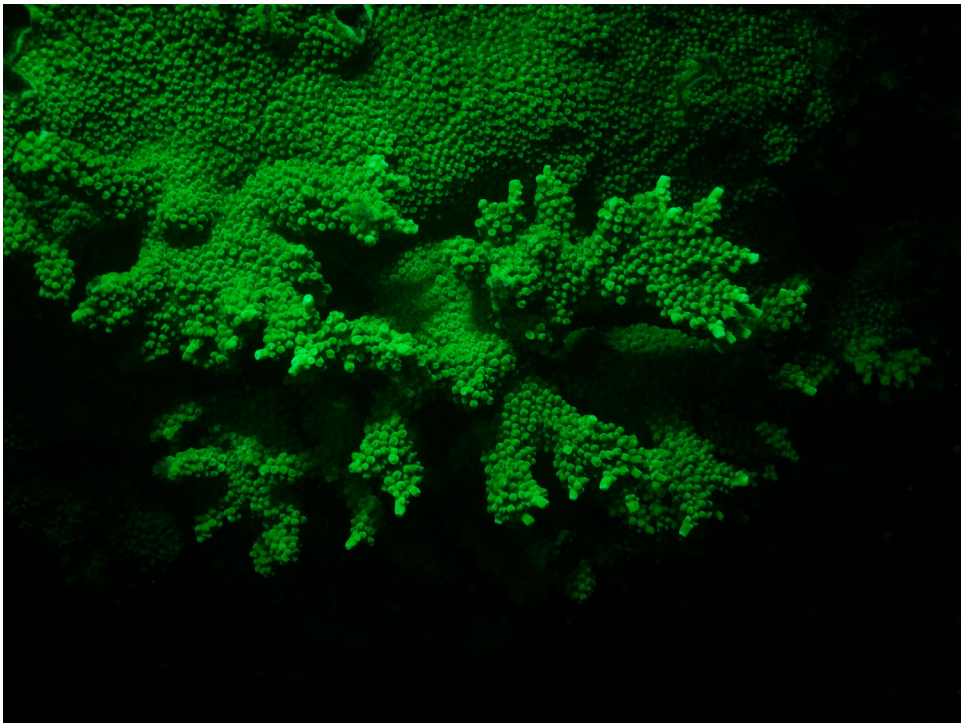


Figure 1. *Acropora prolifera*. Courtesy of Coral Morphologic.



Figure 2. *Acropora prolifera* at Carrie Bow Caye Island. Courtesy of Nicole Fogarty.

exposed the survivors – the super coral candidates, he told me in one of our many conversations. In his words: ‘This disaster is another form of inadvertent “assisted evolution” that produced “super corals”’ (see also Braverman, 2018, pp. 228–230).

Specifically, Foord believes that Miami Beach, with its ‘polluted waters, manmade substrates, and discarded bicycle frames’, is in fact the most cost effective coral laboratory on the planet. He speculated that ‘the appearance of the hybrid *Acropora* was just the literal proof that evolution is not only happening at an observable rate in corals, but that these human-made conditions are also accelerating evolution beyond what is happening on the wild reefs’. ‘It’s the super corals who are going to save us’, he told me.

Coral tanks in the city: who are the aquarium corals?

Alongside such urban corals who live in the periphery of our polluting and polluted cities, a great number of corals are taking hold of the urban environment in the epicenter of the city and thus the least likely of places: human homes. Studies of domestication in dogs have highlighted the mutual factors that have resulted in the human-dog bond (Dukatkin & Trut, 2017; Grimm, 2015). Recent studies have gone even further to suggest that no less than humans, dogs were active evolutionary participants in their domestication as they stood a better chance of survival with humans. The idea is that ‘we didn’t domesticate dogs. They domesticated us’ (Hare & Woods, 2013; *National Geographic*, 2013). What if corals were doing the same?

Foord's quote in the epigraph highlights the possibility that corals are indeed recruiting humans to help them survive the deteriorating conditions of the oceans. Their precarious state in the wild is the result of myriad human induced causes, including offshore pollution and overfishing, with warming water temperatures and increase in ocean acidification extending what some say might be the final blow for reef building corals as we know them (Hughes et al., 2017). Instead of intimate dog eyes and a joyful tail to wag, corals may be using other strategies to recruit us: spectacular colours and shapes, as well as unusual means of reproduction, are just a couple of the more visible examples. In the words of prominent coral aquarist Sprung, who, as I already mentioned upfront, coauthored the three-volume book series *The Reef Aquarium* – the Bible of coral aquarists: 'Corals charm people into investing in them' (interview). 'The human is attuned to the coral in a visceral way', Sprung explained, emphasising the sensorial interaction between aquarium corals and humans. Using their colours to first entice humans, corals are also charismatic in their behaviour: 'Corals also have memory, they can be trained. If you feed them at a certain time, they expect you to be there', Sprung told me. Such intimate routines are typically only possible in the shared human-animal environments of the home or aquarium, and do not occur in the wild.

But how does a coral make it to the urban home in the first place? A cursory search on eBay provided 5976 results for coral and live rock, including frag kits, cured reef plugs, and special coral glue (eBay, 2018; see, e.g. Figures 3–5). The corals' numerous colours, morphs, and fluorescent variations come replete with respectively colourful names. Superman Monti and Armor of God Zoanthids are featured alongside Morning Glory, Orange Crush, Fire and Ice, Mad Hatter Madracis, and Candy Striped Aussie Lori corals. The naming of coral morphs is controversial. According to Foord,

almost everyone you talk to, including the vendors who rely on these names, will say that naming corals is absurd and talk about how everyone is just oversaturating ("photoshopping") their photos to exaggerate the corals' fluorescence, thus adding to their perceived value when bought sight unseen. (interview)

At the same time, Foord pointed out that names can be helpful, for instance in tracking the lineages of coral clones. He explained that: 'Starting in the early 2000s with eBay, PayPal, and FedEx overnight shipping, people could start collecting rare strains, thus names and origin stories became important'. Coral naming has been particularly significant because of the lack of other mandatory documentation of coral origins. For example, there is typically no other way to tell whether a specific coral originated from the wild or from captivity, which can have ethical implications in conservation discourses, as I will discuss shortly.

The coral hobby changed dramatically since the 1990s. According to Foord: 'back in the 1990s, people would scoff at the size and price of the corals people buy today; people were just excited to get a coral that could survive, it didn't have to be crazy-colored'. But the advent of LED, followed by the emergence of digital social networks, brought about major changes to the reef hobby, enabling the proliferation of coral reefs in urban homes and the rise of a consumer culture, knowledge, and industry to accommodate this phenomenon. The corals themselves, too, have become more urban, as less and less of them originate from the wild, or even from mariculture farms situated within the ocean. A growing number of corals are instead clones of their wild conspecifics, reproduced and cultivated at the heart of the city. 'In the 1990s, all the corals were



Figure 3. Screenshot from saltwaterfish.com., where coral offerings are divided into eight subcategories.⁵

completely collected; now they are pretty much all aquacultured', Foord noted. 'Cloning and fluorescence are new to humans', he told me. 'Corals are [thus] harbingers of both the future and the past. Waiting for humans to figure them out'.

Growing corals in the city: a brief history

The desire to maintain corals in aquariums traces its history back to Victorian times, although such early attempts to keep corals alive were typically unsuccessful (Borneman, 2008, p. 4). Indeed, the task of cultivating aquarium corals is not as simple as it may sound. Despite their plantlike appearance, corals are animals – a community of many individuals called polyps, which are typically no larger than a few millimetres. A close look at a coral polyp reveals tentacles sprouting from a calcium carbonate base called a corallite. Living in the polyps of scleractinians, microscopic algae (zooxanthellae) perform photosynthesis during the daytime that provides the majority of the nutrients necessary for the polyps to survive. At night, the coral polyp uses its tentacles to sting and catch live prey. Corals are highly sensitive to water conditions and therefore require very specific, and consistent, water quality and temperature (Reef2Reef, 2014). Even more importantly, scleractinian

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Figure 4. Nano Mushroom Pack. From liveaquaria.com, screen shot from January 4, 2018. <http://www.liveaquaria.com/product/2315/nano-mushroom-pack?pcatid=2315&c=598+2315>

corals must also have proper illumination (in terms of intensity and colour spectrum) for a successful photosynthetic process.

In the mid-twentieth century, isolated attempts to use seawater exchanges and natural light in both Europe and the Philippines succeeded in keeping a variety of corals alive over extended periods (Borneman, 2008, p. 4), but the major advances in coral husbandry occurred in the late 1980s and throughout the 1990s with efforts by private aquarists. Specifically, these years saw the improvement of suitable lighting systems, better protein skimmer designs, the use of calcium reactors that incorporate CO₂ to dissolve limestone, and the development of advanced water pumping systems (Sprung, 2019, e-mail communication). Coral husbandry has evolved to the point whereby all symbiotic corals who rely on light as a major source of food can survive in a tank. As already mentioned, the most recent development on this front, which has radically transformed the reef hobby, is the LED (light emitting diode) that promotes coral fluorescence.

The rapid advances of the private aquarium hobby saw a similarly rapid rise in public aquarium reef displays and their inclusion as popular and important components of their facilities. Today, living coral reef exhibits have become global in distribution and are often used as tools for education, conservation, and science. To take the United States as one example: of 230 facilities accredited by the Association of Zoos and Aquariums in the United States, 49 are aquariums (AZA, 2017). Following in the footsteps of the zoos' recent emphasis on conservation (Braverman, 2012), aquariums, too, are increasingly taking on the charge of saving the wild, with a special focus on the depleted and

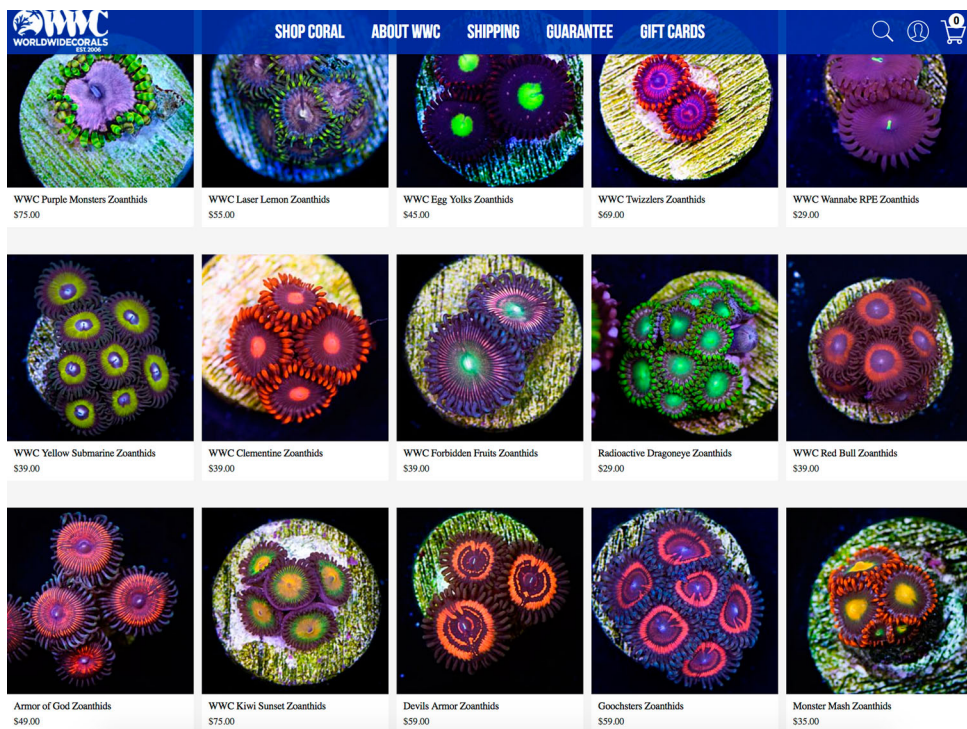


Figure 5. Zoanthids. From <https://worldwidecorals.com>

understudied state of oceans (Braverman, 2019). This charge, which has been underway in the last decade or so, is expressed in much of the educational materials presented by aquariums, especially regarding sharks and certain other imperiled species. The New England Aquarium in Boston dedicates an entire exhibit to corals and their uncertain futures and many others are following this path and incorporating live corals – once seen as too much trouble to maintain – into their exhibits.

The task of maintaining public marine exhibits is indeed challenging (Braverman, 2019). The first public aquarium was opened in the London Zoo in 1853. Today, the Georgia Aquarium is one of the largest aquariums in the world with 550,000 square feet of exhibits, including over 100,000 animals (Georgia Aquarium, 2005; Wikipedia). Most public aquariums are located close to the ocean for a steady supply of natural seawater. An inland pioneer was Chicago's Shedd Aquarium, which received its seawater in special tank cars shipped by rail. Steinhart Aquarium in San Francisco features one of the deepest coral reef aquariums in the world at 25 feet (7.6 m) with 212,000 gallons (802,507 l) of water (Wikipedia).

While there are close ties between coral keepers in public aquariums and private hobbyists, there are also significant differences between these groups. Most aquarists in public institutions were also hobbyists at a certain point, and some still maintain private tanks in their spare time. Foord referred to public aquarists as 'a wishbone cut in half'. He explained that they straddle between the world of conservation science, with its orientation toward large scale environmental protection, and that of coral hobbyists, who have a more individualised and commercial orientation.

Another degree of separation between the two groups results from the accredited zoo industry standards that animals are not for sale. Hence, aquarists from public aquariums cannot trade corals with hobbyists – they can only trade them amongst themselves or with certain research institutions. Notably, there is also a difference between zoo and aquarium recruitment: while zoos typically cannot obtain exotic animals from the wild and have developed a sophisticated network of reproduction for this reason (Braverman, 2012), many public aquariums still directly collect their animals, including corals, from the wild. Toronto's Ripley Aquarium's former director of husbandry, Neal, told me along these lines:

We mainly collect [our animals] at the Florida Keys, and we have a 'no hands' rule. We use nets and try not to handle [animals] at all and we also get to pick. We have permits and of course follow their requirements, but we also try to make good decisions as we go. For example, although it is not a requirement of the permit, we will decide to take smaller animals that don't yet reproduce, and leave the reproducing ones on the reefs. Collecting our animals ourselves means that we are in control of collecting and can do so in the most sustainable and conservation oriented way possible. (interview)

While hobbyists typically cannot travel out of the city, as their corals require constant care, biologists (as well as scuba divers, yet another group of coral lovers) often travel intensely, privileging tropical sites around the globe that are typically as far removed from the city as possible. These groups also usually do not see eye-to-eye when it comes to more substantial issues.

In their position as conservation aquarists, a growing number of former hobbyists are newly performing central roles in restoration projects, such as designing nurseries in imperiled marine areas and teaching biologists how to handle corals in labs. 'Aquarists have discovered lots of stuff that [conservation] biologists never saw before', Foord explained. Founded and directed in 2002 by a former Rotterdam Zoo staff, the nonprofit organisation SECORE (SExual CORal REproduction) facilitates partnerships among aquariums, and between aquarists and marine biologists in the field. SECORE also executes large scale restoration projects and has been developing strategies for increasing the corals' sexual reproduction for conservation purposes. The Coral Restoration Foundation (CRF) is another important group that emerged from the work of former live rock grower Nedimyer and is now managing the largest coral nurseries for restoration in the world (Braverman, 2018, pp. 139–152).

Historically, biologists and divers have blamed the coral hobbyists for much of the demise in wild reefs, pointing to the damage wrought on these systems by their commercial exploitation for the aquarium trade (Thornhill, 2012). Sprung argued in response that

scientists isolate themselves, often complaining that no one cares about their corals. But when they visit a coral aquarist show and see the level of enthusiasm toward corals, they are flabbergasted. They are used to thinking about our industry as a wasteland – a place where wild corals are taken to die – and are not aware of the huge mariculture tradition and the extent to which corals are actually alive and thriving in our homes. (interview)

Ecotourism to tropical sites was supposed to increase the public's awareness to the faltering state of corals in the wild and to the need to change existing fishing and farming practices, such as those using explosives and cyanide to collect fish. But while divers

saw themselves as a big part of the solution, now there is an increasing recognition of the damages wrought to the reef by certain diving practices. 'They used to point the finger toward us', Foord told me. 'Now people are realizing how damaging the carbon footprint of flying to these remote places is. It can't be overlooked – these divers might as well be burning coal'. The tensions between *in situ* and *ex situ* conservation, which I traced elsewhere (Braverman, 2015), are highly apparent in this context.

The sexual reproduction of corals is practically nonexistent in most home tanks, but is starting to trickle into public aquariums through conservation initiatives. Corals also reproduce asexually by fragmentation, which is the central reproductive mode for their artificial propagation. Aquaculturists call this mode of breaking off and growing small coral pieces to create multiple reefs 'fragging'. The small clones are genetically identical to the 'mother' coral, yet can also adapt to different environmental conditions through what coral hobbyists refer to as 'morphing'. 'People want morphs', Foord told me. 'Like light skin and brown skin in humans, corals, too, morph into a spectrum'. Creating a tank with dazzling colours and keeping it alive for what could potentially last forever is a passion of many aquarists, who dedicate hours every day, and thousands of dollars, to this hobby.

Alongside the committed coral collectors for whom reproduction is a way to afford sustaining their collections, there are also those who are looking to make a 'quick buck', Foord further described. He referred to these people as 'frag junkies', implying that the business of asexually reproducing corals is addictive. 'The live animal trade is going to attract a certain type of people with a "get rich" attitude – it doesn't matter if we're talking about tigers, reptiles, or corals', he reflected. Yet he quickly qualified that the coral trade is unlike that of other exotic species: First, it is not as easy to smuggle corals because they need to be maintained under certain water conditions to survive; Second, the tight-knit and highly networked coral hobby is efficient in screening these people out. 'Facebook gets the word out', Foord said. 'I don't think that [illegal trade] accounts for more than one percent of the official transactions not recorded'. Obviously, this is from a hobbyist's point of view; conservationists will likely have a very different position on this matter, as I discussed elsewhere (Braverman, 2018, p. 126).

Since its emergence only two or three decades ago, the coral trade has become a multi-million dollar industry. A growing number of coral hobbyists has also emerged, and is characterised by a tight social network on Facebook and a mushrooming of coral clubs around the country. According to Foord, over the past several years Facebook has become the most important platform for reef aquarists to ask questions, share photos of their tanks and corals, and buy 'frags' in auctions. 'Many of the biggest online sellers use both FB and eBay to sell their coral frags', he told me. Online webforums have been another important part of the coral hobby culture. Yet despite the internet's global power, local reef clubs are still central for the aquarium hobby. 'Back in the 1990s, there were very few saltwater specific aquarium clubs, as most hobbyists used freshwater tanks back then', Foord told me. Now, he said, 'even' his home state of rural New Hampshire has its own reef aquarium club. Foord explained that 'joining a reef club is probably the best way for a beginner or young person to acquire cheap coral frags or even colonies of fast growing, weedy "basic" corals that aren't "valuable" on the open market'. Large organisations such as MACNA and Reefapalooza orchestrate mega coral events several times a year. A culture of caring for corals in the city has emerged.

The regulation of city corals

Other than through tracing the financial footsteps of this culture or sitting around salt water aquarium shops for extended time periods, it is difficult to assess the magnitude of this industry and the scale of private coral cultivation in the city. No license or permit are required to propagate corals in one's home, no trips to the veterinarian, vaccines, or other surveillance-enabling methods. According to a 2017–2018 survey conducted by the American Pet Products Association (APPA), of 124.5 million households in the United States, the number of pet-owning households was 84.6 million, with dogs and cats at the top of the list (48% and 38%, respectively), then freshwater fish (at 10%) and, finally, saltwater fish (at 2%, alongside horses) (APPA, 2017, p. 9). The keeping of corals as pets constitutes an even smaller percentage within the saltwater fish industry, Sprung told me in our interview.

While much of the coral industry is unregulated and unsupervised, certain laws and regulations do apply to the export and import of corals into the city. Specifically, trade regulations enacted by the 1975 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) aim to ensure that international trade in specimens of threatened wild animals and plants does not impact their survival. All scleractinian, or stony, corals are regulated under CITES Appendix II, which means that a permit is required for their export and that the coral 'must be prepared and shipped to minimize any risk of injury, damage to health or cruel treatment' (CITES). Mariculture has its own CITES permit arrangement, which is apparently easier to obtain, per Foord.

In addition to international laws, nation-states enact their own laws to protect their corals. The only countries that allow CITES export of stony corals to the United States are Australia and Tonga (Fiji),³ while the Marshall Islands allows export of maricultured (but not wild) stony corals to the United States. Within the United States, Florida prohibits the removal of stony corals from its waters, to the extent that coral aquaculturists across the United States can typically propagate corals only from the Pacific Ocean, even if they live in Florida or nearby. This has been a constant source of frustration for many aquarists and hobbyists, Foord told me.

Coral aquarists have also been frustrated with the conservation imperative of protecting imperiled corals through prohibiting their fragmentation. Such conservation practices of designating corals as threatened and endangered are often seen as detrimental to the survival of these corals. 'I personally am upset that they listed them as [threatened]', Foord told me about the Endangered Species Act's listing of two Caribbean *Acropora* species. 'The biggest threats to corals are [by] the activities of the government itself', he argued, lamenting the old-fashioned mentality of fortress conservation that means 'leaving corals there to fend for themselves'. 'Had the listing passed 10 years earlier, there probably wouldn't be any coral restoration happening today', he offered (for a discussion of NOAA's attempts at coral uplisting, as well as the broader biopolitics of listing corals on endangered species lists, see Braverman, 2018, pp. 163–170).

Thinking with city corals

Aquarium hobbyists typically take care of salt water tanks – with live rock, anemones, corals, and other marine forms of life – within their homes. This hobby requires a high

level of commitment because one must keep the marine ecosystem intact within an airy environment – like a bubble but in reverse (i.e. with the air outside and the water inside the bubble). Foord told me about this responsibility: ‘You’re playing God [by] maintaining an entire trophic system. Unlike caring for a cat or a dog, you have to create and maintain this ecosystem on a 24/7 life support’. As someone who attempted to maintain a salt water tank with corals and other animals, I can fully attest to the level of daily commitment required, especially when one does not purchase high end technology. For Foord, this type of absolute care provides the best possible conservation education one can offer children. ‘The planet is really no different than an aquarium’, he told me – a statement that would surely make many conservationists cringe. Teaching children about the interdependencies of myriad factors within the tank’s micro ecosystem, they are also taught about caring for the planet. In today’s rapidly changing environment, humans have no other choice but to learn how to manage natural systems, per Foord. His stance resonates with more interventionist approaches in conservation science, which have extended support to strategies such as assisted migration and assisted evolution. These approaches have been contentious in more traditional conservation circles (Braverman, 2018, pp. 4–6).

When I asked him about the status of the corals themselves and, in particular, about whether he sees them as pet animals (like dogs), or as exotic animals (like tigers or snakes), Foord did not have a ready answer. He has a hard time treating corals as domesticated pets, Foord admitted, because they are not domesticated animals in the usual way. ‘I see them more as plants and their propagation more like the orchid hobby. They are clones – they came out of the ocean exactly as they are: wild. The corals in our tanks can be [genetically] traced back to the ocean’.

To complicate matters further, over the years corals living in captivity have also selectively adapted to aquarium conditions. For example, they have microbial communities that are different from their wild conspecifics. At the same time, Foord also wanted to emphasise that ‘aquarium corals were never selectively *bred*’. ‘There’s nothing domesticated about them’, he stated point blanc. Instead of the word domesticated, then, Foord offered the term ‘acclimated for human life’. ‘Corals are wild animals that are acclimated to human life, and clonal’. His colleague and peer aquarist Sprung had a different take on domestication. ‘Even the vegetative propagation of corals could produce domestic strains through grafting, as has been done with plants’, he told me. Sprung predicted that the domestication of corals, too, will undergo significant changes. ‘As coral breeding (spawning in captivity and growing out the offspring) becomes more common, there is a wide open canvas for the development of truly domestic corals’ (e-mail communication).

For Foord, however, tank corals are no different from ornamental orchids. The coral-orchid analogy can also account for why aquaculture is portrayed as a practice in agriculture rather than in conservation biology, and why the corals are seen more as a commodity and a resource than as members of endangered animal species. When I asked him about the ethics of taking corals from the wild for commercial purposes, and about the legitimacy of the heightened capitalist sentiments surrounding their ongoing production by aquarists, Foord responded:

Coral is the most sustainable fish in the ocean. You don’t even have to remove the mother colony from the wild to generate a new form of income. That’s why I am a big fan of aquaculture and mariculture: it empowers local communities to produce a sustainable ornamental trade. (see also Rhyne et al., 2012; Rhyne, interview)

'It's not consumption, and the coral is not a commodity – it's a clone', Foord further insisted. 'You're in fact *producing* a reef. There's no cost'. Accordingly, for Foord the ethos of reef keeping is situated at the nexus of democracy and capitalism. 'The coral hobby is as big as it is because it is a free economy', he argued.

Such 'win-win' promises for conservation and economic growth through the commodification of nature have been increasingly criticised by scholars wary of 'green capitalism' and the neoliberal marketisation of biodiversity (e.g. Heynen & Robbins, 2005; Iggoe, Neves, & Brockington, 2010). Moore referred to privately funded restoration as 'corporate coral', arguing that 'such corporate projects attempt to transform chaotic reef worlds into working seascapes via the reorganization of human and nonhuman reef-building species perceived to work as one' (2018, n.p.). 'Corporate coral looks like care, but care can obfuscate novel forms of exploitation and settlement', she continued. 'Coral are struggling, and responsibility is required from those who profit from industrial-scale extraction, development, and emissions. But the long-term effects of restoration are unproven, and debates rage about what methods are most effective'. While Moore's work focused on restored corals transplanted into the ocean in Indonesia and not on corals in urban tanks, her insights could be relevant in this context, too.

Yet others have pointed to the fluid, ambiguous, and amphibious nature of commodities when one regards the complete social lives of their objects (Claus, 2017, p. 160; Kopytoff, 1986, p. 73; Pauwelussen & Verschoor, 2017). In the coral context, Claus's research on Okinawan restoration practices emphasises the religious and cultural significance behind this economic endeavour. In her words:

[coral] purchasers link them to existing religious and cultural practices and recreate corals as sites for altruism, memorialization, and divine communication. Restoration corals, in the hands of local amateur ecologists, become a way to simultaneously democratize knowledge of the sea and contest prevalent techno-scientific conservation approaches. (Claus, 2017; abstract)

Practices of coral purchase and transplantation therefore result 'not in estrangement but in the entanglement of nature and culture', Claus concluded (2017, p. 172). Finally, an ethnographic study of coral-human interface in Indonesia highlighted the blessed space of amphibiousness enabled by the corals (Pauwelussen & Verschoor, 2017, p. 295).

Similarly, Foord emphasised that the reefer community not only cultivates corals; it also cultivates a 'culture of cooperation and sharing'. Corals are traded between reefers at no cost, thereby contributing to a collaborative network. For him, this collaborative culture is the very opposite from that practiced among coral biologists, who he regards as highly territorial and competitive. Coral-human relations in the city are thus different from those that have transpired in the wild, or even on restored reefs, Foord implied.

But what about the 'cost' to the corals themselves? What does a death of a coral mean? 'This death doesn't matter', Foord replied when I posed these questions to him, explaining that it is the clone that dies, and hence may easily be replaced. Furthermore, he argued, 'this is how [corals] reproduce – by being snapped in half. That's why something destructive like a hurricane is also productive'. Still, he acknowledged that 'no animal likes to be snapped in half'. The question thus becomes, for Foord, whether the amount of calcium carbonate calcified by reef aquariums in tanks is a 'net positive'. If it is positive, then reef life in the tank – and in the city writ large – is on the rise and the practice of cultivating

coral is ethically justified, in his view. Indeed, the reef culture industry 'is a good deal for the corals', he summed up.⁴

Whether one wants to adopt Foord's utilitarian coral-quantifying approach or not, it is clear that human-coral relationship in the city is complicated and calls for special examination. The practice of keeping coral in the city indeed challenges the terrestrial order of things, problematising the traditional classifications between wild and captive (as the coral is an exactly the same, genetically, as her wild other), pet and domesticated (as corals do not fall neatly in either classification; rather, they are 'acclimated wild corals'), commercial and communal (as the culture surrounding their propagation seems to draw strongly on both), and even life and death (as corals are animals but they are also clones, hence identifying and demarcating their death is difficult). The coral's distinctiveness, and her mixed plant-animal reproduction in particular, can invoke a different political modality than the biopolitical one more associated with mammals, thereby flagging the complex relations between aquatic life and capital. Is the cloned coral in an urban tank a 'lively commodity', in the same way that Indian lions (Barua, 2016, p. 6), North American cougars (Collard, 2012), companion dogs (Haraway, 2008, p. 62), or even restored 'corporate corals' (Moore, 2018) are?

Conclusion: toward coral cities

Premiered in Art Basel Miami, Coral Morphologic's 2010 installation Artificial Reef showcased local coral reef projected in massive scale on prominent skyscrapers in Miami Beach. The limestone that constitutes these buildings is mainly composed of the pulverised fossils of coral that colonised southern Florida when it was submerged in the

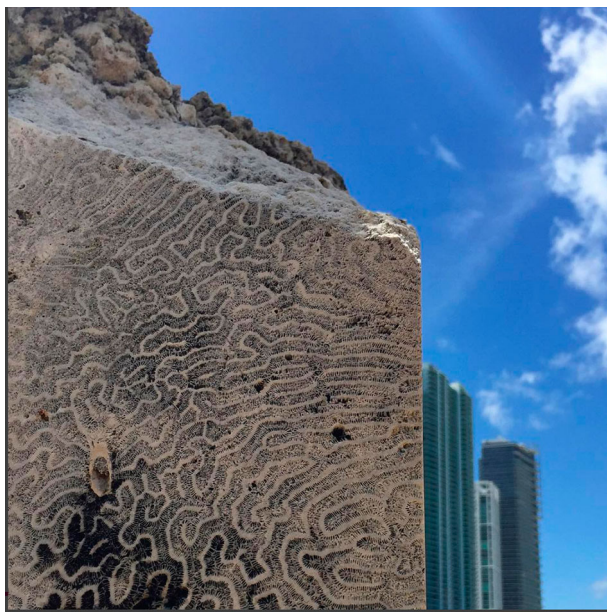


Figure 6. Corals and skyscrapers. A fossilised brain coral (*Pseudodiploria* sp.) in a monument on Biscayne Boulevard in downtown Miami. Photo by Coral Morphologic. Reproduced with permission.

ocean some 125 thousand years ago, the project's cofounders explained in a two-part documentary called 'Coral City' (Coral City [n.d.](#)). They emphasised that

projecting the corals onto those buildings references the geologic past, it references the technological present we're in, and [it references] the potential future, where if sea levels continue to rise, corals would have no problem coming right back in and cementing themselves to themselves. ... The whole city is a giant bed of coral that used to be underwater and might go back under. (Coral City [n.d.](#); see also Figure 6)

The coral should be our flag, should be our mascot. Miami is coral city', Foord argued in the documentary. Corals are not only the past, but also the future, he continued. In this future, humans will become symbiotic with corals and will learn their ways. Eventually, corals will take over the city – which was built upon, and with, their skeletons – not only from the outside, but also from within.

Notes

1. This use is intentional and meant to encourage readers to reflect on our seemingly neutral linguistic categories and to consider seeing nonhuman animals as subjects.
2. Additionally, I became a coral hobbyist for a short period, during which I regularly visited at the local saltwater reef store and consulted with its manager. For a discussion of my methodology in my research for *Coral Whisperers*, and more generally, see Braverman, 2018, pp. 14–19.
3. However, Fiji's Ministry of Fisheries banned all harvesting, purchasing, sales and export of live coral and aquarium rock (also known as live rock, coral rock or fossil coral), effective December 28, 2017 (*ABC News*, 2018). In 2018, the Indonesian government issued a blanket ban on all exports of corals, stunning the global ornamental fish industry.
4. The story becomes more complicated when fish enter the picture. 'It's the fish that need replacement', Foord explained. Still, 'it is more justified to keep a fish alive in a tank than to eat it', he stipulated. To eat a fish is a luxury for most of us, not subsistence, he added. 'So unless one's a vegan, I don't accept their moral argument against keeping a tank'.
5. Sprung clarified the taxonomy:

Corallimorpharia such as *Discosoma*, *Rhodactis*, and *Ricordea*, and zoantharians such as *Zoanthus* and *Palythoa*, are not corals – at least they are not to be confused with scleractinia – but related creatures from coral reefs and coastal habitats, which have served to inspire the aquarium hobby's interest in corals and coral reefs. Foord (as well as many aquarium hobbyists) often refers to 'corals' generically in such a manner that it is inclusive of the abovementioned creatures and even anemones such as the Rock Anemone, *Phymanthus* crucifer. (Sprung, email communication)

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