IBEROSTAR GROUP

WAVE OF CHANGE

Wave of Change Coral Restoration Program

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Why Research?

Marine environments are changing at an unprecedented rate. Anthropogenically induced global climate change and related threats such as elevated water temperature, ocean acidification, relative sea-level rise and increased frequency and intensity of hurricanes are some of the greatest threats to coastal marine ecosystems.

With nearly 40% of the world's population living within 100 kilometers of the coast, growing populations and increasing tourism efforts are putting high pressure on coastal areas in terms of waste disposal, aquaculture, recreation and other services.

More than 80% of Iberostar's hotels are located along the coastline. Coral reefs, mangroves, seagrasses, wetlands, dunes, and other ecosystems all play an integral role in protecting our coasts and in turn, our hotels. Our commitment to the oceans is ingrained in our company DNA, and is one of the pioneering ways we contribute towards leading Responsible Tourism. Specifically, we have committed to having all ecosystems that surround Iberostar properties in improving ecological health alongside profitable tourism by 2030. In order to achieve this, we not only need science based targets that align with global goals (for example, the IUCN target to achieve 30% ocean protection by 2030, or the UN SDG14.2 target to sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts), but investigative research to achieve those targets. That means a rigorous, science-based and expert-informed approach to our actions in coastal health. In specific cases, we also aim to share our findings in the peer-reviewed literature such that our learnings from Coastal Health may be applicable to the greater research community. This allows for efforts such as Wave of Change to bring much needed science and research in surprising new settings.

To conduct this research and work on coastal health, we have our own internal team of researchers as well as collaborations with NGOs or universities in the countries where we operate. We aim to complement existing work in the region, ensure our questions are based on the latest scientific findings and immediately apply our findings to improve our ocean stewardship.

We also believe any research we conduct should be open sourced to the best of our ability. Therefore, we do our best to share our methodologies and data streams openly on our website or common data repositories.

Performing sound, fundamental research is at the heart of all we do because we understand this type of rigorous science is necessary to ensure a resilient and productive future for our oceans.

A Tourism Perspective: Defining Goals of Reef Restoration for Iberostar's Wave of Change

Approximately half of Iberostar's global operations are based in coastlines facing the Caribbean basin. As of 2020, Iberostar complexes create a combined total of 10.2km of beachfront in this region. According to the World Resources Institute 500m resolution map of tropical coral reefs of the world, 80% of Iberostar's beachfront in this region has reefs within a 5km distance of the property. In total, just under six square kilometer of reefs provides direct ecosystem services to our hotels, operations, and community. Thus, ensuring coral reef protection, resilience, and restoration are a major part of our strategy to achieve all ecosystems in improving health along profitable tourism by 2030.

Globally, coral reefs are one of the most biodiverse and productive ecosystems on the planet (Garzón-Ferreira, 1997). They are built from a symbiosis between symbiotic algae and coral polyp which builds an exoskeleton of calcium carbonate, most commonly in colonies (Epstein et al., 2019). Increasingly, the role of the microbiome (the bacteria that live with the coral) is also demonstrating to play an important role in the life history of the organism (Rosenberg et al., 2007; Rädecker et al., 2015). There are over 60 different species of corals known in the Caribbean with over 2000 species of coral known worldwide. While the corals themselves are diverse and productive, it is the habitat they provide that offers most of their ecosystem services. Together, the collection of species is known as a coral reef, representing diverse morphological forms that provide three-dimensionality to the landscape on the seabed which in turn offers shelter, food, and additional ecological, economic and social services.

A coral reef's innumerable services can be categorized into provisioning (food from fisheries and subsistence fishing), coastal protection (a biological sea-wall that protects from wave action and storms), cultural (heritage and tourism), and supporting (nursery habitat for marine biodiversity) (Millenium Ecosystem Assessment, 2005). Healthy reefs are therefore crucial not only for coastal communities that depend on them for food and livelihoods, but also for any other public or private organization or community that is directly or indirectly benefiting from these services.

Despite the clear financial, cultural, and intrinsic values of this ecosystem, coral reefs are also in rapid global decline. Global stressors include threats such as bleaching and acidification seen from climate change and proliferation of algae or other organisms due to changes in global nutrient distributions (West and Salm, 2003; Mumby, 2009; Albright and Langdon, 2011; Arias-González et al., 2017). Local stressors include direct damage from dredging, disruptive fishing practices, or anchor damage as well as indirect damage from overfishing or nutrient or sediment pollution, poorly managed coastal construction (Aronson et al., 2008; Anthony et al.,

2015; Hughes et al., 2017 and 2018). Some of the largest causes of global coral decline have been caused by disease outbreaks (i.e. White Band in the Caribbean), damage from hurricanes, and bleaching from heat pulses (i.e. the global bleaching event in 2016) have caused the largest overall reduction in coral cover. However biologically and culturally important reefs have also been disproportionately damaged by poorly managed coastal development, localized nutrient pollution, and overfishing or destructive fishing practices. As conditions from global climate change are expected to worsen, some of the most severe stressors such as bleaching events or hurricanes are expected to become more severe and more frequent (Jokiel, 2006; Huges et al., 2018). Even with massive action on climate change to achieve only 1.5˚C of warming by 2050, it is predicted that we are likely to lose 90% of live coral reefs. In the Caribbean, it is documented that when live coral is lost, soft algaes can take over the habitat which, without critical herbivores such as urchins or parrotfish or reduction in overall nutrients, can cause a tipping point for the system, making recovery challenging (Aronson et al., 2002; Hughes et al., 2007; Mumby, 2009; Arias-González et al., 2017). Once a coral reef is degraded, it is possible that certain ecosystem services such as coastal protection will persist for a period after the live reef declines (the structural complexity remains), but they are expected to slowly start to decline or shift without a functional and resilient reef-based ecosystem (Edwards & Clarck, 1998; Edwards & Gómez, 2007; Lirman et al., 2010). Despite this decline, coral reefs as an ecosystem have shown the capacity to recover from even greater levels of global decline over paleontological timescales, however it is the communities, business, and nations that depend on these critical ecosystem services that will additionally and immediately feel the negative consequences of lost reef ecosystems.

Thus it is in humanity's interest to find pathways for building resilience in and restoring coral reefs around the world. Global climate action, marine protection, sustainable fishing practices, and effective management of water systems (both at the scale of waste water treatment as well as the intersection between watershed and ocean) are critical tools that have proven to be effective in returning coral cover. However given the extent of loss expected from global and local stressors, there is increasing recognition by the coral reef research community that reef restoration must play a strategic role in protecting their critical ecosystem services (Abelson, 2006; Precht, 2006; Petersen et al., 2007; Edwards & Gómez, 2007; Edwards, 2010; Johnson et al., 2011; Nakamura et al., 2011; Young et al., 2012; Toh et al., 2012; Lirman et al., 2014; Chamberland et al., 2015, Rinkevich, 2015; Schopmeyer et al., 2017; Calle-Triviño et al., 2018)

While there are many challenges to successful reef restoration, we present three major challenges:

1. Reef restoration has not been demonstrated at scales larger than 3 hectares (for reference, this is less than 1% of the total reef surrounding Iberostar alone). This is likely due to the challenging biology of the ecosystem, the relatively slow growth of most

foundational coral species, logistical challenges, and relatively recent efforts under limited funding.

2. The efforts must remain resilient in the face of climate change. There are initial studies demonstrating that it is possible to curate field-based coral nurseries that are more resilient to bleaching events, but low overall genetic diversity or unaccounted genetic diversity in many restoration efforts has hindered this practice at scale. Additionally, most restoration efforts currently focus on a limited number of species, not accurately representing the biological diversity of the reef.
3. Lack of clarity regarding the goal of restoration. Restoration of an ecosystem can work towards recreating a historical baseline, however new opinion has demonstrated the logistical and value-based challenges of choosing and restoring to such a state (if it is even characterized in the first place). Work by the Coral Restoration Consortium has demonstrated that the goals of restoration could fall into four, potentially overlapping categories: restoration for coastal protection, for fisheries, for tourism, and for biodiversity conservation. However there are few restoration efforts that have been designed with a specific or set of goals in mind.

Here we present our proposed goal of restoration for Iberostar's Wave of Change movement. We determine that tourism is in fact not a separate category of restoration for Iberostar. Instead, we value first coastal protection, then restoration for increasing fish biomass (if possible, fish biomass important for local food security), and finally for biodiversity. We aim to do so while optimizing resilience to expected threats from climate change at scale in at least the locations where our operations persist reaching an upper limit of the 5.6 square kilometers of reef that surround our hotels. It is our intention that our annual research strategy and our science based targets allow us to contribute to scaling efforts that can remain resilient in the face of global climate change. We aim to do so not only through practical application for our direct coastal protection, but strive to contribute to knowledge through both research and outreach as well as provide a definition for successful restoration as defined by the tourism sector for the tourism sector. We believe in doing so, our clients will retain and improve their dive experiences, have an opportunity to see a more naturally functioning resilient ecosystem, can develop a connection to the place because of that, can even contribute to the efforts through our global Wave of Change movement, and, as a result, will have a chance to enjoy that resource for generations to come.

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