

THE OFFICIAL MAGAZINE OF THE OCEANOGRAPHY SOCIETY

Oceanography

CITATION

Dybas, C.L. 2016. Ripple marks—The story behind the story.

Oceanography 29(4):16–18, <http://dx.doi.org/10.5670/oceanog.2016.92>.

DOI

<http://dx.doi.org/10.5670/oceanog.2016.92>

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Ripple Marks

The Story Behind the Story **BY CHERYL LYN DYBAS**

Protecting the World's High Seas Heritage from the White Shark Café to the Sargasso Sea

Sunken coral islands...floating rainforests...giant undersea volcanoes...spires of rock resembling sunken cities. None of these rare places can be added to the list of World Heritage sites because they are in the high seas, outside any national jurisdiction.

A report released in August by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) World Heritage Centre and the International Union for Conservation of Nature (IUCN) explores the ways in which the World Heritage Convention could in fact apply to these wonders of the open seas.

The report, *World Heritage in the High Seas: An Idea Whose Time has Come*, addresses five such sites. Each has

outstanding universal value, the document states, a key principle of the World Heritage Convention.

The report was supported by the Khaled bin Sultan Living Oceans Foundation, the French Marine Protected Area Agency, and Jaeger-LeCoultre. The initiative also received support from the Nekton Foundation.

The five proposed deep-sea and open-ocean sites are: the Costa Rica Thermal Dome in the Pacific Ocean, an oasis that provides critical habitat for myriad species; the Sargasso Sea in the Atlantic Ocean, home to an ecosystem based on floating algae; Lost City Hydrothermal Field in the Atlantic, an 800-meter-deep area dominated by carbonate monoliths that reach 60 meters high; Atlantis Bank, a sunken fossil island in the subtropical waters of the Indian Ocean; and the White Shark Café, the only known gathering place for white sharks in the North Pacific.

"The deepest and most remote ocean harbors globally unique places that deserve recognition, just as we have given

to the Grand Canyon National Park in the United States of America, the Galápagos Islands in Ecuador, or the Serengeti National Park of the United Republic of Tanzania," says Mechtild Rössler, Director of the UNESCO World Heritage Centre.

FAR FROM COASTS, BUT CLOSE TO THREATS

Although the newly recommended high seas sites are in distant locales, they're not safe from the effects of climate change, deep seabed mining, and pollution, states the UNESCO-IUCN report.

For the areas to benefit from the recognition and protection of the World Heritage Convention, however, adjustments to the inscription process are needed. Countries may propose sites, but these five high seas zones don't fall under any nation's domain.

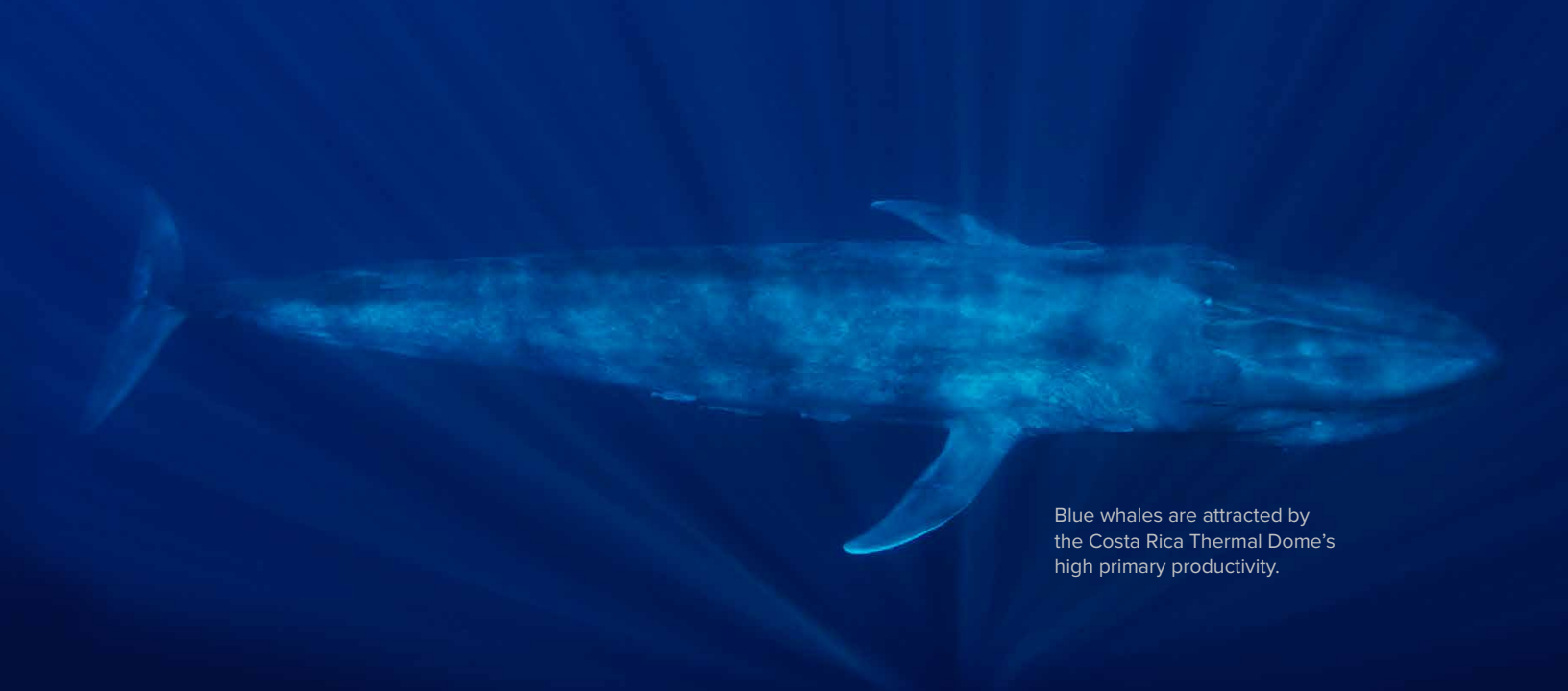
"The high seas have outstanding value on the global scale, yet they have little protection," says Dan Laffoley, Principal Advisor on Marine Science and Conservation for the IUCN, and co-author of the report. "These areas are exposed to



LEFT. The three-story-tall actively venting carbonate tower called IMAX protrudes from the north face of a much larger edifice called Poseidon in the Lost City Hydrothermal Field. Poseidon rises ~60 m above the surrounding seafloor. The area has been active for >120,000 years. © D.S. Kelley and M. Elend, School of Oceanography, University of Washington

BELOW. Great white shark at Isla Guadalupe, Mexico, August 2006. Photo by Terry Gross © via Wikimedia Commons





Blue whales are attracted by the Costa Rica Thermal Dome's high primary productivity.

threats such as pollution and over-fishing. It is therefore crucial to mobilize the international community to ensure their long-term conservation.”

CAFÉ FOR WHITE SHARKS

In the case of the White Shark Café, this eastern Pacific gathering spot provides open-ocean winter and spring habitat for otherwise coastal great white sharks. Halfway between Baja California and Hawaii, the area hadn't been a suspected shark hangout. But when scientists mapped data from satellite tags placed on 179 great white sharks between 2000 and 2008, they discovered that the sharks frequently travel to and loiter there.

Coming mostly from rookeries along the Pacific coast, the great whites take up to 100 days to arrive, traveling at about two knots. The tagging study showed that the sharks adhere to a rigid route across the sea, returning to exactly the same spot.

Because both male and female sharks have been tracked to the café, an early hypothesis was that it could be the undersea equivalent of a trendy pickup bar. Further studies, however, reveal that juvenile sharks also make their way there.

“We're only beginning to understand what it means to have the equivalent of African lions in the ocean wilderness off California,” says marine scientist Barbara Block of Stanford University, who has long studied the White Shark Café.

While at the café, the sharks dive to depths of more than 300 meters as often as once every ten minutes, found Salvador Jorgensen of the Monterey

Bay Aquarium's Project White Shark. The purpose of the sharks' deep dives isn't yet known, but the great whites linger, often for months, in what seems to be an oceanic “desert” where food is scarce.

EXQUISITE SCULPTURES IN THE DEPTHS

The Lost City Hydrothermal Field in the deep Atlantic, discovered in 2000, was formed by a combination of geological and biological forces. It's an otherworldly place with active hot spring venting where serpentinite cliffs weep boiling fluids, producing delicate, finger-like growths and multi-pinnacle chimneys. The process has been happening for some 120,000 years, states the *World Heritage in the High Seas* report.

The site is dominated by Poseidon, a 60-meter-tall edifice made of carbonate. “Endemic invertebrate species are likely to exhibit unusual biochemical and physiological adaptations that have not yet been described in nature,” according to the report. “Lost City has been suggested as an example of the chemical precursors for the origin of life.”

The hydrothermal field has also attracted NASA's interest as a testing ground for identifying the chemical signatures of possible life on other planets and moons.

Lost City, the UNESCO-IUCN report professes, “is globally singular among all known hydrothermal sites in the eerily lovely sculpture of its carbonate precipitates, their size and longevity.” (Read more about Lost City in *Oceanography*, volume 20-4, <https://doi.org/10.5670/oceanog.2007.09>.)

OASIS BENEATH THE WAVES

The Costa Rica Thermal Dome in the eastern tropical Pacific is an oceanic oasis created by the interaction of winds and currents. It covers a 300- to 500-kilometer-wide area. Although “mobile,” its presence off the coast of Costa Rica is predictable, scientists have found.

“The Costa Rica Thermal Dome was first observed in 1948,” according to the report, “and is recreated seasonally through an interaction between coastal winds and currents. It is defined by the globally-unique shoaling of a strong, shallow thermocline with upwelling of cool, nutrient-rich water that promotes blooms of surface plankton.” The upwelling flows from summer into autumn, then diminishes in December and January.

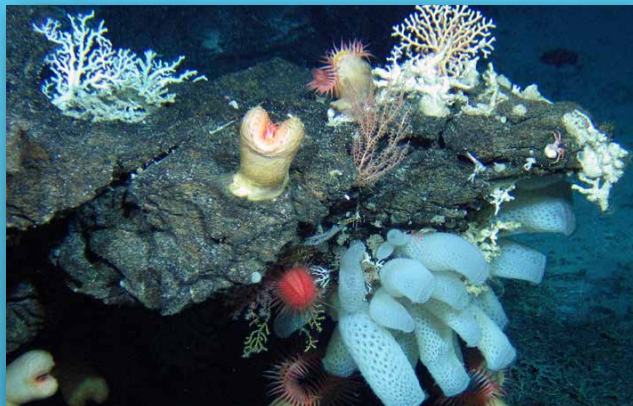
The dome's high primary productivity attracts large ocean fish and marine mega-predators—sharks, tunas, dolphins, and whales. It's part of a migration corridor for critically endangered leatherback turtles, and offers feeding and breeding habitat for endangered blue whales.

The upwelling of deep, nutrient-rich water is especially important to the eastern north Pacific blue whale population, the largest in the world at some 3,000 animals. The dome offers habitat for the whales to feed, mate, and raise calves.

All is not bliss at the oasis, however. The dome is exposed to threats from heavily trafficked shipping lanes, overfishing, pollution from both ocean and land-based sources, including agriculture and wastewater, and climate change.



BELOW. The floating habitat *Sargassum* creates provides food, refuge, and breeding grounds for an array of marine species, including sea turtles. Photo credit: NOAA



LEFT. Diverse coral gardens and complex sea cliff deep-sea communities characterized by large anemones, large sponges, and octocorals at Atlantis Bank, Southwest Indian Ocean. © The Natural Environment Research Council and IUCN/GEF Seamounts Project C/O Alex D Rogers. <https://creativecommons.org/licenses/by-sa/3.0/igo/deed.en>

RAINFOREST OF THE OCEAN

The “Golden Floating Rainforest of the Ocean,” the Sargasso Sea, is home to an iconic pelagic ecosystem that depends on floating seaweed called *Sargassum*, the world’s only holopelagic (remaining pelagic throughout its life cycle) algae.

The Sargasso is also the sole sea without coasts. It’s located in the North Atlantic subtropical gyre, as these whirling waters are called. The Sargasso Sea is bordered by the Gulf Stream to the west, the North Atlantic Drift to the north, the Canary Current to the east, and the North Equatorial Current and Antilles Current to the south. The islands of Bermuda are the only land within its boundaries.

The Sargasso is the only ocean gyre with a floating community based on *Sargassum*. The floating weeds host a diverse community of organisms that includes 10 endemic species, according to the report. The Sargasso is also the one known breeding location of European and American eels.

Despite its remote location, this sea adrift faces threats from floating plastic debris, shipping traffic and vessel discharges, climate change, and overfishing.

PROTECTING ATLANTIS

Far off the coast of southern Africa on the Southwest Indian Ridge lies a sunken tectonic fossil island called Atlantis Bank. This undersea mountain is of “cold” or tectonic origin rather than the more common “warm” volcanic starting point of seamounts. It has a unique paleontological record and was pivotal to understanding the geology of ultraslow seafloor spreading ridges, the report states.

Atlantis Bank “is considered a tectonic window” into ages long past, “and provides one of the best places in the world for the study of Earth’s geology.” It rises from depths of more than 5,000 meters and peaks at 700 meters.

The sunken island was named for the mythical Atlantis because of the preservation of its ancient island features, including

two fossil beaches, lagoons, and a submerged headland. More than two-thirds of the bank is covered with ripple marks identical to those in the sand on exposed coastal beaches, scientists have found. These ripple marks were “frozen” or lithified as rock millions of years ago when the island subsided.

The complex topography of the bank has protected it from bottom trawling. “That’s particularly important in preserving diverse seabed communities in subtropical waters on the Southwest Indian Ridge,” according to the report.

Atlantis Bank harbors stunning deep-sea coral gardens and sea cliffs strewn with armchair-sized sponges, large anemones, and octocorals. Sharks and solitary corals at the summit include species yet to be named by science.

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