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Massive sargassum invasion may be the new normal

T 
ourists weren't the only ones alarmed to see the heaps of sargassum seaweed washed up on local beaches this summer. Although shorelines have been buried in seaweed in years past, marine scientists are asking why the sargassum invasions are occurring more often now, over far wider areas, and with devastating consequences.

Sargassum is a brown algae (a type of nonflowering plant) that grows in oceans worldwide. Two species that thrive in the North Atlantic are *holopelagic*, meaning that *Sargassum natans* and *S argassum fluitans*
spend their entire life-cycles floating freely on the ocean, thanks to gas-filled bladders that resemble small grapes, and they are the two species we regularly see on Florida beaches.

Out on the open ocean, the plants float in gigantic mats and miles-long "windrows" that act as refuges for more than 120 species of marine life -- including endangered sea turtles, game and commercial fish, migratory birds, and even some creatures that spend their entire lives in the "golden floating rainforests."

These ribbons of seaweed occupy only thin layers at the top of the water column, a few feet at most, but the communities they support extend far below. Fishermen know that a quick shake of a clump can produce tiny shrimp, crabs, seahorses, and a number of juvenile fish, which can be

used as bait for the bigger game lurking several meters below.

To protect this crucial habitat, the United States government imposes strict limitations on removing sargassum from federally protected waters.

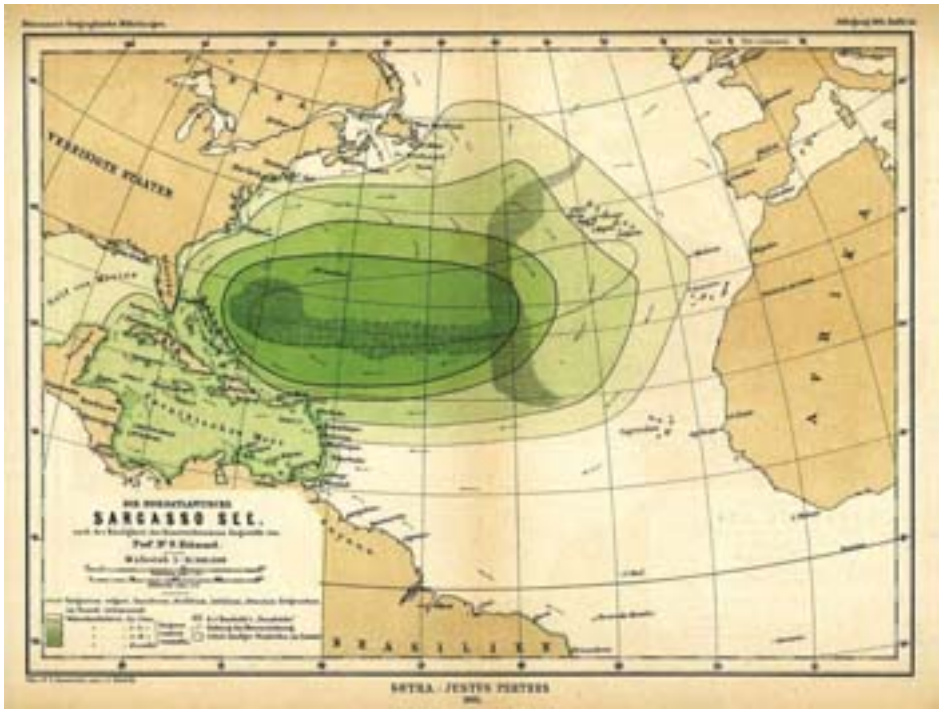
Although generally harmless to humans, swimmers will often complain that the seaweed is itchy, smelly, and unsightly. But the sargassum that washes ashore helps stop beach erosion by holding sand in place and fertilizing the plants that stabilize dunes. As annoying as it can be to humans, the seaweed is an integral part of marine and coastal environments.

“We love sargassum,” says Brian Lapointe, Ph.D., a research professor and oceanographer at Florida Atlantic University’s Harbor Branch Oceanographic Institute. “It’s like a fish factory out there,” he tells the *BT*, referring to the floating biomasses. “It provides one of the unique features of the North Atlantic Ocean and Sargasso Sea -- and all the biodiversity relies on the floating sargassum habitat.”

The Gulf Stream usually carries the seaweed quickly past South Florida beaches unnoticed, but if the currents and winds are in alignment, the sargassum can be driven right toward the coastline, as it was in mid-June and early July. The amount varies greatly from year to year, but summer is considered sargassum season here.

“It’s been that way forever,” says retired lifeguard Seth Rosenthal.

Rosenthal has been guarding South Florida beaches since 1974. He was a lieutenant with Miami Beach Ocean Rescue from 1979 until his official retirement in 2004.



“Sometimes, the winds are blowing in a certain direction; it brings all that stuff in,” he says. “After the rough, rough days, all that seaweed would get washed in. Then the wind would stop and the seaweed would just be sitting there on the water.”

“It was terrible for us,” recalls Rosenthal. “If we had to go in the water to save someone or go take a swim, that stuff was nasty. It’d be all over the place.”

Rosenthal recounts that beach-cleaning crews would turn out daily while he was a lifeguard, using heavy machinery to rake and bulldoze the seaweed mounds. Today crews are more cautious about removing beached seaweed. Careless handling can destroy endangered turtle eggs and accelerate beach erosion.

A cursory glance at photo and news archives reveals that these massive inundations have regularly happened at Miami beaches. Early 20th-century black-and-white photographs often display the telltale black lines of dried sargassum, and news accounts of inundations that rival this summer's go back to the 1930s.

However, Lapointe and other marine scientists believe that this year's influx is tied to an unprecedented bloom occurring across the Atlantic basin, one that could signal increasing sargassum inundations in our future.

Lapointe explains that there is compelling evidence that we're seeing a long-term change here. Although he describes the Florida inundations as "moderate," he adds, "it's having catastrophic effects in some places in the Caribbean."

Over the past decade, sargassum has plagued the eastern Caribbean, where the seaweed was seen only in small amounts in the past. During 2011-2012, 2014-2015, and again in 2018, the inundations grew into significant problems for residents of the Lesser Antilles. With blocked beaches and bays, the tourism and fishing industries were hit hard.

The seaweed reportedly interfered with turtle hatchings and created dead zones, killing underwater plants and animals, fish, corals, and bioluminescent plankton, among other sea life. Local governments in the Caribbean are clearing the beaches and inshore waters as best they can, an expensive undertaking for small island countries.

Sargassum propagates asexually by breaking off buds, which can then grow rapidly. During winter and spring months, sargassum builds up in massive quantities in the nutrient-rich Gulf of Mexico. As the winds shift, the Gulf's Loop Current moves much of it out into the Gulf Stream.

The seaweed is then carried in a bigger loop around the northern Atlantic Ocean by the North Atlantic Current, the Canary Current, the North Atlantic Equatorial Current and, finally, by the Caribbean Current before returning to the Gulf of Mexico.

While on this journey, Lapointe believes the seaweed is coming into contact with new sources of nutrients, such as run-off from rivers in Africa and South America, upwelling from the deep sea, and even iron-rich Saharan dust. A fraction of the seaweed remains trapped in nutrient-sparse Sargasso Sea at the center of those circling currents, says Lapointe. And much of it beaches or sinks before beginning the cycle again.

"I've been monitoring sargassum off Big Pine Key since 1982-83," says Lapointe, "so I have a baseline from the '80s of its chemistry. I never would have in my wildest dreams believed that we'd see global change happening today like we are seeing -- the blooms and the changing chemistry. There are a lot of us on this planet now, and we are having profound effects on the global nitrogen cycle."

Lapointe has been measuring increasing levels of the nutrients in seaweed, and “all the evidence is pointing to increasing nitrogen driving that change.” Indeed, “nutrient pollution” has long been considered one of the country’s most challenging environmental problems.

While nitrogen and phosphorous are necessary for human life, excessive levels of these elements coming from agriculture, soil erosion, and effluent are entering the Mississippi River from as far north as Canada. When this excess exits the river system in the Louisiana Delta, it changes the seawater chemistry and alters the food chain, creating a dead zone in the Gulf of Mexico. Now multiply those consequences by every agricultural center/river system in the world.

“There are a lot of moving parts here, but we do know that this problem started in the Gulf of Mexico,” says Lapointe. “[The 1980s sargassum inundations in Texas] co-occurred with the expansion of the dead zone by the Mississippi River. The connection with the nitrogen from the Mississippi matches the timeline.”

Then, he adds, there’s the question of the BP spill.

The massive amounts of seaweed hitting the Caribbean began about a year after the 2010 *Deepwater Horizon*
oil spill in the Gulf of Mexico.

At the time of the spill, a highly controversial oil dispersant called Corexit was used in unprecedented quantities -- some 1.84 million gallons -- to mitigate the oil slick spread. Corexit ostensibly breaks down the oil into small droplets that naturally occurring marine bacteria further degrade until the oil has been eliminated.

Lapointe notes that nitrogen sources are used in major spills to quickly grow more oil-eating bacteria. If that was the case here (BP was secretive about its cleaning activities), it’s possible that excess nitrogen fueled an explosion of sargassum, the effects of which we’re still seeing.

“I’ve thought a lot about this,” says Lapointe. “How could this happen -- where it went from being a problem only in the Gulf of Mexico to suddenly expanding beyond the Gulf?”

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