It's a Small World After All

Blown across the Atlantic Ocean, dust from the Saharan Desert has impacts close to home.

story by **LILY WALKER**

Back in 2018, I received a text from my mom with a link to some photos of Russian ski mountains emblazoned in orange. A mysterious, dusty haze had settled over the area, the particles of which were captured by falling snow. Olympic skiers were rendered blind in this Martian-esque landscape, the media was a flurry, but I was not nonplussed. I was struck with recognition of the exact color that was not a stranger to me. I had just spent the two previous summers in the Florida Keys at the Mote Marine Research Laboratory studying dust that traveled all the way from Africa's Sahara Desert. Now that this same orange Saharan dust had traveled to another distant location, I marveled at the interconnectedness of the dynamic system that is our world.

While at Mote, I was studying the effects that Saharan dust deposition has on coral reefs in the Atlantic, trying to understand if there is a link between their poor health and the increase of "dust events" in the area. The relationships that have emerged are fascinating and complex.

The dust that finds its way high enough into the atmosphere to be carried thousands of miles across the ocean gets its characteristic color from its high iron content. Iron is a scarce nutrient in certain ocean waters and is necessary for the growth of certain species of microorganisms. Our main finding, which confirms previous scientific work and has been corroborated by studies in Texas, is that dust stimulates the growth of some types of coral pathogens. We found that its deposition stimulates the growth of a genus of bacteria, Vibrio. While there are multiple species of Vibrio, some are particularly harmful to humans and the environment. Some species are deadly, human flesh eaters, others cause toxic shellfish poisonings, and a few have been shown to be responsible for coral death. Coral "bleaching" is a pervasive problem worldwide and has been shown to be related to an increase in Vibrio populations.

Like many things in ecological sciences, though, this link is not straightforward. There are synergistic stressors that increase the susceptibility of corals to succumb to Vibrio-induced death. Corals have a relatively narrow temperature threshold, and if this is breached, the tiny algae that lives inside and feeds them becomes impaired, leaving coral in a vulnerable state to disease. Since Vibrio is an efficient scavenger for iron, which typically limits its growth in oligotrophic (low in nutrients) seawater, and because dust is rich in this trace metal, populations react positively to these dust events. Temperature driven sensitivity of corals, coupled with an increased number of pathogenic bacteria, creates a situation where coral cannot survive.

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Another example of these complex, far-reaching relationships is the effects that deposited Saharan sediments have on certain phytoplankton species. Scientists have shown that this dust, through its effect on microscopic food webs, may play a role in the development of Karenia brevis (aka red tide) blooms. These bursts of algal growths cause a variety of troublesome impacts along a large area of the southern and eastern United States.

Saharan dust deposition on distant continents is not a new phenomenon. Dust storms have long been a feature of the deserts of northern Africa. These storms carry soil particles high into the atmosphere, wind currents carry those sediments across the Atlantic Ocean, and some are deposited along the coast of the United States. However, over recent decades, the quantity transported has increased and its composition has changed. As the Saharan Desert grows due to changes in land-use and a drier climate, more soils become fragile, degraded, and mobile. This only serves to create dust plumes of increasing size, density, and reach.

Naturally, the increase in Saharan dust deposition events in places like the coral reefs of the Atlantic, estuaries on the Texas coast, and even ski slopes in Russia have varied impacts. The loss of ecological integrity at the source of these sediments also changes the lives of people in that part of the world. The satellite maps of the dust plume reaching across the ocean, the images of recognizable colors turning up in such widely diverse places, and the knowledge of the science of these relationships points to the connectedness of our lives with all the natural and human communities of Earth.

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PHOTO: NOAA