



Confronting Climate Change in the Indian Ocean

A Look at Coral Reefs and Nesting Beaches

In recent years, the issue of climate change has received a good deal of attention from media, governments, and communities around the world. But what does climate change mean for sea turtles and their habitats?

Climate change can affect coastal and marine habitats in far-reaching and complicated ways. For sea turtles, humans, and many other species, coral bleaching and sea-level rise are recognized as significant phenomena related to climate change whose effects are being observed throughout the Indian Ocean.

Coral health directly affects sea turtles that inhabit coral reefs, particularly hawksbills in the case of the Indian Ocean. Hawksbills don't eat coral, but they do forage on sponges and other invertebrates that live in reef crevices. After a coral reef dies, hawksbills are still able to forage among the dead branches. However, erosion eventually turns the dead coral into a smooth bed of sand that is relatively devoid of life and, thus, of food for hawksbills.

Coral reefs host the highest levels of biodiversity on the planet, but their stability is threatened because they are sensitive to increases in ocean temperature. A coral reef depends on the symbiosis between reef-building coral polyps and algae (known as zooxanthellae) that reside within the tissue of the polyps. When the water temperature rises too high, corals expel their algae, causing the corals to "bleach" and eventually die unless the temperature drops in time to allow for their recovery.

Ocean temperature in a given location tends to change seasonally and in response to climate-related phenomena such as El Niño. These changes can be dramatic. In fact, the El Niño of 1998 was the most devastating global coral-bleaching event on record, and it did significant damage to corals in the Indian Ocean. Although some sites recovered quickly, others have yet to do so. Unfortunately, coral-damaging events such as that in 1998 might become more frequent as Earth's climate warms; indeed, several smaller events have occurred since 1998. Studies have shown that background sea-surface temperatures are rising and will reach new highs in the coming decades, which may endanger the health of reefs in the Indian Ocean and elsewhere.

The death of corals also affects tropical beaches that are so important to both nesting turtles and human tourism. Corals are critical to the persistence of beaches for two main reasons: they produce sand, and they protect the beach from erosion. Although massive coral mortality can produce a pulse of sand for beaches, this activity lasts just a few years and is soon followed by sand starvation and sand loss that can expose sharp rock beneath. Furthermore, when corals on reef flats die, they lose some of their breakwater function that naturally reduces beach erosion by decreasing wave energy.

Sea-level rise is another major concern for sea turtles and people throughout the world and in the Indian



Ocean in particular. As polar ice melts at unprecedented rates, rising sea levels take their toll on beaches everywhere. On average, the global rise caused by polar ice cap melting is around 2.5 millimeters (.098 inches) per year. However, at coral atolls that develop as their underlying land mass sinks, the relative rise in sea level can be greater than the global average. This circumstance is why the Chagos Islands in the mid-Indian Ocean and the entire nation of Maldives (comprising some 1,200 islands) are both experiencing a relative sea-level rise of nearly 1 centimeter (cm), or .39 inches, per year—four times faster than the global average! In general, a typical beach experiences about 150 units of horizontal erosion for every 1 unit of vertical rise. Therefore, a 1-cm (.39-inch) rise in sea level in the Maldives could remove 150 cm (59.06 inches) of beach platform each year. As a result, some scientists predict that the Maldives may be submerged within 100 years. As a precaution, the Maldivian government is currently procuring parcels of high ground on the Asian continent to provide a long-term refuge for its 380,000 citizens.

In response to the challenges posed by climate change, efforts are being made around the world to reduce human-induced greenhouse gas emissions—a main driver of climate change—and to prepare coastal communities for the impending effects, as in the case of the Maldives. If we each do our part individually and work toward broader solutions collectively, there is still hope on the horizon for turtles and humans alike. But we must act urgently to address this important challenge.

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