

LOCAL THREATS TO CORAL REEFS

WATERSHED POLLUTION



Local watersheds, also known as drainage basins, carry water and whatever can float on or be carried within the water from higher ground to lower, eventually reaching the ocean. Along many reefs, where coastal populations were historically smaller than present day, there tended to be little ongoing disturbance to corals and reefs. In more recent times, though, coastal populations have increased and even formerly remote places have urbanized. Watersheds are becoming affected in more ways than they once were.

One form of watershed pollution is called sedimentation. This is the increase in small particles in the water from soil, silt, and sand. Weathering of rocks and land during rainstorms are natural sources of sedimentation, and natural buffers, like estuaries, coastal

wetlands, and mangrove forests, help to slow the flow of water as it reaches the ocean and filter out sedimentation. A combined reduction of natural buffers and increased sources of sedimentation have intensified this type of watershed pollution. Sources include roads, deforestation and forest fires, mining, and agricultural uses such as animal grazing and tilling or plowing. Large amounts of sedimentation entering the ocean cloud the water and cover the coral, blocking the zooxanthellae's ability to photosynthesize, thereby starving the coral.

Increased human populations also lead to a risk in pollution from untreated wastewater that gets into the watershed. The most common sources of wastewater pollution are from agriculture or human sewage. Both types of wastewater are high in toxins and nutrients, which are bad for corals. Untreated sewage includes bacteria, along with endocrine disruptors, heavy metals, pathogens, and other toxins like antibiotics from pharmaceuticals. Antibiotics can damage the protective mucus coating on corals, which is home to a diverse host of bacteria that function similarly to microbes in the guts of humans. Agricultural wastewater can have issues similar to sewage, especially if the farm has a lot of animals, but it can also include chemicals like fungicides and pesticides used on crops or golf courses/lawns.

Excess nitrogen, for example, is a common component of high-nutrient wastewater and can lead to a surge in phytoplankton in the normally low-nutrient water where coral lives. This, in turn, may spawn algal blooms. These blooms will compete with coral for space on the reef, and while herbivorous fish that eat algae can help, nutrient overload will tip the scales in favor of algae.

Runoff from modern human inhabitation can also include a host of chemicals toxic to the aquatic ecosystems, from fuel and oil, to detergents used in cleaning automobiles, to chemicals found in certain types of sunscreen.

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COASTAL DEVELOPMENT



Coastal development is usually associated with a growing or urbanizing population and is linked to human settlements, industry, aquaculture, and infrastructure. Coastal development can degrade

land-based habitat and have detrimental effects on coral reefs, especially when construction projects are not properly assessed and their effects result in unforeseen impacts.

When piers for shipping, tourism, or fishing have been constructed directly on top of coral reefs, this type of coastal development is considered a direct impact. Other direct impacts include dredging of marinas to ensure the channels are deep enough for ships to pass through. Dredging can tear into the reef structure or disturb nearby corals by smothering them with sedimentation. A process called land reclamation creates land to build on by purposefully pushing dirt and debris into the water; this may be carried out in order to provide the space needed to construct airports or buildings. In some areas, land reclamation has resulted in these structures being built atop or very close to the coral reefs.

Because of hard coral's similarities with brick, sometimes pieces of hard coral may be removed from the ocean to be used instead of bricks during construction projects. Hard coral has also been used as road-fill or ground up and used when making cement for new buildings.

Placement of roads and other development projects may require altering the natural flow of water. For example, a river or wetland's flow will be altered by removing a natural buffer, such as a mangrove forest. By altering the natural flow of water, freshwater and other runoff from the watershed may move more swiftly into the ocean and at a higher rate. Freshwater causes stress to corals and, in large amounts, can be toxic as it alters the salinity levels around the coral.



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EXPLOITIVE FISHING

Exploitive fishing includes fishing practices that are unsustainable and damage the long-term health of fishery resources. As you have learned, certain types of corals and fish have symbiotic relationships, so both species require each other in order to thrive. Here are three of the main forms of exploitive fishing that affect reefs globally.

Overfishing

When fish are harvested from the ocean in large quantity and at a higher rate than they are able to replace themselves, or reproduce, they are overfished. In 2019, this is believed to affect more than 55% of the world's reefs. One of the main causes of overfishing is the trend over the past few decades away from small-scale, sustainable harvests toward larger and indiscriminate takes, which have been possible with evolving technologies. As an example of one indiscriminate fishing technique, purse seine nets catch everything within an area, including fish and other sea creatures, many of which are not targeted by the fishermen and will be thrown back, but may be dead.



Destructive Fishing

Sometimes the easiest way to catch fish can also be the most destructive. One way to catch fish destructively is with poison. This is usually done with a chemical like cyanide (but can be other chemicals like bleach), which is why it is commonly referred to as **cyanide fishing**. This type of fishing is done to stun and trap a fish and make it easy to catch; usually a diver will poison a small area or hole within a reef with the cyanide, which causes the target fish to slow down or stop moving long enough to be caught by hand and transferred to a tank or net to take back to shore. For larger fish, the poison can be metabolized, and the fish will survive, but smaller fish and all the coral polyps, which have come in contact with the cloud of liquid poison, will die. This practice is most common for catching fish for the aquarium trade, a \$4-5 billion industry. The majority of tropical fish comes from wild-caught stock as it is very difficult to breed tropical fish in captivity. Hawaii passed a legislative bill in 2019 banning trade in aquarium fish to protect their reefs.



Destructive fishing also includes a practice known as **dynamite** or **blast fishing**. This is done when fishermen find a school of fish or an area where fish are known to be. They drop a loaded charge of dynamite or homemade bomb into the water to detonate. The underwater shockwave stuns all fish within a range of a few meters and ruptures their swim bladders, which regulate their ability to float underwater. Most fish will float to the surface, where they can be scooped up by the fishermen, but others will also sink to the seafloor and die. The shockwaves will destroy much of the coral reef beneath or near the charge, leaving only rubble. Although the practice is banned globally, it is still very much a threat in some parts of the world.



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PHYSICAL DAMAGE

Physical damage is just what it sounds like, damage to the coral structure through physical means. This happens in a variety of ways, all of which are human caused and nearly all of which are avoidable.

One source of physical damage comes from people touching the reef or corals, either accidentally or on purpose, while surfing, fishing or boating, diving or swimming.



Careless swimmers and divers can damage the coral reef by grabbing hold of the reef in order to stay in place when swimming or by walking on the coral reef. Fishermen looking for a good place to set their line may also choose to walk on the reef instead of remaining in their boats. Divers may accidentally graze the reef with their fins, and surfers may accidentally touch coral when they wipeout. People visiting a coral reef may try to collect pieces of coral as souvenirs for themselves or to sell to tourists. Coral pieces may be sold as jewelry or as pieces of home décor, but neither kind of coral collection is good for reef health.



Boat-sourced damage usually comes from boat anchors dropped overboard directly onto a reef. This can happen when people get close to a reef to fish or dive and don't pay attention to the reef location when they drop anchor. Heavy boat anchors can cause significant damage to corals.

Another type of physical damage is less direct but just as damaging. This type of physical damage comes in the form of marine debris. Marine debris is any type of trash that ends up in the ocean whether from land or from boats on the water. Lost or discarded fishing gear, such as nets or traps, is one form of marine debris. This marine debris gets caught on reefs where it is known to entangle fish and other creatures, some of which become trapped and die.

Marine debris also includes bits of floating trash, such as plastic waste floating on the surface of the ocean or plastic bags that get caught on the coral itself. This waste blocks sunlight from the zooxanthellae and doesn't allow for them to carry out photosynthesis. Plastic marine debris can break down over time into what is called microplastics. These pieces are so small that scientists have found evidence of corals ingesting microplastics, mistaking them for phytoplankton; studies are still ongoing as to whether the microplastics weaken or stress the corals over time, but it is unlikely they help since microplastics carry no nutrients and often host bacteria. It is estimated 8 million tons of plastic finds its way into the ocean yearly.

