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Coral degradation through destructive fishing practices

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All fishing methods affect coral reefs, but destructive fishing practices are further exacerbating the pressures facing reefs around the world. Destructive fishing methods are considered to be one of the largest immediate threats to coral reef ecosystems in some countries. Unlike the disturbance caused by natural disturbances or non-point source pollution, the damages caused by destructive fishing practices can be mitigated by adopting alternative methods that can both reduce damage to the coral and result in more sustainable fisheries.

Destructive fishing methods are unsustainable ways to fish. These practices often result in the loss of edible reef fish, reduction of species diversity and richness, alteration in the size structure of target species, and cause cascading effects on other reef fish with changes in species composition, biomass and density. Any type of fishing activity may cause a phase shift on a reef if the fishing activity is not well monitored and allows too many predators and herbivorous organisms to be removed from the ecosystem[1]. It is important to protect coral reefs because healthy reefs can produce up to 35 tons of fish per square kilometer each year, but damaged reefs produce much less.

Cyanide Fishing

Cyanide fishing is a method used to stun reef fish in order to collect them, which causes damage to the surrounding coral reefs. First practiced in the Philippines in 1962, the purpose of cyanide fishing is mainly to supply live fish for the aquarium trade. Since the 1980s, it has been conducted on a much larger scale to provide live reef fish to restaurants in Hong Kong, Singapore, and mainland China. It is estimated that 4000 or more Filipino fish collectors have used over 1 million kilograms of cyanide on Philippine reefs alone, about 150,000 kg per year.

Cyanide fishing is an inexpensive and effective method for collecting reef fishes that occurs in many places around the world including the Philippines, Indonesia, Cambodia, the Maldives, Thailand, and Vietnam. Fishermen make concentrated cyanide by crushing sodium cyanide (NaCN) pellets into squirt bottles and filling them with seawater. The fishermen then dive down to coral reef areas and squirt the concentrated cyanide into crevices where reef fish hide. The cyanide stuns the fish temporarily, making them easier to capture. The live reef fish are brought back to the ship and are put in seawater for transportation. In other areas of the world, bleach is used similarly to cyanide solution to subdue both reef fish and crustaceans.

The harmful effects of using cyanide on reefs are well documented, but the practice continues, mostly illegally, in many countries. There has been limited research into the effects of cyanide on marine fish. However, the concentrated cyanide has been shown to kill both target and non-target organisms, including non-target fish, corals, and invertebrates, as well as eggs, larvae, and microorganisms.

Cyanide fishing destroys thousands of hectares of essential coral reef habitats every year. Although cyanide leaves the structure of the coral intact, it kills the coral polyps. The cyanide stresses the zooxanthellae, the symbiotic algae that live in coral polyps. The result is “bleaching,” the discoloration that results from the loss of the algae from the polyps, which can be fatal to the coral. Further destruction of the reefs occurs during the cyanide fishing process when the reef fish escape deeper into coral crevices to avoid the cyanide solution. The fishermen then use a hammer to break apart the reef to retrieve the fish. This results in irreparable damage to the reefs. Destroying the reef structure degrades the reef fish

habitat. This practice has significantly damaged reefs in both the Philippines and Indonesia.

Cyanide fishing occurs illegally in most countries that continue the practice, and governments are looking into effective ways to enforce current laws as well as ways to detect cyanide use. One way in which enforcement officials have been able to combat cyanide fishing is through a Cyanide Detection Test (CDT) developed in 1991, which has been used since 1992 in the Philippines. Fisheries officers are able to randomly collect fish samples from fishers, local buyers, and exporters and take them to a CDT lab for cyanide testing.

Explosive Fishing

Blast fishing is a type of destructive fishing that uses dynamite or other homemade explosives to kill or stun reef fish. The practice has been in existence for centuries and is currently conducted on reefs in at least 40 countries or islands around the world. In Southeast Asia, blast fishing is one of the two largest causes of reef degradation. There are a variety of blast devices used in local fishing operations, the most common being a homemade bomb constructed of a bottle with layers of powdered potassium nitrate and pebbles. Other bombs are built using inexpensive commercial fuses or blasting caps in order to use them from the surface, or with gasoline, fertilizers, and sugar. Fishermen collect the fish that float to the surface and divers are used to gather fish hiding on the reef. The use of blast devices is economically efficient – a single bomb costs about 1-2 US dollars to build, while the resulting catch is worth between 15 and 40 US dollars. Blast fishing is a dangerous fishing technique that causes many accidents, such as limb loss; however, the practice is profitable enough to justify the risk.

Blast fishing results in significant harm to coral reefs. The damage occurs mainly on leeward shallow reef areas because they are easy to free-dive and the low currents allow easy collection of fish. The technique damages the coral reef structure by shattering the calcium carbonate skeleton. The explosions that are produced can also create large craters, affecting 10-20 square meters of substrate. This practice destroys coral at a faster rate than it is able to recover. Recovery is difficult because blast fishing is often a chronic disturbance that continually alters the reef environment. Even when blast fishing has ended, it is difficult for new scleractinian coral colonies to settle and grow in fields of dead coral rubble.

The detrimental results of blast fishing include: loss of coral cover, diminished ability of corals to regrow, and the local extinction of coral species. Topographic complexity of the substrate is lost, causing coral recruitment to decline and reducing fish habitat and reef function. Blast fishing can also lead to phase shift where former hard coral communities become dominated by soft corals and macroalgae. There are also declines in fish species and richness and a loss of coral associated fish communities. An estimate by Riegl and Luke put coral recovery from blast fishing at several hundred years. A study done by McManus et al in Bolinao, Philippines modeled the effect of blast fishing on coral reefs. At best, they found that blast fishing would have no significant effect on the reef, while at worst, it resulted in a net loss of coral cover of 14 percent per year. Their model also predicted that blast fishing could reduce the growth abilities of scleractinian coral on the reef slope by one third. It also indicated that reefs with smaller corals would have greater resilience in terms of annual percent regrowth of coral cover than larger corals.

Muroami

Muroami netting is a dangerous fishing practice that has led to extensive coral reef deterioration in Southeast Asia. Fishermen use a combination of nets that are weighted and decorated with brightly colored plastic strips with pounding devices in order to startle and herd reef fish. The pounding devices are usually large stones on ropes or cement attached to a crane fitted to the fishing vessel. The weights are lifted and dropped repeatedly along the reef, breaking live coral along the way. In many counties that use this practice, as many as 300 young boys, 10 to 15 years old, are used to set the nets and bang on the coral. The practice was banned in the Philippines in the 1980s, but continues illegally in some places.

Muroami. (Photo credit: Howard Hall)

Fishing Gear: Entanglement and Bottom Trawling

Normal fishing gear has destructive effects on corals around the world through direct physical damage to the reef structure and substratum. Gill nets, fish traps, and anchors break branching coral and cause coral death through entanglement. There are few studies that have documented the damage done and mortality of corals caused by monofilament fishing line. What is known is that when fishermen drop lines by coral reefs the lines catch the coral by their lead sinkers or steal hooks and then are cut off and left drifting. The discarded lines entangle corals and abrade their polyps and upper tissue layers. Corals are able to recover from small lesions, but when the area of damage is large or the damage occurs frequently, recovery may be difficult. Any bottom dragging gear, like beach seines, can damage corals by abrasion and fractures. A beach seine is a long net about 150 meters with a mesh size of 3 cm and a weighted line to hold the net down while it is dragged across the substrate. Beach seines are one of the most destructive types of fishing gear on Kenya's reefs.

Bottom trawling. (Source: website.net.nz)

Bottom trawling in deep oceans is causing the destruction of cold-water and deep-sea corals. Historically, industrial fishers avoided coral areas because their nets would get caught on the reefs. In the 1980s, rock-hopper trawls were invented; the large tires and rollers that were attached to the bottom of nets allow the nets to roll over any rough surface. Fifty-five percent of cold-water coral in Alaska that was damaged by one pass from a bottom trawl had not recovered a year later. In the Northeast Atlantic, there are scars up to 4 km long on the reefs from bottom trawlers. In Southern Australia, where heavy fishing occurs around coral seamounts, 90 percent of the surfaces where coral grew are now bare rock. Even in the Great Barrier Reef World Heritage Area, seafloor trawling for prawns and scallops is causing localized extinction of some coral species. A report released in 2004 by WWF, IUCN, and the NRDC cited bottom trawling to be the single greatest threat to deep sea environments.

Ways to Prevent Destructive Fishing

Many countries have laws that ban destructive fishing practices, but do not enforce them. In such cases, enforcement needs to be increased as well as local awareness of the detrimental effects and education efforts on alternative fishing methods. Destructive fishing practices lead to damaged fish habitat and less fish, which makes the fishery unsustainable. Coral reefs can be protected with a system of new Marine Protected Areas (MPAs) and better management of existing MPAs. Having MPAs allows enforcement agents to patrol the area for illegal fishing practices and could create "no-take"

zones to ban all fishing. Correctly managed fishing and tourism inside an MPA can provide real economic benefits. White et al. determined the benefits from 1 km^2 of healthy reef to be between 13,000 and 113,000 U.S. dollars. The purpose of many destructive fishing practices is to capture live fish for the aquarium trade and restaurants. Countries need to cooperate to regulate the import and export of fish to identify and allow only those that are caught sustainably. Finally, countries can adopt and enforce the United Nations Food and Agriculture Organization Code of Conduct for Responsible Fisheries. This advocates for cooperation between governments, non-governmental organizations, and industries to support sustainable fishing practices.

Notes

1. **^**In this case, a phase shift occurs when an area of scleractinian coral is replaced and dominated by a different habitat, usually macroalgae.

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