



The impact of fisheries

Brad Erisman, Octavio Aburto-Oropeza, and Richard Cudney-Bueno

The deep sea is out of sight and out of mind to most people and even most scientists, because it is truly a distant world that cannot be visited without the most technologically-advanced vehicles. For this reason, we know very little about the organisms and ecosystems of the deep oceans compared to areas accessible through conventional SCUBA gear and even less about our impacts on them.

Despite our limited information on these deep water ecosystems, seamounts and deep reefs have been exposed to the impacts of commercial and sport fishing activities for over half a century, but only recently has the widespread damage inflicted by such practices gained our attention. It is widely known that fisheries of shallow seas and coastlines have declined and even collapsed in many areas of the world, but few people realize that the same trend has occurred in the deeper, offshore waters.

Commercial fisheries of deep-water reefs and seamounts have been increasing with the demand for seafood, with the crash of shallow water stocks, and with the advances in fishing technology that have allowed large vessels to fish deeper and further offshore. In the Gulf of California, commercial fishing on seamounts and deep reefs coincided with the growth of the commercial shrimp and reef-fish fisheries in the region. For decades, these industries focused their efforts on coastal lagoons and near shore waters, where

The star-studded grouper
Epinephelus niphobles, also called "estacuda"
or "baqueta ploma", constitutes one of the main
fisheries in Bajo de El Charro.
Photo © Octavio Aburto-Oropeza.

they could harvest vast amounts of shrimp, sharks, groupers, and other valuable species with little effort. This all changed by the late 1970s, when the region experienced a tremendous growth in the number of fishing vessels and the amount of fishing effort. When this occurred, nearshore fisheries declined rapidly and fishers began to move to deeper waters in order to maintain their profits and fulfill the growing demand for seafood.

Today, commercial fisheries in the Gulf of California target at least 30 species of fish from deep-water reefs and seamounts. These include sharks that make use of seamounts as feeding and cleaning stations, particularly hammerheads; groupers such as the Gulf coney (*Epinehelus acanthistius*), star-studded grouper (*E. niphobles*), and Gulf grouper (*Mycteroperca jordanii*); snappers (*Lutjanus* spp.), and tilefish (blanquillos, *Caulolatilus* spp.), among others. Like all deep sea and seamount fisheries of the world, those in the Gulf of California have shown a boom and bust pattern, in which short-term high landings and profits are followed by collapses within 5 to 10 years of their initial development. For instance, the Gulf coney was heavily fished throughout the 1970's and during that period it was common for a vessel to carry up to a ton after a single day's work. Today the fishery has collapsed in most areas, and a landing of 100 kg is considered a good day's catch. As large groupers and sharks have all but disappeared from both the shallow and deep reefs, fishers have resorted to fish their way down the food web, harvesting smaller fishes and less valuable invertebrates from these areas until little remains but mud and slime.

The impact of fishing activities on these deep water ecosystems is certainly not limited to commercial activities. Barely regulated sport fisheries have also taken a toll on fish populations of these reefs. For instance, in some places of the Gulf of California, such as

The juvenile individuals of the gold-spotted sand bass *Paralabrax auroguttatus* develop in the sea-grass beds of shallow Gulf waters, and after reaching sexual maturity migrate to the seamounts as new recruits in adult populations.
Photo © Octavio Aburto-Oropeza.

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The Gulf of California has a large fleet of shrimp boats whose dragnets scour and damage the ocean floor in many parts of the region. Photo © Octavio Aburto-Oropeza.









the deep water reefs of the Northern Gulf, sport fishers have the highest impact on populations of the giant sea bass, *Stereolepis gigas*, a species protected in California waters and listed as “Critically Endangered” in IUCN’s *Red List of Threatened Species*. Sport fisheries will also often target breeding aggregations of deep groupers such as pinto and Gulf grouper, with no enforced limits on catches or season restrictions.

Clearly, the rapid rise and fall of deep sea fisheries in the Gulf resulted from an absence of management or regulations; however, the lifestyles of organisms that inhabit these ecosystems have also played a key role in their own demise. Most fishes living on deep reefs and seamounts grow very slowly, take many years to mature, reproduce sporadically, are long lived, and have few natural predators. For example, fishes like Gulf coney or the star-studded grouper do not reproduce before they are seven or eight year of age, and they can live for more than 30 years. This means that when populations are heavily fished, it could take them many years or even several decades to recover.

Seamounts and deep reefs are often referred to as ocean oases: small patches of lush reefs surrounded by miles of sand or mud. Thus these areas often concentrate dense aggregations of fishes and other marine life that are concentrated over small, finite areas to reproduce and or feed. When fishers locate these areas, entire aggregations of these animals can be removed in a period of just a few weeks or, in some cases, a few days. During our expedition, we observed fishers in most of the seamounts visited. The main target was the pacific red snapper (*Lutjanus peru*), an important commercial species in the region with high prices in the market, which reproduces in the transition season between summer and autumn. We bought three individuals larger than 60 cm in length from one of the small boats fishing around Las Ánimas seamount. These animals were two females

Some species of groupers, or “cabrillas”, may reach sizes over 1.5 meters and include the main commercial species that are harvested in the Gulf’s seamounts.
Photo © Octavio Aburto-Oropeza.

and one male ready to reproduce. Even though much of this fishery is carried out using only hook and line, if the majority or all of the breeding adults are harvested from a spawning aggregation, the population may disappear from the reef completely.

In addition to commercial and sport fisheries that target deep water reef species, deep reefs in the Gulf of California have not been immune to the effects of bottom trawling, where boats essentially drag a net in search of shrimp and fish. Most bottom trawling boats in the Gulf of California target shrimp in sandy areas and avoid rocky outcrops as these can destroy their fishing gear. However, these nets often accidentally end up passing through deep water reefs, indiscriminately collecting everything on their pathway. Unfortunately, in the last decade a number of bottom trawling boats called *escameros*, which do target fish, have also been equipped with a special net with rollers capable of passing through some reefs, especially flat patchy reefs known locally as *tepetates*.

Trawling activities on rocky reefs can not only harvest large amounts of unwanted bycatch. They can destroy entire benthic (bottom-living) communities, particularly those dominated by corals, sponges, sea fans and other suspension feeders. Bottom-trawling is known to strip up to 95% of these fauna, pulverizing two hundred year old corals and groves of invertebrates and transforming them into scraped, barren habitats. These benthic organisms constitute the foundation of their respective communities where they serve as essential habitat for fishes and invertebrates, recycle vital nutrients, and improve water quality by filtering out viruses and bacteria. These rich bottom communities provide food and shelter for immense schools of small fishes and predators that feed on them. Marine mammals, sharks, tuna, and octopuses all congregate over seamounts to feed on the rich booty. Even seabirds have been shown to be more abundant in the vicinity of shallow

seamounts. The massive removal of these natural and structural components of the ecosystem has a dramatic cascading effect on the entire ecosystem, causing the breakdown of entire food webs and a decline in local biodiversity and productivity.

Although our expedition reminded us of how unique and diverse these deep reefs can be, it also gave us an unfortunate picture of the impacts of fishing activities. These extended well beyond our expectations and were visible from the shallow surface waters down to 350 m. In El Bajo (Marisla) seamount, the large schools of sharks and jacks that once roamed the top of the seamount in the past were not present. Ghost nets, rusted traps, and old fishing line draped over large stretches of reef down to 300 m, some still containing carcasses of fish and crabs. Many of the reefs were also devoid of the large deepwater groupers that used to dominate the fisheries of these areas in decades past. To our surprise, we also found evidence of the effects of trawling in most of the reefs visited in the Bahía de Loreto area. Reefs and sandy slopes were covered by large trenches and scraped clean by trawling nets. There were broken corals, drag marks, and small patches of reef that were devoid of fishes, invertebrates, or much life at all.

The destructive effects of fishing on deep reefs and seamounts are particularly disturbing considering that entire suites of species are often found at a single location so their removal can result in immediate local extinction. Throughout the world, the unique fauna of these ecosystems are being trawled and dredged away at rates faster than the clear-cutting of the Amazonian rainforests, resulting in the permanent loss of species, some of them before they are even described.

Deep-sea fisheries all over the world have proven to be economically unsustainable and have resulted in the rapid depletion of biota, biological extinction, and irreparable

damage to old-growth habitats. A few countries such as Australia, New Zealand, and Canada have recognized this problem and have taken the first steps towards protecting seamounts through inclusion of certain seamount and deep reefs within marine reserves.

Similar actions are desperately needed to conserve these fragile marine ecosystems in the Gulf of California. If drastic changes to the deep sea fisheries in the Gulf are not made in the near future, the marine biodiversity and productivity of this unique region will continue to deteriorate and so will the communities that depend on the Gulf's resources for their livelihoods and survival.

Schools of large predators like the bigeye jack *Caranx sexfasciatus* congregate around the seamounts searching for preys.
Photo © Octavio Aburto-Oropeza.

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Artisanal fishers in Bajo Marisla harvesting triggerfish *Balistes polylepis* and red snappers *Lutjanus peru*. Photo © Lorenzo Rosenzweig.







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