



Global Implications of Illegal, Unreported, and Unregulated (IUU) Fishing

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Key Points

Global fisheries face an existential threat in the decades ahead from surging worldwide demand, declining ocean health, and continued illegal, unreported, and unregulated (IUU) fishing. IUU fishing also harms legitimate fishing activities and livelihoods, jeopardizes food and economic security, benefits transnational crime, distorts markets, contributes to human trafficking, and undermines ongoing efforts to implement sustainable fisheries policies. It can also heighten tensions within and between countries and encourage piracy. The illicit nature of IUU fishing means that the size of the problem and its negative consequences, can only be roughly estimated.

IUU Fishing by the Numbers

IUU fishing accounts for an estimated 15 to 30 percent of global annual catches, according to some studies. IUU fishing is prevalent because:

- IUU fishing benefits from high demand.
- The profits derived from IUU fishing substantially exceed the potential risks.
- The skills required for most fishers to engage in IUU fishing are minimal.
- The difference between legally and illegally obtained fish is hard to discern.

Prospects

International efforts to counter IUU fishing have grown over the past decades, most recently including the Port State Measures Agreement that came into force in June 2016. However, demand for fish remains strong, criminals tend to be adaptive, and climate change will add additional stress to global fish stocks.

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Global fisheries face an existential threat in the decades ahead as a result of surging worldwide demand, declining ocean health, and continued illegal, unreported, and unregulated (IUU) fishing.

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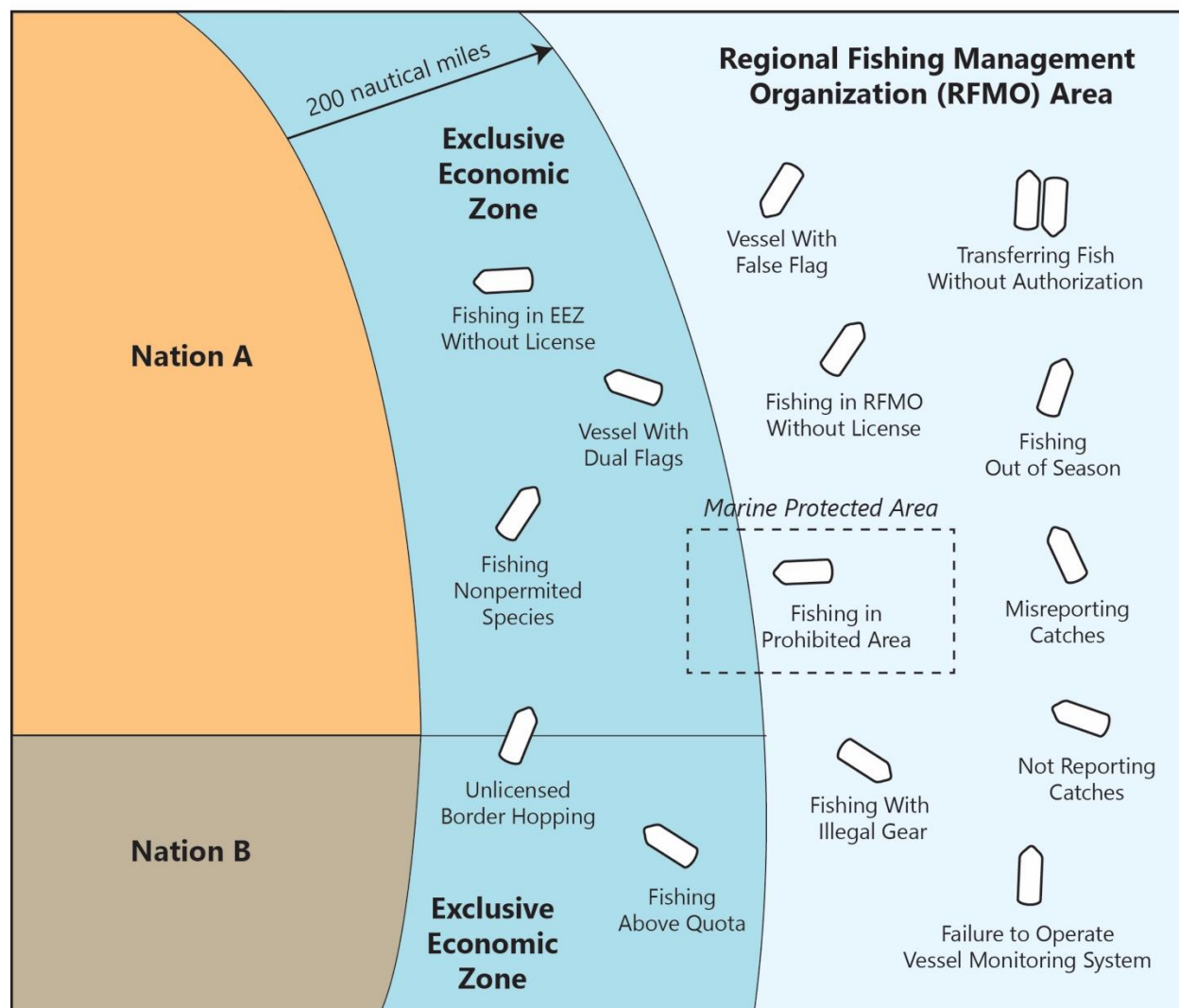
What is IUU Fishing?

IUU fishing refers to a broad set of fishing activities that undermine sustainable fisheries management, although in some cases IUU categories overlap—for example, illegal fishing largely goes unreported.

- *Illegal* fishing refers to fishing activities by vessels from one country in the jurisdiction of another country without permission, or other activities of fishing vessels that contravene fisheries laws. Under the UN Convention of the Law of the Sea, countries have sovereign rights to extract and manage natural resources, including fish stocks, in the waters and seabed within 200 nautical miles of their coastline—known as the Exclusive Economic Zone (EEZ)—but foreign trawlers and other fishing vessels regularly fish illegally inside other countries' waters.
- *Unreported* fishing refers to activities that are unreported or deliberately misreported to proper authorities.
- *Unregulated* fishing refers to fishing activities in areas where there are no applicable conservation or management measures, such as outside any country's EEZ and not under the jurisdiction of Regional Fisheries Management Organizations (RFMOs). EEZs and RFMOs try to foster rules and fishing quotas among interested states to manage critical fish stocks in international waters. The term also refers to fishing by vessels without nationality or flying the flags of a state not party to the relevant RFMO and who therefore consider themselves unbound by the RFMO's rules.

While the term *fishing* is commonly used, marine catches also include *crustaceans* (such as crabs, lobsters, and shrimps), *mollusks* (such as squids, octopi, cuttlefish, and snails), *echinoderms* (such as starfish, sea urchins, and sea cucumbers), and other invertebrates. IUU fishing also occurs in rivers and inland fisheries.

Common Forms of IUU Fishing



Unregulated fishing may also occur on the high seas, outside of any Exclusive Economic Zone (EEZ) or Regional Fishing Management Organization (RFMO) area.

IUU Fishing by the Numbers

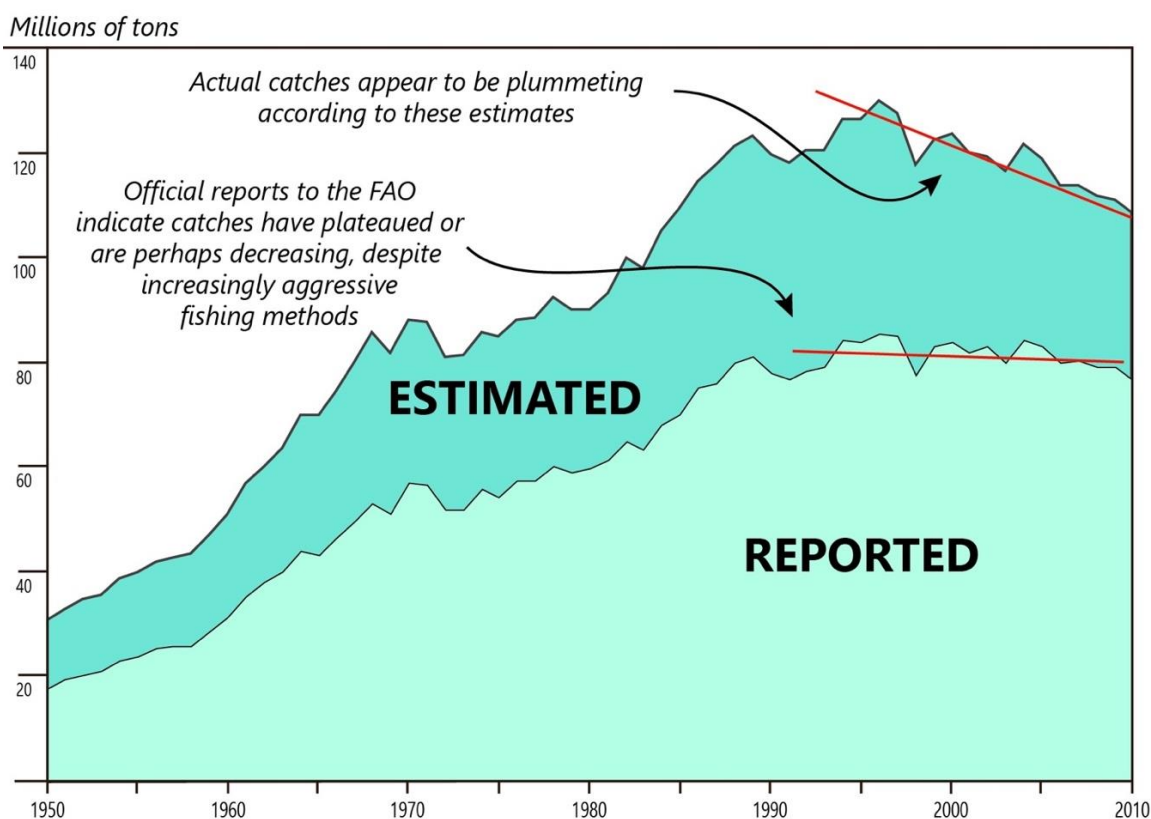
According to the UN Food and Agricultural Organization (FAO) and an academic study, IUU fishing represents an estimated 15 to 30 percent of global annual catches, although the extent of damage to fisheries varies significantly by region and species.

- For example, in some of the worst cases IUU fishing can account for more than half the revenue generated by tuna fisheries and over 80 percent of revenue from anchovy fishing, according to academic reports. West Africa and South and Southeast Asia have historically faced some of the highest IUU fishing levels.

- Areas with higher levels of IUU fishing also have some of the worst rates of fish stock decline, and affected developing nations often face a downward spiral as declining fishery stocks encourages more IUU fishing as fishers chase fewer fish.
- Up to a third of wild-caught seafood imported to the United States in 2011 was caught illegally, according to an academic study. The same study estimates that the United States consumes four to 16 percent of global IUU catches.

IUU fishing is a longstanding problem, but became a more serious issue in the 1990s when sustained overfishing appears to have triggered a sharp decline in actual total catches, even as officially reported data showed only a plateauing or modest fall after decades of increase, according to an academic study (see chart below).

Reported and Estimated Global Fish Stocks



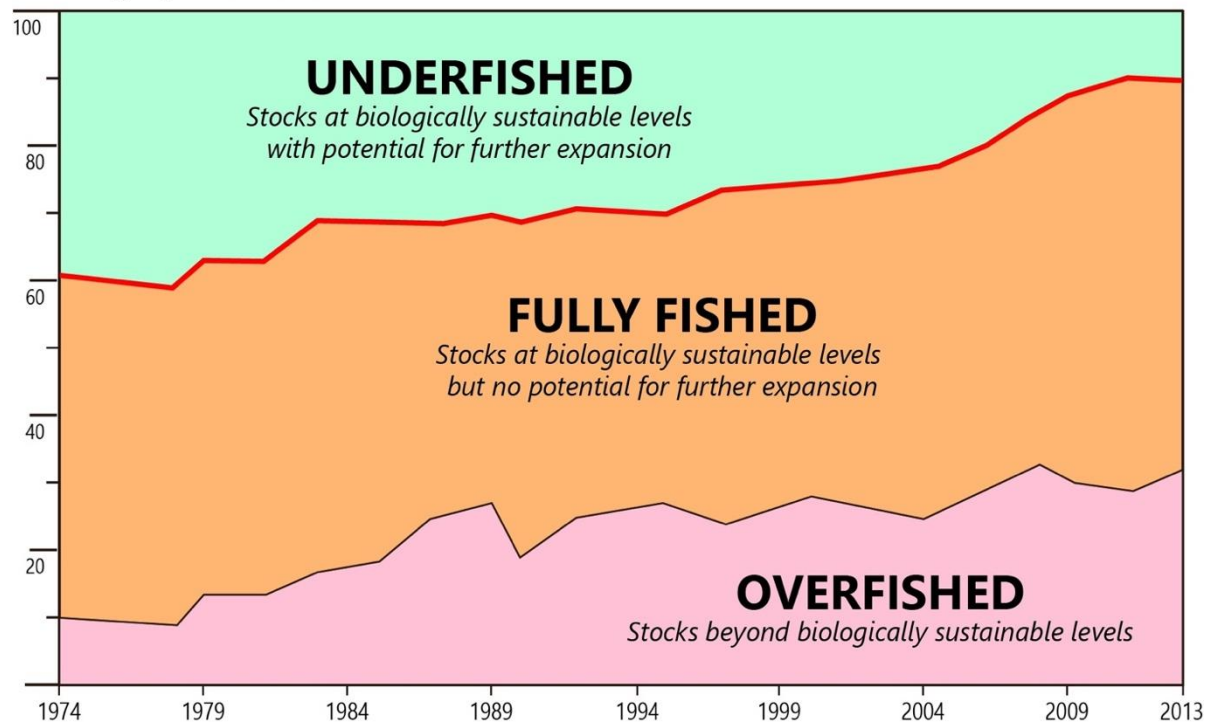
The number of fish caught is underreported by perhaps 30 percent, according to some scientific assessments that attempt to reconstruct catch numbers from other sources. The methodology employed is new and not universally accepted, though few doubt that fish catches are underreported.

Source: Pauly and Zeller, *Nature Communications*, 2016.

The FAO expects more fisheries to be overfished, a trend that will combine with such factors as degradation of marine ecosystems and climate change to render fish stocks even more vulnerable. As such, the negative fallout from IUU fishing will grow as more fisheries become increasingly fragile.

Trends in the State of Global Marine Fish Stocks Since 1974

Percentage of Total Fish Stocks



Approximately 85 percent of the world's fish stocks are fully fished or overfished. Demand for fish from both wild and aquaculture-based sources is expected to increase through 2030, which will almost certainly lead to further overexploitation of fish populations. The percentage of fish obtained through aquaculture has been increasing over the last decade, however.

Source: The State of World Fisheries and Aquaculture, FAO, 2016.

High Demand and Reward . . .

Global demand for fish is high while supplies are dwindling due in large part to overfishing. The demand is likely to grow as global population increases and standards of living improve.

- According to the FAO, nearly 4.3 billion people depend on fish stocks as a source of dietary protein, and population growth will almost certainly increase overall demand for fish products, including common commercial species, luxury dishes, and even exotic specimens for aquariums. Over ten percent of marine catches are for non-food uses, such as fish oil, fishmeal, jewelry, and decorative items, according to the FAO.

- Global fish stocks are half the size they were in 1950, according to scientists cited by the FAO. At the same time, fishing fleets are on average ten times more efficient today than they were in 1950.
- Fishing also remains a major source of employment; according to an academic study, an estimated 40 million people—mostly in developing African and Asian countries—work in the industry. Fishing subsidies have encouraged excess capacity in many fishing fleets.

IUU fishing is profitable despite the extra costs necessary to evade capture and bribe officials. Some small-scale artisanal fishers engaged in IUU fishing activities are probably motivated by noneconomic factors, such as subsistence, however.

- In an economic analysis prepared in 2005 for the Organization for Economic Cooperation and Development (OECD), a number of economic incentives for IUU fishing were identified, including excess or idle capacities on fishing vessels, tax havens, and the comparatively high market value of the targeted fish. The authors note that IUU fishers substantially reduce operating costs by enlisting poorly compensated crews and skirting safety standards. They also cite the emergence of commercial-style IUU fishing operations that employ sophisticated communications technologies to avoid detection and have easy access to bulk processing facilities, which also lower costs.
- An academic study from 2006 estimated that fines assessed to IUU fishing vessels would need to increase more than 20-fold for costs to match the benefits accrued from IUU fishing. Since profits from a particular vessel usually exceed the price of the vessel, many operators abandon the vessel in the event that they are apprehended, according to the same study.

. . . and Low Risk

Those engaging in IUU fishing are rarely detected or fined because of poor governance, gaps in international legal frameworks, corruption, and the remote and vast nature of the operating environment. Illegal fishing activities on the high seas are especially difficult to detect, and even some countries that have robust anti-IUU regulations have only limited enforcement or penalties.

- Many vessels involved in IUU activities are registered with *flag of convenience* states that cannot or do not hold their vessels accountable. IUU fishing vessels tend to exploit larger ports to blend in with legal vessel traffic and fishing operations.
- According to academic researchers, some underreporting of fishing results from subsistence or local-market fishing, as subsistence and traditional fishing vessels are not always required to acquire fishing permits. In countries such as Indonesia and Madagascar, for example, unreported subsistence fishing accounts for a large proportion of all fishing activities.
- A different academic study gave failing grades to over half of the countries assessed for compliance with IUU fishing prevention measures. In Europe, a region with comparatively good governance, this study reported that IUU fines from 2003 to 2004 averaged only one to 2.5 percent of the average value of illegal catches.

Low Barriers to Entry

The financial, logistic, and technical skills required for fishers to engage in IUU fishing are minimal. In many cases, legal fishers also engage in illegal activities, either on the side or simultaneously.

- According to an academic study, younger and less experienced fishers in Indonesia seeking quick profits often turn to fishing with explosives, enabled by illicit “exclusive buyers” that offer all necessary fishing and bombing equipment, including a boat. These buyers offer large down payments in exchange for sole purchasing rights to fishers’ catches and often force fishers to fish heavily to pay back these debts.

Authorities and Consumers Often Unaware

As fish products move through the supply chain, the difference between legally and illegally obtained fish becomes hard to discern. Traceability in the seafood supply chain is challenging to monitor and measure, even in counties where financial and human resources are available. According to a body of scientific reporting, mislabeling—either accidental or intentional—is rampant.

- Poor standards for identifying and publishing the origin of fish products have been one of the greatest hindrances to identifying and combatting IUU fishing activities, according to several academic studies and the National Oceanic and Atmospheric Administration (NOAA).
- Transshipment and so-called *fish laundering* commingle illegally caught fish with legal catches. An estimated 95 percent of IUU tuna fishing activities in the EEZs and high seas adjacent to Australia, New Zealand, Papua New Guinea, and 12 smaller Pacific Islands, for example, are conducted by licensed vessels that fish beyond their quotas or authorized areas and then transfer the illegal portion of their catch to other vessels at sea, according to an international fisheries consulting company. Illegally transshipped catches make up 12 percent or roughly \$600 million of the tuna fishing industry in the Pacific, according to 2014 estimates in a report by a major US foundation.

Over 65 percent of consumers surveyed in 60 developed countries prefer food from sustainable sources, according to an October 2015 study by a leading global market research firm. Most seafood consumers are probably unaware of the threats to sustainability posed by IUU fishing and the market pressures that might undermine its profitability are minimal. Seafood fraud worsens the problem and takes many forms, including substituting a low value species for another one or mislabeling fish to avoid breaching quota allotments.

- Roughly 50 percent of fish sold in 134 restaurants, grocery stores, and seafood markets in Massachusetts were not the same species that the menu or label claimed, as revealed by DNA analysis in an academic report published in 2011. More than 90 percent of the seafood volume consumed in the United States is imported, which elevates the risk of fraud.

Global Implications

IUU fishing poses the most direct threat to food security and economic activity in regions that depend on the ocean as a key source of food and jobs, but this activity also poses growing risks to biodiversity, tensions between countries, and the rule of law, including efforts to combat corruption and criminal activity.

Adverse Effects on Critical Ecosystems and Food Security

IUU fishing contributes to a dangerous reduction in ecologically vital fisheries that support over 4 billion people worldwide. Fish caught by IUU vessels are not included within scientific stock assessments, and thereby IUU fishing undermines efforts to gather the data necessary to sustainably manage affected fisheries, according to NOAA. Fish stocks generally recover slowly from overfishing, according to a body of scientific research.

- Nearly half of Mexico's total marine fisheries catches since at least 1950 have been unreported, according to recent scientific research, undermining the accuracy of stock assessments in Mexican fisheries. The conditions that enable IUU fishing activities in Mexico, such as weaknesses in enforcement and maritime domain awareness—as well as limitations in reporting, monitoring, and recording processes—are common to most fisheries worldwide.
- Unreported catches of Atlantic Bluefin tuna from the Mediterranean have significantly contributed to the rapid decline in the stock, according to a scientific report. The species has been listed as endangered on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species since 2011, although it remains a popular food item in several parts of the world.
- Failure to control unreported catches prevented recovery in North Sea cod—a dietary staple in North America and northern Europe—until only recently, according to an academic report.

IUU fishing activities also result in significant bycatch—the incidental capture of non-targeted species—that undermines the food supply of larger predators and, when discarded in the ocean, decompose and contribute to oxygen-deprived “dead zones.” Bycatch threatens a number of critically endangered species—such as New Zealand's Maui dolphin and the Gulf of California's vaquita porpoise—and indirectly reduces other populations, such as some sea turtle and albatross species, according to UN and academic reports.

- According to the National Oceanic and Atmospheric Administration (NOAA), some IUU fishers engage in *highgrading*, in which the value of a catch is increased by keeping only the best specimens and discarding the rest. This environmentally destructive practice removes far more fish than the fishers quotas allow, resulting in underreported catches with substantial bycatch losses.
- On the high seas, some fishers employ illegal driftnets, which are large-scale passive fishing nets that indiscriminately capture any animal or marine organism that cannot fit through the openings, according to NOAA. The nets are left to drift passively with transponders or marker buoys until the fishing vessel is ready to recover its catch; some nets are not recovered and continue to capture and kill marine animals indefinitely, according to NOAA.

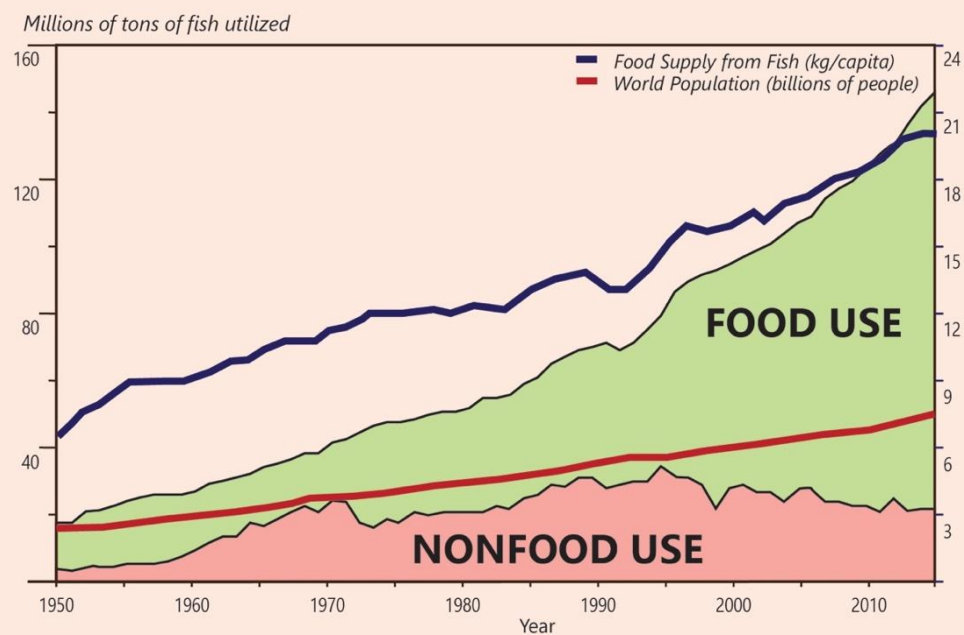
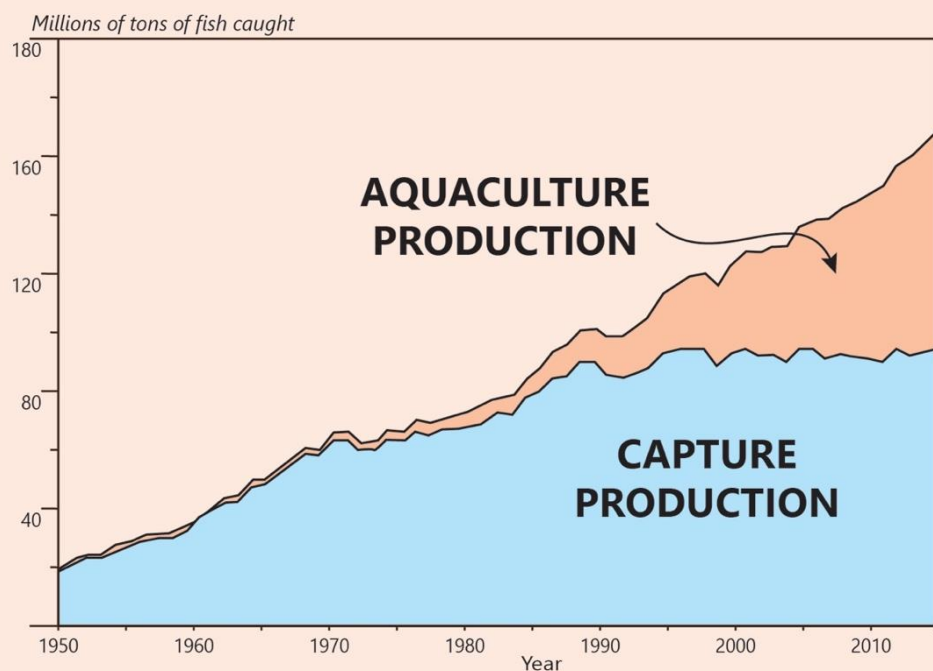
Illegal fishing vessel operators frequently use destructive fishing methods that harm crucial components of marine ecosystems while generally killing more fish than are captured, decreasing fish stocks critical to food security and livelihoods. Fishers often turn to these methods in areas already overfished and further degrade the fish stocks. These practices also pose health and safety risks to the fishers themselves.

- Blast or dynamite fishing has led to the loss of over 50 percent of the coral reef system in Southeast Asia's Coral Triangle, from which 130 million people derive their primary food or income from fishing, according to scientific research. The productive capacity of these coral reefs, which provide critical support to numerous ecosystems, has fallen to just 20 percent of their biological potential. An estimated 95 percent of coral reefs in those regions currently face medium or high threat levels from human activities.
- Blast fishing in Tanzanian waters—much of it improvised from readily available kerosene and fertilizer—is occurring at unprecedented rates, according to nonprofit environmental organizations. An estimated 80 to 90 percent of fish killed by explosives are unrecoverable by the method because the damaged fish sink rather than float. Fish provide 22 percent of the dietary animal protein in Tanzania, and the fisheries sector employs more than 4 million people in the country, according to the US Agency for International Development.
- Cyanide fishing—an illegal practice that is widespread in the Asia-Pacific where fishers spray poisonous cyanide directly onto reefs in an attempt to stun and harvest fish—accounts for an estimated 90 percent of tropical aquarium fish imported into the United States, according to the National Oceanic and Atmospheric Administration. Most fish do not survive the experience and upwards of 90 percent of cyanide-exposed fish die within weeks of exposure, according to the United Nations Environment Program. The indiscriminate nature of cyanide poisoning threatens or kills most of the marine life in its wake, including the coral reefs that have been exposed.

Continued decreases in fish stocks, due in large part to overfishing, threaten global food security. Of the over 4 billion people that consume fish, crustaceans, and mollusks, about a billion people depend on these sources as their primary source of animal protein, according to the World Health Organization (WHO). Fish account for 14 to 17 percent of animal protein intake by humans globally, and in coastal regions it is typically much higher, according to the WHO. Average per capita consumption of fish has doubled since the early 1960s, according to the FAO, with aquaculture supplies helping fulfill growing demand (see graphic below). As fish stocks continue to decrease due in large part to overfishing, aquaculture is almost certain to increase in importance to satisfy the growing global demand for fish as a food source.

Trends in Global Fish Production and Utilization

Since roughly 1990, the growth in fish production has come from aquaculture while fish catches have stalled, primarily from overfishing. Aquaculture, however, uses about half a metric ton of wild fish to produce one metric ton of farmed seafood, according to NOAA. Meanwhile, the growth of food supply from fish outpaces the world population rate, underscoring the growing reliance of fish in human diets.



Source: The State of World Fisheries and Aquaculture, FAO, 2016.

Heightened Tensions Between and Within Countries

Disputes over fishing rights and access to fisheries have become major points of contention for countries that rely heavily on fishing for food or income.

- Chinese fishers in the South and East China Seas have been arrested or fired upon since as early as the 1990s by Indonesian, Japanese, Philippine, and Vietnamese forces, who claim Chinese encroachment into their territorial seas. The Philippines-China Arbitration Tribunal ruled in July that the Chinese “nine dash line” as a claim to maritime space in the South China Sea was illegal, that China failed to prevent harvesting of endangered species on a significant scale, and that China’s actions prevented the Philippines from exercising its rights in its EEZ under the UN Convention of the Law of the Sea. This finding is unlikely to reduce tensions in the region as Beijing has publicly rejected the court’s jurisdiction.
- In response to increased incursions in its waters by Chinese fishing vessels, South Korea has constructed artificial reefs north of the South Korean-administered islands along the Northern Limit Line near North Korea. The artificial reef program, according to a geopolitical consulting firm, is an attempt by Seoul to build a passive defense system that snags or cuts fishing nets. North Korea, which does not recognize the Northern Limit Line, has decried the reefs as a violation of its sovereignty.
- Conflict over traditional fishing rights in the Bay of Bengal between Sri Lanka and India has led to the arrest of fishers from both countries and confiscation of their vessels. As of March 2016, Indian authorities claimed that the Sri Lankan Navy was holding 99 Indian fishers and 83 boats.
- In March 2016, Argentina’s coast guard sank a Chinese vessel suspected of fishing illegally in Argentina’s EEZ off the Patagonian coast. When identified, the Chinese boat began evasive maneuvers and then attempted to collide with the Argentine vessel, according to the Argentine Naval Prefecture.
- In March 2015, Somali students, residents, and fishers demonstrated against the presence of Italian fishing vessels that they claim were illegally operating in Indian Ocean waters near Mogadishu.
- In January 2014, Senegalese authorities detained 62 Russians and 20 Bissau-Guineans on board a trawler seized for alleged illegal fishing. The ship was freed a few weeks later after the private owner paid \$1.2 million, his third fine in a decade.
- For many years in the 1990s and 2000s, the Liberation Tigers of Tamil Eelam (LTTE) terrorist group exploited the pervasiveness of illegal fishing in Sri Lanka’s and India’s waters to hide contraband smugglers among fishing vessels, according to an academic report. The LTTE’s smuggling efforts allegedly capitalized on local illicit fishers’ expertise on navigation and maritime evasion.

Threats to Economic Interests and Livelihoods

IUU fishing disrupts both small- and large-scale fishing operations and adversely affects populations who depend on threatened fisheries. IUU fishers typically operate at lower costs than legal fishers and reduce expected government revenues by fees and taxes.

- Many poor coastal communities rely heavily on fishing for their survival. In Madagascar, unreported fishing from illegal or subsistence activities has caused authorities to underestimate fish stocks and permit unsustainable levels of large-scale commercial fishing, according to an academic report. Madagascar's stocks have declined significantly, which increases the food insecurity and economic losses in a nation already vulnerable to food shortages and political turmoil.
- In Guinea, illegal fishing by Chinese trawlers has undercut the livelihoods of local fisherman, who have struggled to earn a living since the dramatic increase of Chinese boats in the Gulf of Guinea that began in 2008.

IUU fishing also disrupts fishing industries in developed states. In 2014, revenues from fishing contributed nearly \$90 billion annually to the United States—which is responsible for approximately one-fifth of the world's fisheries within its EEZ—and supported over 1.5 million jobs. Fishing vessels often target commercially important species such as cod, tuna, orange roughy, and Patagonian toothfish (marketed as Chilean sea bass). The populations of these large predatory fish have been reduced by 90 percent of their preindustrial levels, according to some academic estimates.

Undermining Rule of Law

IUU fishing erodes the rule of law by providing illicit individuals and organized crime groups a source of income as well as infrastructure that benefits smuggling and other illicit activity.

- Italian 'Ndrangheta crime boss "Fish King" Franco Muto—arrested in July 2016 with 56 others from his organization—was credited with controlling the majority of Italian fishing vessels along the Tyrrhenian coast, as well as numerous nightclubs and dry cleaners. His operation is also accused of drug trafficking, extortion, and robbery.
- In South Africa, illegal abalone fishers and their teams have been paid by highly organized syndicates with cash and methamphetamine, according to academic fieldwork in the region. According to these studies, gangs operating in South Africa's Western Cape—collectively labelled the Cape Flats gangs—have exchanged illicit abalone for drugs, drug precursors, and cash with Chinese transnational criminal organizations. Arrests of individuals operating in covert abalone drying factories—which according to South African investigators are increasingly sophisticated, expensive, and designed for high throughput—have typically been of East Asian nationals and some linked to Chinese triad groups. The evolution of the factories from simple drying cupboards and pantries to commercial-style operations illustrate the increasing sophistication of the illegal sector and the relatively low level of risk involved.
- In May 2016, Mexican police arrested a smuggler carrying 121 fish bladders from the critically endangered totoaba endemic to the Gulf of California in Mexico. A single totoaba bladder—used primarily in soups—can cost up to \$10,000 in the Chinese market, according to the US Fish and Wildlife Service.
- Russian organized criminal groups are involved in many levels of the illegal trade of high-grade sturgeon caviar, which began when governmental oversight systems faltered as the Soviet Union collapsed in 1991, according to several academic sources.

There is limited information on the extent to which IUU fishing contributes to corruption, although high levels of IUU fishing activities almost certainly could not go undetected and unpunished without the acquiescence of authorities. Corrupt officials shield illegal fishers from enforcement, enable laundered fish to enter markets, and persuade observers to look away, according to nongovernmental organizations.

- Indonesian military officials were identified on transport vessels in Raja Ampat, a remote archipelago in the West Papua province, during the peak of IUU fishing in the late 1990s and early 2000s, according to surveys conducted for an environmental nongovernmental organization.
- Near Cambodia's largest lake, Tonle Sap, a journalist was reportedly beaten to death in February, 2015 after exposing authorities who accepted bribes to overlook illegal fishing, which locals have cited as causing a crash in the lake's fish stocks.

IUU fishing also acts as a vector for human trafficking in the form of forced labor, particularly for boats that remain at sea for long periods of time, according to a nongovernmental organization. Fisheries workers are often poorly-paid migrant workers operating under poor labor conditions, and are sometimes abused and forced to remain at sea, according to nongovernmental organization and open-source reports. In many places, declining catches from overfishing increases pressure to reduce fishers' costs by exploiting cheap labor. Many labor migrants are inexperienced fishers, exacerbating the dangers and difficult conditions found in most forms of industrial fishing. Long-haul fishing vessels—those operating at sea for a month or more—have been accused of having particularly acute labor abuses, according to UN and nongovernmental reporting. A survey in 2013 by the International Labor Organization, for example, found that 25 percent of workers on long haul fishing ships in Thailand were not working willingly.

- Many Thai fishers exploit laborers in slave-like conditions to compete for plummeting fish stocks in waters near Thailand—the third-largest seafood exporter in the world, according to the European Union and various environmental groups.
- In surveys of fishing laborers from Myanmar, five percent reported violence and threat of violence aboard IUU fishing vessels. There have also been eyewitness reports of executions of fellow workers as a means of enforcing compliance. Almost 60 percent of interviewed migrants trafficked from Cambodia into the Thai fishing industry reportedly witnessed the murder of a coworker by the ship's captain, according to a 2009 UN report on human trafficking.

Increased Risk of Maritime Piracy

The shortfalls in maritime governance that enable IUU fishing also facilitate maritime piracy, although many other factors are also involved, such as state weakness, a tradition of maritime expertise, and favorable geography, according to a body of academic research.

- In an academic study analyzing 2,600 piracy incidents reported to the International Maritime Bureau (IMB) from 2004 to 2013, the authors found that states with reduced values of fisheries production are more likely to experience piracy. The authors conclude that changes in labor opportunities in the fishing sector—driven primarily by overfishing—increases the number of potential pirate recruits.

- IUU fishing contributed to the surge in piracy off Somalia in the 2000's because many Somali fishers, who had learned to seize vessels in order to prevent illegal fishing in their historic fisheries—transferred these initially defensive skills to piracy—according to scholars. As Somali fishers' incomes decreased as stocks diminished, they applied their newfound ship-seizing skills to piracy.

Piracy, in turn, threatens legal fishing.

- Attacks on fishing boats, as well as tankers and cargo ships, have soared in the Gulf of Guinea over the past decade, according to the International Marine Bureau, despite a downturn in global piracy.
- According to a Nigerian fishing executive interviewed for a press report, Nigeria's fishing industry has been decimated by piracy and the country now imports 80 percent of its fish. The same report also noted the brutality of some attacks, in which members of the fishing crew froze to death after being locked in refrigerated storage rooms. Other countries bordering the Gulf of Guinea are similarly affected.

Prospects

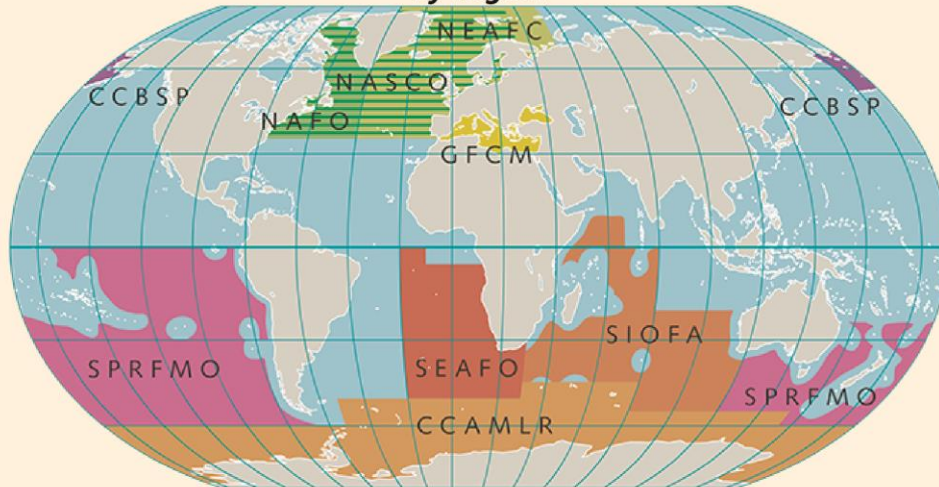
International efforts to counter IUU fishing have picked up momentum since the term was first formally used in a 1997 report by the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR), highlighting the growing risk of overfishing in the Southern Ocean. Shortcomings in voluntary efforts to manage the fishery have prompted some countries to take more direct action to counter IUU fishing by trying to reduce demand or step up enforcement.

- Over the years, various groups of states have come together to create Regional Fisheries Management Organizations (RFMOs, see following figure)—to collectively agree on managing and conserving fish stocks in international waters, with limited success. States not party to such organizations are unlikely to honor international or other agreements.
- The most successful RFMO probably has been CCAMLR in the Southern Ocean surrounding Antarctica and IUU fishing for some species—such as toothfish—is at its lowest point in 20 years there. This is probably because CCAMLR aims to protect the marine ecosystem as a whole rather than a single species, but also because the Southern Ocean is remote and contains few EEZs. Most RFMOs, however, struggle to share information, conduct vulnerability assessments of fishery ecosystems, establish best management practices, or promulgate performance measures. RFMOs will continue to play a critical role in combating IUU fishing, however, particularly as communication and information sharing deepens between RFMOs.

Regional Fisheries Management Organizations (RFMOs)

A regional fisheries management organization (RFMO) is an international organization formed by countries with fishing interests in an area. Some manage all fish stocks in a specific area, while others focus only on highly-migratory species, particularly tuna. Membership is voluntary and countries are not bound by the decisions of an RFMO to which they do not belong.

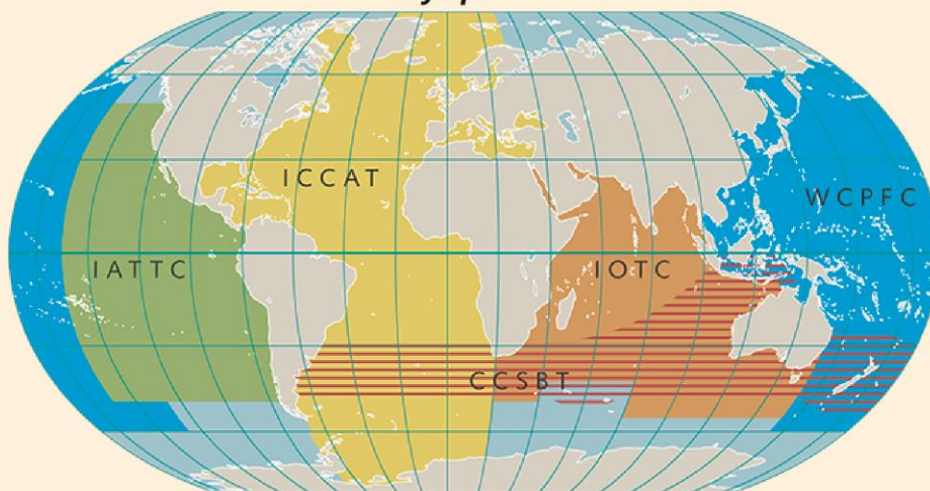
By Region



Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)
Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea (CCBSP)
General Fisheries Commission for the Mediterranean (GFCM)
North Atlantic Salmon Conservation Organization (NASCO)

North East Atlantic Fisheries Commission (NEAFC)
Northwest Atlantic Fisheries Organization (NAFO)
South East Atlantic Fisheries Organization (SEAFO)
South Indian Ocean Fisheries Agreement (SIOFA)
South Pacific Regional Fisheries Management Organization (SPRFMO)

By Species



Agreement on the International Dolphin Conservation Program (AIDCP)
Commission for the Conservation of Southern Bluefin Tuna (CCSBT)

Indian Ocean Tuna Commission (IOTC)
Inter-American Tropical Tuna Commission (IATTC)
International Commission for the Conservation of Atlantic Tunas (ICCAT)
Western and Central Pacific Fisheries Commission (WCPFC)

Source: World Ocean Review, 2013.

- In at least two instances since 2014, Indonesian authorities have publicly blown up as many as 60 foreign fishing vessels—primarily from China, Vietnam, Malaysia, and the Philippines—that were seized for allegedly fishing illegally in Indonesian waters. Indonesian authorities have destroyed more than 170 vessels since 2014 to deter IUU fishing.
- Malaysia announced plans in July 2016 to adopt a modified version of Indonesia’s approach, sinking seized fishing vessels to create artificial reefs.
- The European Union is stepping up efforts to improve labeling and education to reduce demand for illegal fish, while leaning on other countries to follow suit or face commercial sanctions.
- At the global level, the FAO in 2001 developed the first International Plan of Action (IPOA) to prevent and counter IUU fishing.

More recently, the Agreement on Port State Measures to Prevent, Deter, and Eliminate Illegal, Unreported, and Unregulated Fishing (PSMA)—the first binding international treaty to focus on IUU fishing—entered into force in June 2016 with 60 signatories, including Australia, Chile, the European Union, New Zealand, Norway, and the United States. Under the agreement, parties are obliged to ensure that all fishing vessels that enter their ports announce their arrival and submit to an inspection of their cargo, gear, and records. Signatories also pledged to share information on violators. The PSMA’s focus on port activities is likely to substantially augment current maritime monitoring and interdiction efforts since catches obtained from IUU fishing must ultimately arrive on land to be profitable. Unless many more port states sign and implement the PSMA, the efforts to counter IUU fishing could prove limited, however. Illicit actors—particularly those that are highly organized and well-financed—tend to be adaptive and will likely find ways to circumvent PSMA protections by using ports in countries not party to the agreement, falsifying catch records, and other means.

Climate change will add additional stress to global fisheries

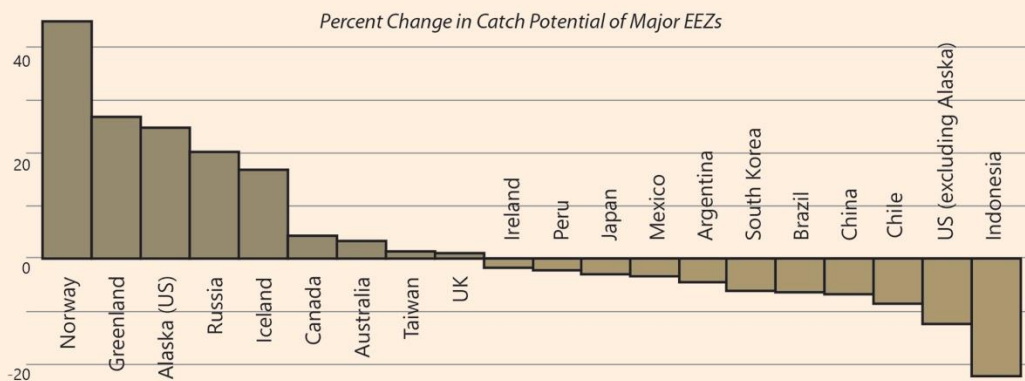
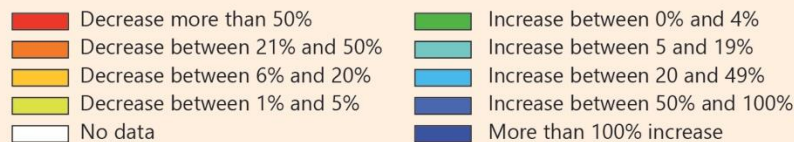
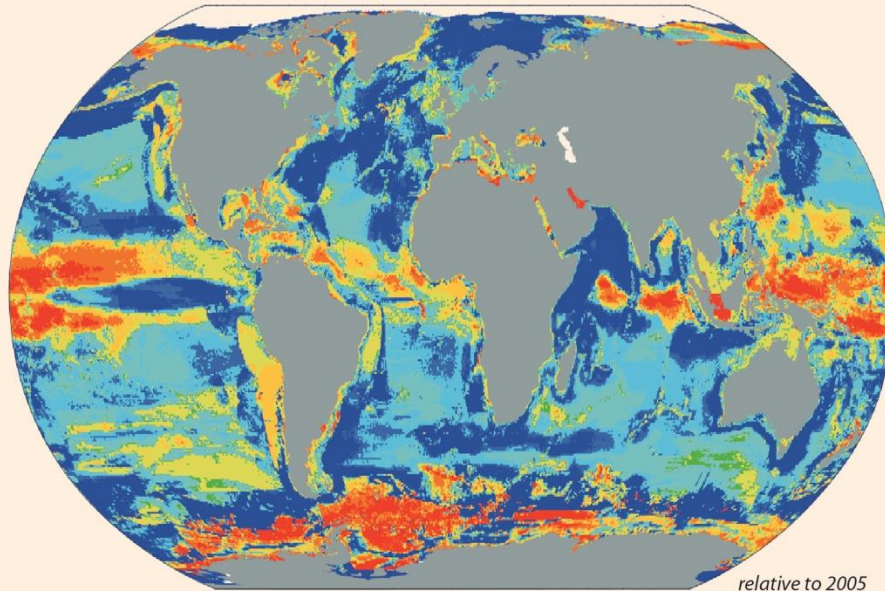
Projected effects of climate change will redistribute or deplete already vulnerable fishing stocks. Warmer and more acidic ocean conditions will likely decrease the abundance and diversity of marine species in some areas, and the worst fishery disruptions might occur in already vulnerable communities. Rising ocean temperatures will also likely increase the frequency of events that trigger short-term disruptions to fisheries, such as toxic algal blooms and abrupt changes to habitats. These shifts could spur new regional food and economic security concerns, and different conflicts over fisheries may emerge.

Ocean warming will disrupt many biological processes and cause fish stocks to shift toward the poles. Historically tropical fish will likely invade temperate areas, shifting fish stock composition and location. According to the Intergovernmental Panel on Climate Change, the oceans will become increasingly acidic as they absorb greater amounts of atmospheric carbon dioxide.

- Warming of ocean surface temperatures and increasing carbon dioxide concentrations could disrupt complex nutrient circulation between deep and shallow waters. This has already happened to some extent in the Caribbean Sea, according to an academic study. Although the effects will vary regionally, upwelling of nutrient-rich water from the ocean bottom could be disrupted, harming many important fisheries.
- According to an academic study, tropical fisheries will almost certainly be the most vulnerable, in large part because IUU fishing and coral reef declines already are particularly severe in the tropics. For example, fish production could decrease by 10 to 60 percent in South and Southeast Asia; in contrast, other areas (such as West Africa and US coasts) might experience significant productivity increases as phytoplankton production shifts with temperature. Globally, many commercially valuable fish populations will shift away from the tropics to temperature habitats.
- Ocean acidification has induced coral bleaching in reefs that support fishery-dependent coastal communities in Kenya, Madagascar, Mauritius, Seychelles, and Seychelles, according to academic reports, with adverse effects on local populations that use fishing for subsistence and income.

Projected Changes in Maximum Catch Potential by 2060 From Climate Change

In a moderate greenhouse gas emissions scenario, global fisheries are likely to reflect a change in maximum catch potential that varies throughout ecosystems. Regions in red—which include the South China Sea, the equatorial Pacific, the Southern Ocean, and parts of the Indian Ocean—are projected to see up to a 50 percent decline in fish catch by the half century. The EEZs in some nations will see an increase in fish stocks. Effects from ocean acidification and overfishing were not considered in this model.



Source: Intergovernmental Panel on Climate Change, 2014; Cheung et al, *Global Change Biology*, 2009.