

Oceans Away

Student Reading

Inspired by their majesty and mystery, we depend on our oceans and their coasts, not just for pleasure and food...but also as a counterweight to extremes of heat and cold on land...Although we often view the ocean as starting where the land ends, that separation is arbitrary. Land and oceans are part of the same global system. Activities on one profoundly affect the other.¹

—David Rockefeller, Jr., Vice Chair National Park Foundation and Member of the Pew Oceans Commission

Oceans cover 71 percent of the Earth's surface and support the largest species diversity of any ecosystem, making the ocean the largest habitat on Earth. Most of the known species of fish are found in the ocean, mainly along coastal areas. The ocean's coral reefs harbor biodiversity so rich in animal life that they have been dubbed "the rainforests of the sea." But, for centuries, humans have regarded the oceans as an inexhaustible source of food, a useful route of transport, and, unfortunately, a dumping ground. What's more, this dumping ground was often believed to be too vast to feel the effects of human action.

For centuries, humans have overlooked the integral role of oceans to our health, our economies, and even our weather. There is mounting evidence that the size of the world's human population, its activities, and the extent of its technological advancements are overwhelming the ocean's resources. Over the last few decades, human activity has seriously taxed the ocean's ecosystem, leading to progressive deterioration of marine habitats and species. According to the World Wildlife Fund (WWF), habitat loss is probably the greatest threat to the variety of life on this planet today. Many marine species are losing their natural habitat to **coastal developments**, and **overfishing** is plundering many more. Some are dying off from ocean pollution and **bycatch** (unintentional and unwanted wildlife capture during fishing operations, often thrown back into the ocean dying or dead), and ecosystems such as **coral reefs** are suffering the multiple effects of climate change and human damage. It is time for humans to acknowledge that the oceans are part of our common heritage and our common responsibility.

Fishy Business

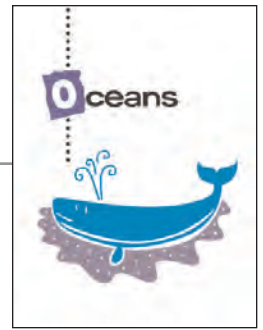
Marine ecologists and ocean conservationists identify overfishing as the most immediate threat to ocean ecosystem health. Over the past four decades, the world's once-abundant fisheries have been exploited at an unprecedented rate. As the demand for seafood grows, the global fishing fleet has grown over two and a half times larger than the oceans can sustainably support. According to a recent study of

the North Atlantic Ocean, fish numbers are now just one sixth of what they were 100 years ago.² This means humans are taking more fish out of the ocean than can be replaced by those remaining. Simply put, more and more people are competing for less and less fish and worsening the existing ocean crisis. As a result,

- 52 percent of the world's fisheries are fully exploited, while 25 percent are overexploited, depleted, or recovering from depletion.³
- Seven of the top ten marine fisheries, accounting for about 30 percent of all capture fisheries production, are fully exploited or overexploited.⁴
- The overexploitation and mismanagement of fisheries has already led to some spectacular fishery collapses. The cod fishery off Newfoundland, Canada, collapsed in 1992, leading to the loss of some 40,000 jobs in the industry.^{5,6} The cod stocks in the North Sea and Baltic Sea are now heading the same way and are close to complete collapse.
- As many as 90 percent of all the ocean's large fish have been fished out.⁷
- Several important commercial fish populations have declined to the point where their survival is threatened.

The growing size of the world's human population, the demand for fish, and the profit margin of some of the large commercial fishing fleets are the driving forces behind current levels of overfishing. Giant fishing fleets, employing technologically advanced equipment, have made large-scale fishing much easier than ever before. The new technologies also make it easier to overexploit fisheries. As larger fish are wiped out, the next smaller fish species are targeted, exceeding the ocean's ecological limits.

Populations of **top predators**, a key indicator of ecosystem health, are disappearing at a frightening rate. Ninety percent of the large fish that many of us love to eat – tuna, swordfish, marlin, cod, halibut, skate, and flounder – have been fished out since large-scale industrial fishing began in the 1950s. The depletion of these top predator species can cause a shift in entire ocean ecosystems. These changes endanger the structure and functioning of marine





ecosystems and, hence, threaten the livelihoods of those dependent on the oceans, both now and in the future.

Double Catch

Destructive fishing practices (DFPs) such as **blast** and **cyanide fishing** and **muro-ami nets** also pose a significant threat to fish and other marine wildlife. DFPS result in direct damage to fisheries habitat or to habitat-structuring organisms, such as hard coral communities.⁸ The muro-ami technique involves setting bottom nets and then driving reef fish from their hiding places into nets by walking or stomping on coral reefs. Also, many fisheries catch fish other than the ones that they target. **Bycatch** is widely recognized as one of the most serious environmental impacts of modern commercial fisheries. In some trawl fisheries for shrimp, the discard may be 90 percent of the catch. Other fisheries kill seabirds, turtles, and dolphins, sometimes in huge numbers.

The victims of bycatch are varied and many. Different fishing methods kill different animal species.

For instance, nets kill dolphins, porpoises, and whales; longline fishing kills birds; and **bottom trawling** (scraping of the ocean floor) devastates marine ecosystems.⁹ Although there are some devices designed to reduce bycatch, such as the turtle exclusion device (TED), they are not always effective.

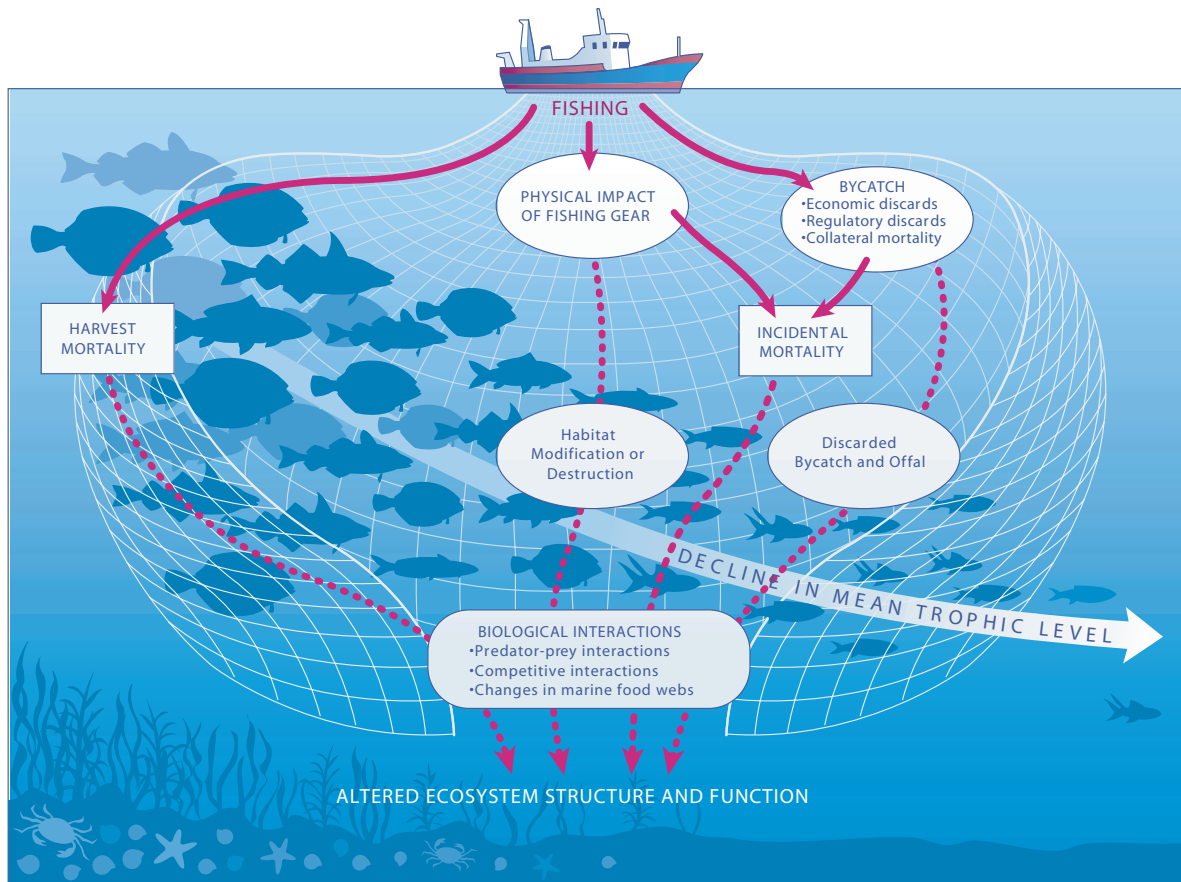
Cruising to the Coast

Unfortunately for marine life, coastal areas have historically been the most popular habitat for people. Today, about 60 percent of the world's populations live within 60 kilometers of the coast. This proportion is expected to rise to 75 percent within three decades.¹⁰ In the United States, more than half of the population lives in coastal counties. The resident population in these areas is expected to increase by 25 million people by 2015.¹¹ While people have lived in coastal areas for thousands of years, the enormous megacities that have developed over the past 100 years have destroyed natural marine and coastal habitats. Eight of the world's ten biggest cities are located on coasts: Tokyo, Mumbai (Bombay), New York, Shanghai, Lagos, Los Angeles, Calcutta, and Buenos Aires. In the United States, 14 of the 20 largest cities and 19 of the 20 most densely populated counties lie along the coast.¹² As cities grow, the construction of supporting infrastructure such as roads, housing, factories, and other developments grows along with them.

Throughout most of the world, coastal zones are overdeveloped, overcrowded and overexploited. Economic development and population pressures have mounted in coastal areas worldwide for the past 30 plus years, sparking widespread resource degradation in over half of the world's coastlines.¹³ Coastal ecosystems – some of which are the most productive and biologically diverse on the planet – support a huge variety of life and serve as nurseries for much of the biodiversity of the entire oceanic system. Coastal zones have the most nutrients of all marine ecosystems, and although they only account for 10 percent of the ocean environment, they are home to over 90 percent of all marine species. Of the 13,200 known species of marine fish, almost 80 percent of them are in coastal zones.¹⁴ Coastal development and associated sprawl destroy and endanger valuable coastal ecosystems such as wetlands. From the 1970s to the 1980s, the United States (excluding Alaska) lost more than half of its original wetlands. Louisiana, alone, has lost half a million acres of wetlands since the 1950s.¹⁵

In coastal areas around the world, shoreline developments have destroyed the habitats and breeding grounds of several marine species.¹⁶ The growth of

Ecosystem Overfishing



Fishing directly affects the abundance of marine fish populations (harvest mortality) as well as the age of maturity, size structure, sex ratio, and genetic makeup of those populations. Fishing affects marine biodiversity and ecosystems indirectly through bycatch, habitat degradation, and through biological interactions (incidental mortality). As commercially valuable populations of fish decline, people begin fishing down the food web, which results in a decline in the mean trophic level of the world catch.

Source: Pew Oceans Commission, *America's Living Oceans: Charting a Course for Sea Change*, 2003

the tourism industry and other coastal developments threaten habitats, species, and whole bionetworks by the elimination of ecosystems such as mangroves, sea grass beds, deltas, and estuaries. These ecosystems serve as both nurseries for valuable fishery species and as coastal barrier protection.

Polluting the Water

In many parts of world, coastal waters are polluted with untreated (or partially treated) municipal, industrial, and agricultural wastes. Fertilizers from agricultural fields and lawns also represent major pollutants in coastal areas. These pollutants deliver an excessive amount of nutrients to coastal waters, a condition called **eutrophication**. Algal species in the water use these excess nutrients to grow rapidly, or bloom. These blooms often lead to a depletion of the water's dissolved

oxygen which, in turn, suffocates local marine life. Areas experiencing low dissolved oxygen are often referred to as **dead zones**, since few marine organisms can survive in these areas. Eutrophication has created enormous dead zones in several parts of the world, including the Gulf of Mexico and the Baltic Sea. In addition, flourishing algal blooms can cause human disease and lead to beach closures. Algal blooms that adversely affect people or marine life are often called harmful algal blooms or toxic algal blooms.

Man-made chemicals and other toxic materials such as radioactive waste also find their way into the ocean through deliberate means. Considered a convenient dumping ground for centuries, the ocean contains all sorts of discarded toxic materials. The practice of ocean dumping went on until the London Dumping Convention banned it in 1972; an amended

treaty in 1996 (the London Convention) further restricted what could be dumped at sea.¹⁷ Dumping, however, still continues. Cruise ships routinely use the ocean as a dumping ground. In one week, a typical cruise ship generates 210,000 gallons of black water (sewage), 1,000,000 gallons of gray water (from showers, etc.), 37,000 gallons of oily bilge water, more than eight tons of solid waste, millions of gallons of ballast water (containing potential invasive species), and toxic waste from dry cleaning and photo processing labs.¹⁸

Rivers bring in even more pollutants, including chemicals and heavy metals, along with increasing loads of erosion sediment.¹⁹ Oil spills also cause huge damage to the marine environment (evident by the 2010 spill that occurred when the Deepwater Horizon oil rig exploded in the Gulf of Mexico) but are only responsible for around 12 percent of the oil entering the oceans each year. A study conducted by the U.S. National Research Council states that 56 percent of the oil that enters the ocean comes through drains and rivers as waste and runoff from cities and industry. However, the effects of oil spills, though not as common, can be long lasting. New evidence strongly suggests that components of crude oil (polycyclic aromatic hydrocarbons) persist in the marine environment for years and are toxic to marine life.²⁰

Over 80 percent of marine pollution comes from land-based activities. From plastic bags to pesticides, most of the wastes we produce on land eventually reach the oceans either through deliberate dumping or runoff from drains and rivers. This includes oil, fertilizers, solid garbage, sewage, and toxic chemicals. If solid wastes such as plastic bags and bottles, glass containers, and other materials are not properly disposed, there is a good possibility that they could end up in the ocean. Plastic decomposes slowly and is often mistaken by marine animals for food. Plastic materials have been found in the stomachs of several marine animals such as whales, dolphins, seals, and turtles. Plastic six-pack rings, for instance, are choke hazards for marine animals.

Hard Core Damage

Globally, 58 percent of the world's reefs are at risk from human activities. An estimated 26 percent of the Earth's reefs have been seriously damaged or destroyed by a combination of factors including coastal development and tourism, land and marine based pollution, destructive fishing practices, and climate change.²¹ Reefs have suffered indirectly from sediment from inland deforestation and removal of coastal mangroves, industrial pollution, and nutrient

pollution contributed by sewage, fertilizers, and urban runoff.²² Coral reefs have been evolving for the last 240 million years and scientists estimate that, in total, more than one million plant and animal species are associated with the coral reef system, despite the fact that they only comprise 0.2 percent of the ocean surface.²³ If present rates of destruction are allowed to continue, 60 percent of the world's coral reefs will be destroyed over the next 30 or so years.²⁴

Many people are unaware of the diverse ecological richness of the coral reefs and their benefits to humankind. Not only do reefs provide feeding, breeding, and nursery areas for fish and shellfish, but they also offer a pharmacopoeia of potential medicinal benefits. Some coral species may contain bio-active components that hold cures for cancer, HIV, or other diseases. Now, more than half of all new cancer drug research focuses on marine organisms. Compounds that have been extracted from a Caribbean reef sponge form the basis of AZT, a treatment for people with HIV infection.²⁵ Corals are also being used for bone grafts, and chemicals found in several species appear useful for treating viruses.²⁶ Coral reefs are also important as a source of economic livelihood and nutrition for many. Globally, one-fifth of all animal protein consumed by humans comes from marine environments – an annual catch valued at \$50-100 billion.²⁷

However, if the present rate of coral damage continues unchecked, many of the potential and actual benefits of coral reefs may be lost. In regions such as the Caribbean, 32 percent of the coral reefs are estimated to be threatened by coastal developments related to tourism. Tourism overuse, especially dive tourism, is proving harmful to coral reefs. The constant trampling by snorklers and divers has begun to put stress on the reefs. Research has shown significantly lower overall hard coral cover at high intensity sites compared with low intensity and undived sites.²⁸ In addition to the damage caused by coral tourism, coastal developments pose a very high risk to coral reef health. In many areas, coral reefs are mined for construction materials – sand and limestone – that are made into cement for new buildings. However, it is the indirect effects of development that are the most damaging, such as shoreline construction and modification. These processes disturb sediments and smother corals; sewage release blocks sunlight and reduces coral growth.

Destructive fishing practices also pose serious threats to coral reefs. Blast fishing in the Caribbean, East Africa, and Asia and cyanide fishing and muro-ami nets in Asia and parts of the Pacific have detrimental consequences for coral reefs.

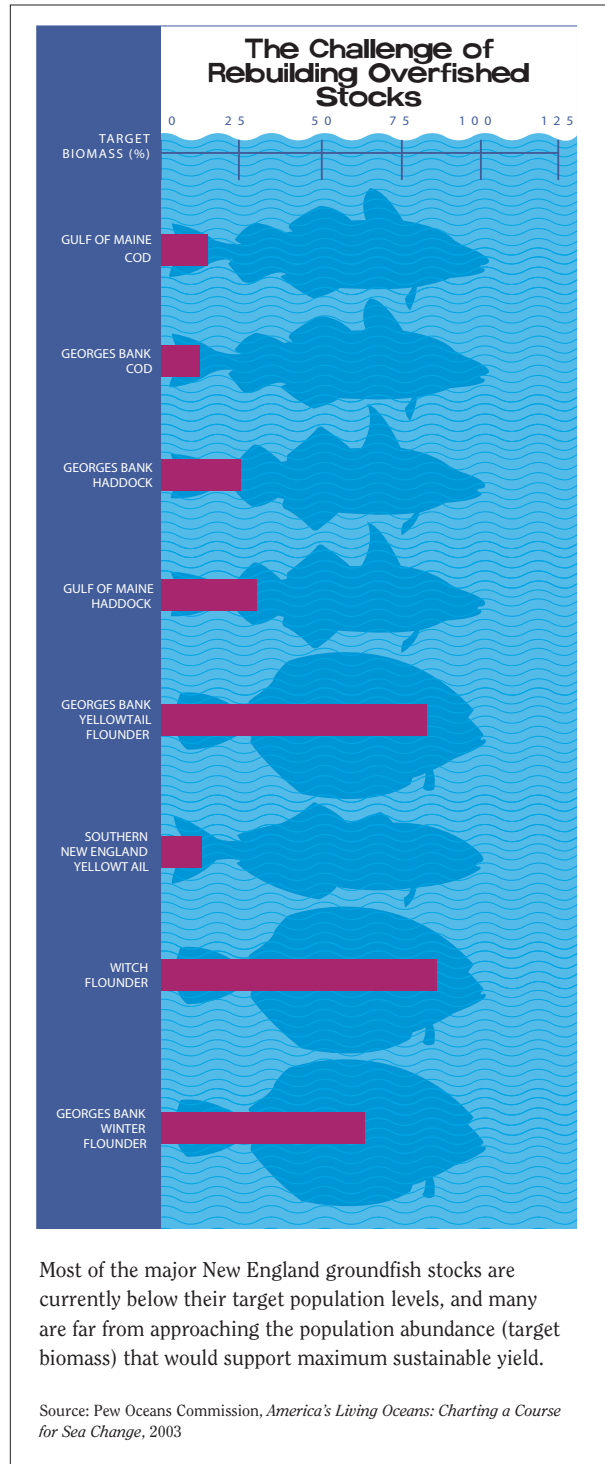
Still Time for Change

The ocean can be a friend, providing a source of nourishment and economic livelihood for millions, as well as a potential source of medical cures. It can also be a formidable foe, made much more perilous if we destroy the barriers that nature put in place to protect us from the ocean's wrath. Warming trends, rising sea levels, and the destruction of important barrier reefs and coastal ecosystems that help to protect the earth from the sea have intensified dangerous weather effects such as hurricanes and tidal waves. Although humans have caused significant harm, some of which cannot be reversed, there is still hope that conservation of ocean ecosystems can avert or reduce some of the deleterious effects that have already been set in motion.

In the midst of crisis, there are some signs of successful projects to restore our oceans. Thanks to strict size and catch limits, the striped bass and North Atlantic swordfish have made striking comebacks. After waste discharges were reduced, seabirds, kelp beds, and fish communities returned to the coastal waters off Los Angeles. More success stories will depend on national and international efforts to chart a new course for ocean management.²⁹

Improved implementation of existing marine agreements is essential to confront threats to the ocean. In February 2004, the Convention on Biological Diversity (CBD) set the stage for rapid action to address threats to marine biological diversity beyond national jurisdiction. Success has also been achieved in international marine law to control pollution from ships through conventions developed under the International Marine Organization. The IUCN World Conservation Union has noted a rapid increase in marine conservation efforts since 2002 and a renewed focus on marine conservation in nations and international organizations.

The 1994 **United Nations Convention on the Law of the Sea** serves as the international framework for further development and implementation of effective ocean-related international law and policy. The Convention defines maritime zones, protects the environment, preserves freedom of navigation, and establishes clear guidelines for businesses that depend on the sea for resources. As of 2011, 162 nations have acceded to the Law of the Sea Convention. The United States is one of the very few industrialized countries that has not ratified the treaty. Accession to the Convention would allow the United States to fully participate in international discussions regarding the management of the oceans and to influence decisions that affect ocean resources.



On a national level, the United States has made some progress in developing priorities for improved protection and management of its ocean and coastal resources. In 2004, the President-appointed **U.S. Commission on Ocean Policy** released its findings and recommendations for a new comprehensive national ocean policy.³⁰ The U.S. Commission report followed the 2003 release of similar recommendations by the Pew Oceans Commission.³¹ Both of these reports

identified a national set of priorities including the need for ecosystem based management, ocean governance reforms, improved fisheries management, increased ocean science and education, and more funding for ocean and coastal programs. In 2004, in response to these reports, President George W. Bush released the U.S. Ocean Action Plan to promote progress on the priorities and issued an executive order establishing a new Cabinet-level Committee on Ocean Policy to coordinate federal ocean policy and to address the Commissions' recommendations.

As work progresses on ocean issues at the international and national levels, we must also recognize the duty of every individual to protect the Earth's waters. Seemingly small actions can have a large cumulative impact on the health of oceans, such as recycling items so they do not end up as trash in oceans, properly disposing of hazardous materials that could harm ocean wildlife, and cleaning up after pets so bacteria and nutrients from their wastes do not contribute to pollution. Even in non-coastal areas, pollutants can flow into local streams and eventually end up in the ocean. Individuals can become actively involved in protecting ocean resources by volunteering to help clean up a nearby beach, stream, or coral reef; monitoring water quality in local waterways; or helping to educate others about ocean issues.

Endnotes

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