DYING OCEANS -

THE CATASTROPHIC AFFECTS OF OVERFISHING

PHASE 1

FA/YSDN 3008 - Zab Hobart
Hillary Chen
214829089

NOTES- REFERENCES AND DATA

OVERVIEW

The oceans are getting 3x overextended due to our exploitation of the oceans resources for water, fish oil, marine life etc. 90% of the world's oceans are either fully fully exploited or overexploited and that number has been increasing over the years (top right image). The rapid decline in fish population is concerning for the people who hope on eating fresh fish later on in life as well as those whose entire livelihoods depend on it.

STANDFORD UNIVERSITY

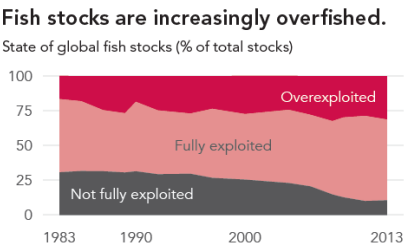
"All species of wild seafood will collapse within 50 years, according to a new study by an international team of ecologists and economists. Writing in the Nov. 3 issue of the journal Science, the researchers conclude that the loss of marine biodiversity worldwide is profoundly reducing the ocean's ability to produce seafood, resist diseases, filter pollutants and rebound from stresses, such as climate change and overfishing.

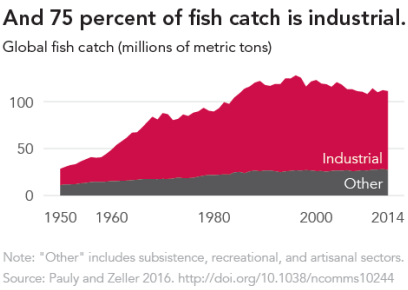
"Unless we fundamentally change the way we manage all the ocean species together as working ecosystems, then this century is the last century of wild seafood," said study co-author Stephen Palumbi, professor of biological sciences at Stanford's Hopkins Marine Station."

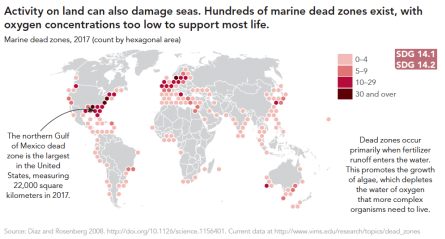
"Based on current global trends, the authors predicted that every species of wild-caught seafood—from tuna to sardines—will collapse by the year 2050. "Collapse" was defined as a 90 percent depletion of the species' baseline abundance."

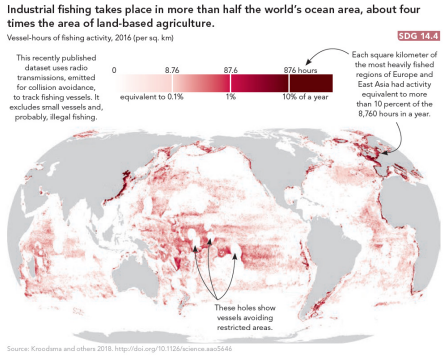
CAUSES- HISTORY OF FISHING

Fishing has been a practice that has been centuries old. For example, the Haida Gwaii in Vancouver relied heavily on the salmon runs that occur in BC every year. However, the way we consume fish today has put a massive strain on the ocean's



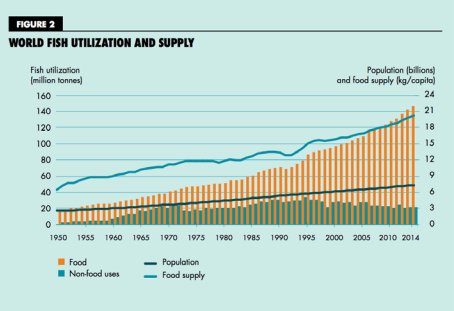






Source: 14 Life Below Water." The World Bank. http://datatopics.worldbank.org/sdgatlas/SDG-14-life-below-water.html."
From top to bottom:
Image 2: Industrial fishing is where the majority of fish are being taken.
Image 3: runoff and other environmental damage causes marine deadzones where fish cannot survive
Image 4: fishing acitivity around the world

resources. The abundance of fish that once was, is simply no longer around. Fresh fish catches have declined by 1.2 million tonnes a year since 1996 (The Sea Around Us). Fisherman are having harder times meeting their quotas as "The modern fishing fleet must work 17 times harder for the same catch as its sail-powered 1880s counterparts." (Overfished Ocean Strategy: Powering Up Innovation for a Resource-Deprived World). Even with improved technology fishermen only catch 6% of what they did 120 years ago."(The Guardian) This is attributed to several factors:

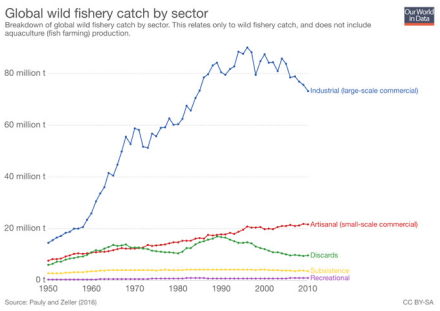


Source: FAO United Nations. The State of World Fisheries and Aquaculture 2018: Meeting the Sustainable Development Goals. FAO, 2018.
Outlines the world's supply of fish in association to consumption. As the world's population increases so does the demand in fish.

NATIONAL GEOGRAPHIC

"Marine scientists know when widespread overfishing of the seas began. And they have a pretty good idea when, if left unaddressed, it will end.

In the mid-20th century, international efforts to increase the availability and affordability of protein-rich foods led to concerted government efforts to increase fishing capacity. Favorable policies, loans, and subsidies spawned a rapid rise of big industrial fishing operations, which quickly supplanted local boatmen as the world's source of seafood."

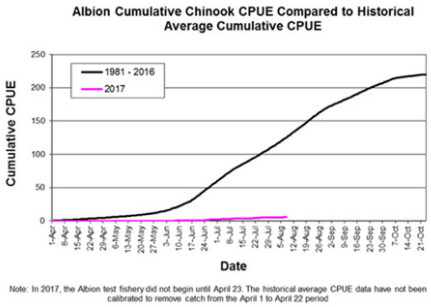


Source: Ritchie, Hannah, and Max Roser. "Meat and Seafood Production & Consumption." Our World in Data. August 2017. https://ourworldindata.org/meat-and-seafood-production-consumption#wild-fishery-and-aquaculture-production.
More descriptive graph on wild fisheries and how industry accounts for the large majority of caught fish.

IMPROVED TECHNOLOGY

Nowadays technology has been improved to find and capture thousands of fish as a time. Trawlers and driftnets can kill and take thousands of marine life at a time without even taking any commercial value. For example, "huge trawling nets could trap 12 Boeing 747 planes." (Canadian Wildlife Fund) Bottom trawlers are also hugely destructive as they essentially scrape the bottoms of the ocean from marine life such as coral, sponges and fishes. This practice brings up sediment on the ocean floor. The sediment also doesn't settle as fast as people used to believe- this effect can actually be seen from space. Usually it is done in the deep sea, but when it is dragged over shallower water it is evident that the plumes of sediment have large effects on marine life (ScienceDaily). Animals become vulnerable to predators as they have nowhere to hide because the rocks, coral, seaweed

etc gets uprooted (ScienceDaily). Frank Pope wrote in the Times of London, "Bigger, more powerful and more plentiful trawlers scrape clean every accessible patch of seabed. Companies out to please their shareholders fish only for immediate profit, exploiting every loophole to continue. Politicians paralyzed by fear, of angering the fishermen, are made complicit." Some of these trawlers are capable of catching 250 million tons of fish at a time (Encyclopedia of Crisis Management). They use bottom trawlers so often that the seabeds cannot replenish themselves quickly enough.



Source:"BC Chinook Salmon Runs Are in Serious Trouble." Georgia Strait Alliance. georgiastrait.org/bc-chinook-salmon-runs-serious-trouble/. Catch Per Unit Effort (CPUE) outlines the decline of salmon in 2017 compared to previous years.

ENCYCLOPEDIA OF CRISIS MANAGEMENT

"Overfishing can be generally defined as the fishing of a body of water to such an extent that the fish population cannot produce maximum sustainable yield on a long-term basis. Growing world populations have led to the demand for seafood more than doubling in the last 30 years. This demand—together with the rise of illegal, unreported, and unregulated (IUU) fishing; poor fisheries management; destructive fishing methods; and greater exploitation of the world's fisheries—is driving some fish species to the brink of extinction. A 2006 study of bycatch data by the journal Science concluded that if fishing rates continue at the current rate, all fish stocks will collapse by 2048. Approximately $50 billion a year is lost from the global economy through depleted stocks and poor management. The global fishing industry sustains coastal communities through employment opportunities and by providing a valuable source of protein for local communities. Overfishing has several knock-on effects and can lead to greater crises, including reduced economic and social opportunities and ecological disruption, which can lead to the severe depletion of certain fish species and, in some cases, their extinction, The 1970s' Peruvian anchovy crash, 1980s' North Sea herring collapse, and 1990s' Atlantic cod collapse were disastrous events that greatly affected the local economy and harvests. By the late 1980s, 90 million metric tons of catch had been removed from the oceans. As a result, fishing stocks have failed to recover, and the low availability of traditional fish stocks and the decline of major predators such as Bluefin tuna and Chilean sea bass have forced fishermen to fish further down the food chain,

often in deeper waters, depriving other marine animals such as seabirds and seals of a regular source of food. Government subsidies and policies led to a rise of large-scale commercial trawlers, some capable of landing over 250 million tons of fish. International territorial fishing disputes, such as the 1950s' Icelandic cod wars and the long-running mackerel dispute between Iceland/Faroe Islands and the European Union (EU), have occurred constantly between neighboring countries over fishing rights."

SCIENCE DAILY

"Bottom trawling, an industrial fishing method that drags large, heavy nets across the seafloor stirs up huge, billowing plumes of sediment on shallow seafloors that can be seen from space.

As a result of scientific studies showing that bottom trawling kills vast numbers of corals, sponges, fishes and other animals, bottom trawling has been banned in a growing number of places in recent years. Now satellite images show that spreading clouds of mud remain suspended in the sea long after the trawler has passed.

But what satellites can see is only the "tip of the iceberg," because most trawling happens in waters too deep to detect sediment plumes at the surface, say scientists speaking a symposium session called Dragnet: Bottom Trawling, the World's Most Severe and Extensive Seafloor Disturbance at the American Association for the Advancement of Science 2008 Annual Meeting February 15."

""Bottom trawling is the most destructive of any actions that humans conduct in the ocean," said Dr. Watling. "Ten years ago, Elliott Norse and I calculated that, each year, worldwide, bottom trawlers drag an area equivalent to twice the lower 48 states. Most of that trawling happens in deep waters, out of sight. But now we can more clearly envision what trawling impacts down there by looking at the sediment plumes that are shallow enough for us to see from satellites," he said.

"Bottom-trawling repeatedly plows up the seafloor over large areas of the ocean" said Mr. Amos. "Until recently, the impact was basically hidden from view. But new tools -- especially Internet-based image sites, like Google Earth -- allow everyone to see for themselves what's happening. In shallow waters with muddy bottoms, trawlers leave long, persistent trails of sediment in their wake."

Susanna Fuller studies impacts of trawling on sponges in the Northwest Atlantic Ocean. "Seafloor animals such as glass sponges are particularly vulnerable to bottom trawling," said Ms. Fuller, a graduate student of Professor Ransom Myers. Dr. Myers, who died last year, had published a series of papers showing that overfishing has eliminated 90 percent of the world's large predatory fishes and is devastating marine ecosystems."

"There are tens of thousands of trawlers worldwide. They fish for shrimp and finfishes. Some bottom trawling operations catch 20 pounds of "bykill" for every pound of targeted species."

THE GUARDIAN

"And as bottom trawling and dredging continues, such a fate awaits most other UK inshore fisheries. "Trawlers have transformed life on the seabed, converting three-dimensional, complex habitats rich in coral, sponge and sea fan to endless monotonous expanses of shifting gravel, sand and mud," adds Roberts. Nor is the damage confined to the seabed. Stocks of fish – robbed of any hiding places on the seafloor – have suffered correspondingly. Common skate, angel shark, halibut and wolfish, once plentiful, have virtually disappeared from British waters while bottom fish – which cling to the seabed – such as cod, haddock and turbot, have suffered drastic declines in numbers.

The grim scenarios described in 1866 pale by these descriptions, as Roberts makes clear. By studying the first official statistics of UK fish landings, which began in 1889, he has discovered that our fishing – which was mostly done by sailing boats without radios or echo-finders – was far, far more successful than its modern equivalent. "For every hour spent fishing today, in boats bristling with the latest fish-finding electronics, fishers land a mere 6% of what they did 120 years ago. Put another way, fishers today have to work 17 times harder to get the same catch as people did in the 19th century." And the reason for this startling state of affairs is straightforward: we have caught so much fish in our own waters over the past 150 years, there is little left for us today. Some species hover at the edge of extinction. Our seas, and the floor below them, have been stripped of their riches."

INCREASED FISH CONSUMPTION

People are consuming more fish than ever before- around 20 kilos a year. Nearly one billion people rely on fish for nutrition and protein (WHO).

FISHERIES AND OCEANS CANADA

"The impact of global overfishing is typically measured in environmental and economic terms, but often overlooked is the threat depleted fish stocks pose to the millions of people around the world who depend on fish for food.

According to the World Resources Institute, about 1 billion people – largely in developing countries – rely on fish as their primary animal protein source. Fish is highly nutritious, and it serves as a valuable supplement in diets lacking essential vitamins and minerals."

WORLD HEALTH ORGANIZATION

"Despite fluctuations in supply and demand caused by the changing state of fisheries resources, the economic climate and environmental conditions, fisheries, including aquaculture, have traditionally been, and remain an important source of food, employment and revenue in many countries and communities (11). After the remarkable increase in both marine and inland capture of fish during the 1950s and 1960s, world fisheries production has levelled off since the 1970s. This levelling off of

the total catch follows the general trend of most of the world's fishing areas, which have apparently reached their maximum potential for fisheries production, with the majority of stocks being fully exploited. It is therefore very unlikely that substantial increases in total catch will be obtained in the future. In contrast, aquaculture production has followed the opposite path. Starting from an insignificant total production, inland and marine aquaculture production has been growing at a remarkable rate, offsetting part of the reduction in the ocean catch of fish.

The total food fish supply and hence consumption has been growing at a rate of 3.6% per year since 1961, while the world's population has been expanding at 1.8% per year. The proteins derived from fish, crustaceans and molluscs account for between 13.8% and 16.5% of the animal protein intake of the human population. The average apparent per capita consumption increased from about 9 kg per year in the early 1960s to 16 kg in 1997. The per capita availability of fish and fishery products has therefore nearly doubled in 40 years, outpacing population growth."

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

"Despite the increasingly prominent role of aquaculture in total fish supply, the capture sector is expected to remain the primary source of a variety of species and vital for domestic and international food security.

World food fish consumption is projected to increase by 19 percent (or 29 million tonnes) by 2026 compared with the base period (average 2014-2016).

Of the 177 million tonnes of fish consumed worldwide in 2026, the lowest consumption is expected in Oceania and Latin America. Asia, meanwhile, will consume more than two-thirds of the total, or 127 million tonnes, of which 56 million tonnes will be consumed outside China. Asia is also expected to continue to account for the majority of consumption growth, accounting for 76 percent of the additional fish consumed by 2026.

World per capita apparent food fish consumption is projected to reach 21.6 kg in live weight equivalent by 2026, up from an average of 20.3 kg in 2014-16.

Per capita fish consumption will rise in all continents except in Africa, where population growth will outstrip its increasing food fish supply."

POOR REGULATION AND ILLEGAL FISHING

30% of fishing in the oceans go unreported making it difficult for governments to keep on top of the status of the ocean. (Global News) Fishing boats make false reports and the government subsidizes fishing boats $30 billion in annual subsidies. This money can go towards purchasing better technology for boats such as trawlers. People have learned how to use logistic to evade authorities and unregulated fishing happens mostly in poorer nations where they do not have the same resources available to detect illegal fishing (Encyclopedia of Crisis Management).

GLOBAL NEWS

"A new study released in Nature Communications says that 30 per cent of the fish being caught worldwide is not reported.

The study found the annual global catch to be roughly 109 million metric tons, about 30 per cent higher than the 77 million officially reported in 2010 by more than 200 countries and territories.

This means that 32 million metric tons of fish goes unreported every year, more than the weight of the entire population of the United States.

"We know the catches, or we thought we did, by countries reporting to [the Food and Agriculture Organization] what they catch. Every year they report to [them]," said Daniel Pauly, a UBC professor with the UBC Fisheries Centre and lead author of the study.

But their findings indicate flaws in how the data is collected. Pauly and his team say most countries focus their data collection on industrial fishing, which overlooks artisanal, subsistence and illegal fishing, as well as discarded fish, which can be difficult to track."

WORLD WILDLIFE FUND

"POOR FISHERIES MANAGEMENT

A lack of management oversight, government regulations, and traceability of fishing activities has long been a problem in the fishing industry. Current rules and regulations are not strong enough to limit fishing capacity to a sustainable level. This is particularly the case for the high seas, where there are few international fishing regulations, and those that exist are not always implemented or enforced. Many fisheries management bodies are not able to adequately incorporate scientific advice on fish quotas, and customs agencies and retailers cannot always ensure that the fish entering their country is caught legally and in a sustainable way.

ILLEGAL FISHING

One key dimension of the overfishing crisis is illegal, unregulated, and unreported fishing. It occurs across all types of fisheries, within national and international waters, and small scale to large industrialized operations. Illegal fishing accounts for an estimated 20% of the world's catch and as much as 50% in some fisheries. The costs of illegal fishing are significant, with the value of pirate fish products estimated at between $10-23.5 billion annually.

SUBSIDIES

Many governments still continue to subsidize their fleets, allowing unprofitable operations to subsist, and overfishing to occur. Today's worldwide fishing fleet is estimated to be up to two and a half times the capacity needed to catch what we actually need."

NATURAL DISASTERS & HUMAN IMPACT ON ENVIRONMENT

Environmental disasters can speed up the natural decline of fish species. Floods and tsunamis throw fish out of their natural habitat. "In northern Japan, the entire fishing industry has been in "terminal decline," with the 2011 tsunami only accelerating the collapse." -Overfished Ocean Strategy: Powering Up Innovation for a Resource-Deprived World How humans treat the environment has a great impact on fish population and can attribute ot overfishing.

CANADIAN WILFLIFE FEDERATION

"The world's wildlife-rich coasts are the most abused part of our seas. Ninety percent of all ocean waste — about 20 billion tonnes of it each year — stays in coastal waters, where it poisons breeding grounds, disrupts sea-loving creatures, harms humans, and ruins beaches.
Many of the planet's people live in horribly crowded settlements and depend totally on their fragile, polluted coasts for food and jobs. Small island countries could not survive without healthy coasts.
We have already destroyed about half the world's coastal wetlands and many creatures living there.
People have cut down half the world's mangrove forests to make artificial shrimp ponds.
More than two-thirds of the world's largest cities sprawl along coasts. Singapore, for example, has destroyed nearly all its mangroves and coral reefs. Californians have filled in 60 percent of San Francisco Bay to make more land."

OVERFISHED OCEAN STRATEGY: POWERING UP INNOVATION FOR A RESOURCE-DEPRIVED WORLD

"Like his father and grandfather before him, Al Cattone has been living off the sea for all his life. For the Gloucester fisherman who spent over 30 years braving the Atlantic's waters, fishing is "not so much a job as it is an identity." But this legacy is coming to abrupt end. In light of extreme declines of cod stocks, the New England Fishery Management Council voted to slash allowed cod catch rates by 77 percent in the area from Cape Cod to Nova Scotia. The destruction of fishing communities across the region is expected to follow, with a domino effect on seafood processors, wholesalers, distributors, and retailers – an entire industrial ecosystem. But the unpopular move is backed by the harsh reality that the cod stocks today are very far from healthy, with some communities netting a bare 7 percent of moderate targets set by the National Oceanic and Atmospheric Administration.

In his struggle and sadness, Al is not alone. In the United Kingdom, the modern fishing fleet must work 17 times harder for the same catch as its sail-powered 1880s counterparts. In northern Japan, the entire fishing industry has been in "terminal decline," with the 2011 tsunami only accelerating the collapse. Recently, the Financial Times has become one of the most prominent voices about the fish crisis, warning the world of the decline in fish stocks, which is more severe than predicted. "More than half of fisheries worldwide face shrinking stocks, with most of these in worse condition than previously thought, leading to yearly economic losses of $50 billion." And if the proven losses of the present are not enough, the projected losses of the future exceed anything that could be imagined. According to a Stanford University study, overfishing could take all wild seafood off our tables by 2048."

CONSEQUENCES

DEPLETED MARINE BIOLOGY

"We see an accelerating decline in coastal species over the last 1,000 years, resulting in the loss of biological filter capacity, nursery habitats and healthy fisheries," - Heike Lotze

"In 2003, a scientific report estimated that industrial fishing had reduced the number of large ocean fish to just 10 percent of their pre-industrial population." - National Geographic

"Over the past 100 years, some two-thirds of the large predator fish in the ocean have been caught and consumed by humans, and in the decades ahead the rest are likely to perish, too. In their place, small fish such as sardines and anchovies are flourishing in the absence of the tuna, grouper and cod that traditionally feed on them, creating an ecological imbalance that experts say will forever change the oceans."(Marc Kaufman, Washington Post, February 20, 2011) 40 different types of fish species in the Mediterranean alone may go extinct. The Atlantic bluefin was a main concern as 80% are consumed for sushi. BC Chinook Salmon are also in serious trouble due to overfishing which could lead to the extinction of southern killer whales as 90% of their diet consists of Chinook Salmon. Canada had also had to stop fishing for Atlantic Cod in the 1990's as the population was undergoing severe overfishing and was on the brink of extinction (WWF). Currently, sturgeon is one of the most critically endangered species. They take around 6-25 years to mature and most of their roe is taken to make caviar. The sturgeon population has declined by 70% due to illegal harvesting as selling them have become very profitable (WWF). The loss and decline of these species will alter the entire marine ecosystem. The Canadian Wildlife reserve states that "dolphins, birds, and Steller's sea lions have declined in the North Pacific. That's because we fished too much of their favourite food — Alaskan pollock. In the same way, Falkland Islands penguins starved to death when fishermen caught too many squid." The way we fish will have a devastating impact on all sections of the food chain and we will lose more than just fish.

THE GEORGIA STRAIT

"The endangered southern resident killer whales are on the brink of extinction with only 76 whales left. One of the greatest threats to their survival is the lack of abundant chinook salmon, which make up to 90% of their diet. For reasons not yet fully understood by scientists, the southern residents have shown that they will rarely switch their primary food source from chinook to another species, and therefore face starvation in the wake of dismal chinook salmon returns for the past several years along the entire coast of British Columbia."

"As the data in the report shows, BC salmon are in serious trouble. Action by DFO must be taken immediately to protect the salmon stocks we have left and to rebuild populations for the future. The southern resident orcas face a serious risk of extinction if chinook populations continue on the downward spiral they are currently on. The graph below illustrates this year's Albion cumulative chinook Catch Per Unit Effort (CPUE) compared to historical average cumulative CPUE, with 2017 barely exceeding the zero line. The data is collected on the lower Fraser River at Albion, BC. Fraser River

chinook are a crucial source of food for the southern resident killer whales from spring through fall."

"DFO needs to take similar direct action up and down the BC coastline to ensure that wild salmon stocks are not depleted any further. It is clear that current management of BC salmon stocks is failing. Chinook fisheries need to be closed now so that the species can begin to rebuild before it is too late. BC salmon are at risk of facing the same fate as the east coast cod fishery that collapsed in the early 1990's."

WORLD WILDLIFE FUND

"It has been over 15 years since the moratorium on fishing Atlantic cod in eastern Canada, but the fish stocks have not replenished. The disappearance of cod in the region is a wake up call on the effect that overfishing can have on a fish stock. WWF works with governments and the fishing industry to see that other cod stocks in the Atlantic and Pacific Oceans avoid a similar fate."

"Cod are currently at risk from overfishing in the UK, Canada and most other Atlantic countries. As fisheries have become more efficient at catching cod, populations have declined.

Continued unregulated, unreported and illegal fishing, together with liberal quotas mean the stocks do not have a chance to recover. Use of indiscriminate fishing gear which leads to cod bycatch also contributes to the problem."

"Several species of sturgeon are considered threatened with extinction as a result of over-fishing, poaching, water pollution, damming and destruction of natural watercourses and habitats.

Regulation of river flow and over-fishing are the major reasons for sturgeon population declines over the 20th century. Sturgeon are vulnerable to over-fishing because of their late sexual maturity (6-25 years). During the 1990s the total catch was dramatically increased by unprecedented illegal harvest. Poaching activity in the Volga-Caspian basin alone is estimated as 10-12 times that of legal catch. The same situation occurs on the Amur River.

Sturgeon fishing and trade in the products is a very profitable business. Compared to other fishery activities it is often viewed as "gold-mining". Illegal harvest and trade in sturgeon products is a well managed and operated business, controlled by organised crime and associated with world-wide corruption. Over-fishing and poaching has led to a significant reduction in total legal catch, in the world and especially in the main sturgeon basin – the Caspian Sea."

"Caviar is the unfertilised eggs of sturgeons. For many gourmets, caviar, dubbed 'black pearls', is a food delicacy without parallel. The three main traded species of sturgeon produce distinctive caviar: Beluga, Osietra (Russian sturgeon) and Sevruga (stellate sturgeon). The colour and size of the

caviar are influenced by the species and the stage of maturity of the roe. The most sought after and expensive caviar is from beluga, a gigantic fish that can weigh as much as 1,200 kg, measure five metres and live for 100 years. Today, Iran and Russia are the main exporters of caviar, about 80% of which is taken from three species of sturgeon in the Caspian Sea: Russian sturgeon (around 20% of the market), stellate sturgeon (28%) and Persian sturgeon (29%).

In 1998 international legal trade totalled over 220 tonnes of caviar. For the year 2002 all countries announced total export quotas for caviar to the Convention on International Trade in Endangered Species of Flora and Fauna (CITES) at a level of 193.6 tonnes. Of these Iran (39.6%), the Russian Federation (28.8%) and Kazakhstan (16%) were the largest caviar exporters with Switzerland (24%), France (19%) and Germany (17%) the biggest importers. While legal quotas may be sustainable, they need to be set recognising the high level of illegal harvest and trade. During the period 1998 and part of 1999, eight CITES Parties seized over 20 tonnes of caviar, indicating a substantial illegal trade. It is believed that a significant amount of all sturgeon caught in the Caspian Sea is traded illegally."

IMPACT ON HUMANS

The Financial Times reports, "More than half of fisheries worldwide face shrinking stocks ... leading to yearly economic losses of $50 billion." Many people rely on fisheries for income especially people from coastal fishing villages. A Stanford University study projects that wild seafood will no longer be attainable by 2048 if we continue overfishing in the same way. A collapse of wild seafood is defined as "90 percent depletion of the species' baseline abundance." The decline of seafood is only one facet of the larger picture. Depleted ecosystems can become vulnerable to "invasive species, disease outbreaks and noxious algal blooms." Without marine life inhabiting oceans it will be unable to filter out the toxins in our waste increasing the chance of disease.

Many fisherman call their job a lifestyle and the depletion of fish can greatly impact their way of life as well as villages that rely on seafood for their income and nutrition. "In many African and South Asian coastal nations, fish may account for as much as 50 per cent of protein in a typical diet."- Government of Canada. This is making these resources less accessible to these people who may be impoverished. Many people also rely on fishing for jobs. Around 200 million people are employed in the fishing industry. When Canada shut down the cod industry in the 1990's 50,000 people alone lost their jobs (Canadian Wildlife Federation).

FISHERIES AND OCEANS CANADA

"Despite having one of the most regulated fisheries in the world, Canada has not been immune to the effects of overfishing. The collapse of the Atlantic Canadian cod fishery in the 1990s is one of the most commonly cited examples in the world of overfishing and its economic, social and cultural implications. Since the collapse of the cod, and resulting cod fishing moratorium, which has been in place since 1992, other fisheries, such as lobster and shrimp, have provided alternatives for some fish harvesters,

however, many harvesters were forced to give up fishing—and a way of life passed down from generation to generation—altogether. Thousands of individuals have left the fishery for work in other trades or professions, and in many cases, other parts of the country.

Today, overfishing remains a threat to the social and economic welfare of many countries, but none more so than in developing island states. Fishing is not only an important facet of these economies, in many cases it is a central element in the traditional diet of its citizens. In many African and South Asian coastal nations, fish may account for as much as 50 per cent of protein in a typical diet. The decline of fish stocks in coastal waters as the result of overfishing and illegal fishing activities is making this important resource much less accessible for some of the world's poorest citizens."

CANADIAN WILFLIFE FEDERATION

"Around the world, more than 200 million people work in the fishing industry. More than five million people fish fulltime in Southeast Asia alone. When Canada shut down the cod fishery, 50,000 people lost their jobs. You can see how taking too many fish harms people and the economy.
Overfishing harms many wildlife species. For instance, dolphins, birds, and Steller's sea lions have declined in the North Pacific. That's because we fished too much of their favourite food — Alaskan pollock. In the same way, Falkland Islands penguins starved to death when fishermen caught too many squid.
Advanced technology allows fishermen to catch more fish. For instance, some huge trawling nets could trap 12 Boeing 747 planes.
Fish face other threats, such as having their homes destroyed by pollution, dredging, logging, and development. That's why we need to look after watery ecosystems and not overfish. Countries around the world must also cooperate on who can fish how much and where. After all, our finny friends don't carry passports!"

HOW WE CAN HELP

"Restoration of biodiversity greatly increased productivity and made ecosystems 21 percent less susceptible to environmental and human-caused fluctuations on average"- Stanford University
Through marine preserves we are able to protect parts of the ocean from overfishing which gives us the ability to help these regions to recover can occur in around three to ten years. Pollution prevention and maintaining important habitats will help us control things like coastal water quality and stabilizing ecosystems. Through supporting programs such as Ocean Wise we can be more aware about the fish that we eat to make sure they come from sustainable sources. We should push for better fishery management and regulations to prevent illegal fishing from occurring. An increase in efficient, effective, legal and regulated aquaculture could give wild fish a break from becoming overfished in their natural habitats. However, it must be clear that there must be regulations put in place for this to be effective.

FISHERIES AND OCEANS CANADA

"Aquaculture represents about a third of Canada's total fisheries value and about 20% of total seafood production. The value of aquaculture production has increased by 63% over the last ten years, to $962 million in

2013 from $591 million in 2003. In fact, Canadian production has increased four-fold since the early nineties."

CANADA'S OCEANS WEBSITE

"All these things take a toll on our ocean species and habitats. Whats more, climate change is changing ocean temperatures and acidification. This is why we urgently need smart ocean management plans that protect important ocean ecosystems- and will keep all our oceans healthy. Unfortunately just 1.6% of the worlds oceans have been declared as marine protected areas (MPAs).

These areas are important because they protect habitats such as coral reefs from destructive fishing practices, also protected areas allow the recovery of fish and other marine life that have been depleted from over fishing. While over 90% of oceans are open to fishing, people are now starting to realize something must be done in order to protect our oceans and all marine life.

But still many governments continue to subsidize their fleets, allowing unprofitable operations to subsist, and over fishing to occur. Today's worldwide fishing fleet is estimated to be up to two and a half times the capacity needed to catch what we actually need."

BIBLIOGRAPHY

"14 Life Below Water." The World Bank. http://datatopics.worldbank.org/sdgatlas/SDG-14-life-below-water.html.
- Infographics that expain industrial fishing around the world and maps with places that are overfished. It also explains how climate change is afecting oceans around the world.

"BC Chinook Salmon Runs Are in Serious Trouble." Georgia Strait Alliance. georgiastrait.org/bc-chinook-salmon-runs-serious-trouble/.
- The dire situation that BC Chinook Salmon are in and how that can affect the ecosystem around them.

"Cod." WWF. Accessed September 25, 2018. http://wwf.panda.org/knowledge_hub/endangered_species/cod/.
- Briefly describing why cod are being overfished in places like Canada and the UK as unregulated fishing is the main cause to the problem.

Fiddler, Willow. "Overfishing Is Underreported, Says a New UBC Study." Global News. January 19, 2016. https://globalnews.ca/news/2464992/overfishing-is-underreported-says-a-new-ubc-study/.
- Outlining how 30% of fishing goes underreported leading to the skewing of numbers when trying to determine how much fish is left in our oceans.

FAO United Nations. The State of World Fisheries and Aquaculture 2018: Meeting the Sustainable Development Goals. FAO, 2018.
- This document gives a broad overview of overfishing, fish consumption and the state of the environment on a global scale.

Fisheries and Oceans Canada, Communications Branch. "Aquaculture Statistics." Fisheries and Oceans Canada. January 12, 2013. http://www.dfo-mpo.gc.ca/aquaculture/sector-secteur/stats-eng.htm.
- This site explains what aquaculture is and what role it plays in Canada.

Fisheries and Oceans Canada, Communications Directorate. "Global Consequences of Overfishing." Fisheries and Oceans Canada. February 03, 2006. http://www.dfo-mpo.gc.ca/international/isu-global-eng.htm.
- Brief overview of the effects of overfishing on a global scale with a focus on Canada. They focus on environmental and socio-economic impacts.

Fisheries and Oceans Canada, Communications Directorate. "Overfishing and Food Security." Fisheries and Oceans Canada. June 08, 2012. http://www.dfo-mpo.gc.ca/international/media/bk_food-eng.htm.
- Explains the world's growing appetite for fish and the impact this may have on the fishing industry and our oceans. From the Government of Canada's perspective they outline the steps they have to take to protect our oceans even with this high demand for product.

"Global and Regional Food Consumption Patterns and Trends." World Health Organization. August 06, 2008. http://www.who.int/nutrition/topics/3_foodconsumption/en/index5.html.
- The availability of fish around the world and the demand on a global scale.

"GLOBEFISH - Analysis and Information on World Fish Trade." Food and Agriculture Organization of the United Nations. August 24, 2017. Accessed September 28, 2018. http://www.fao.org/in-action/globefish/news-events/details-news/en/c/1032635/.
- Overall statistics on projected numbers for overfishing and fish consumption around the world.

Hagen, Ryan, Matthew Statler, and K. Bradley Penuel. 2013. Encyclopedia of Crisis Management. Los Angeles, Calif: SAGE Publications, Inc. http://login.library.sheridanc.on.ca/login?url=http://search.ebscohost.com.library.sheridanc.on.ca/login.aspx?direct=true&db=e000xna&AN=592559&site=ehost-live&scope=site.
- This document has crisis management for many different problems but for overfishing they go over the issue and also has suggestions such as putting stricter regulations on fishermen.

McKie, Robin. "Bottom Trawling: How to Empty the Seas in Just 150 Years." The Guardian. February 10, 2014. Accessed September 24, 2018. https://www.theguardian.com/environment/2014/feb/10/bottom-trawling-how-to-empty-the-seas.
- Describes the dire consequences from using bottom trawling as it destroys ecosystems extremely quickly.

"OECD-FAO Agricultural Outlook 2017-2026." OECD-FAO Agricultural Outlook, 2017. doi:10.1787/agr_outlook-2017-en.
- Projected and current statistics for overfishing globally.

"Overfishing." National Geographic, April 27, 2010. www.nationalgeographic.com/environment/oceans/critical-issues-overfishing/.
- Overall summary of overfishing as a global issue and briefly explains the history of fishing as a part of human life.

"Overfishing, Damage to Coasts, and Ocean Health Indicators." Canadian Wildlife Federation: Green Sweat Bee. Accessed September 26, 2018. http://cwf-fcf.org/en/resources/for-educators/resource-sheets/overfishing-damage-to.html.
- Specifically targets how coastlines are being affected by human activity and how that also effects the fish population.

"Overfishing." WWF, World Wildlife Fund. www.worldwildlife.org/threats/overfishing.
- Brief overview of multiple statistcs and overfishing in general.

Ritchie, Hannah, and Max Roser. "Meat and Seafood Production & Consumption." Our World in Data. August 2017. https://ourworldindata.org/meat-and-seafood-production-consumption#wild-fishery-and-aquaculture-production.
- Statistics on fish cosumption over time and breaks down fishing overall into seperate factions.

Robinson, Joseph. "The Effects of Overfishing" Canada's Oceans Website. www.chone.ca/the-effects-of-over-fishing/.
- Talks about the general effects of overfishing but specfically talks about bycatch and how often times fishermen accidentally kill species that they do not mean to take such as marine turtles and endangered species. Also outlines the importance of marine protected areas.

"Science Study Predicts Collapse of All Seafood Fisheries by 2050." Lack of Brain Protein Causes

Sleeping Disorder Narcolepsy in Humans: 9/2000. November 02, 2006. https://news.stanford.edu/news/2006/november8/ocean-110806.html.
- This article explains how the fishing industry is projected to collapse in the next 30 years. They go over the steps we must take to prevent that an that we still have a chance to save our oceans.

SeaWeb. "Bottom Trawling Impacts On Ocean, Clearly Visible From Space." ScienceDaily. www.sciencedaily.com/releases/2008/02/080215121207.htm (accessed October 1, 2018).
- This article goes into depth the damage and trauma that occurs when bottom trawling is used to uptake fish. They describe that the sediment that is brought up from this process remains cloudy for much longer than people originally anticipated and is only known now because of technology such as google maps.

"Sturgeon." WWF. Accessed September 28, 2018. http://wwf.panda.org/knowledge_hub/endangered_species/sturgeon/.
- Outlines how sturgeon are now an endangered species as they are highly coveted for caviar and are illegally fished often.

Zhexembayeva, Nadya. "Overfished Ocean Strategy: Five Principles That Make It Work." Overfished Ocean Strategy: Powering Up Innovation for a Resource-Deprived World, 2014, 24-41. Accessed September 24, 2018. doi:10.5848/bk.978-1-60994-965-5_3.
- Zhexembayeva mainly focuses on the impact overfishing has and will have on humans. She also explains that fishermen must work much harder than in the past for the same amount of fish as the abundance simply is not around anymore.