

IB Extended Essay

Research Question: To what extent do the impacts of commercial fishing on Pelagic fishes in the Ocean compare to the potential benefits of commercial fishing for human society?

IB Subject: Environmental Systems and Societies

Personal Code: ftr749

Session: May 2017

Essay Words: 3405

Abstract Words: 185

Abstract:

This essay explores the question, to what extent do the impacts of commercial fishing on Pelagic fishes in the ocean compare to the potential benefits of commercial fishing for human society? The investigation was completed using various sources from multiple perspectives, from blogs to environmental scientific journals. The sources used were intended to give a holistic, academic picture of the commercial fishing industry. Views of environmentalists, researchers, and commercial fishermen were considered. The investigation analyzed differing forms of data from studies already conducted. This data was evaluated to draw clear conclusions. It was found that Pelagic fish stocks have steadily decreased over time and are negatively impacted by commercial fishing. Based on the data the commercial fishing depletion seem to outweigh the potential benefits to human society. Pelagic fish populations are being reduced by commercial fishing practices due to bycatch and accidental kills. Pelagic species are some of the most fished species, and it was found that they are being pushed to the ecological limit. The oceans may be gravely affected due to extensively low pelagic fish populations and the constant pressure of commercial fishing.

Table of Contents

I.	Introduction	pg 4
II.	Historical Context and Modernization of Fishing	pg 4-7
III.	Oceanic Pelagic and Costal Pelagic Species Data	pg 7-8
IV.	Trophic Levels and Falsification of Data	pg 8-10
V.	Impacts: Depletion and Animal Cruelty and Waste	pg 10-11
VI.	Benefits: Economic Growth and Recreational Fishing	pg 11-12
VII.	Possible Solutions and Current Policies	pg 13-14
VIII.	Conclusions	pg 14-15
IX.	Works Cited	pg 15-18

I. Introduction

Throughout history fishing has been a necessary part of life for humans. People used fish as forms of various natural resources such as food and tools. Often, ocean fishing allowed societies to survive when the environment was harsh or food sources were low. Mass commercial fishing started after World War II when the Japanese created large mechanized fishing vessels to increase production of fish (Pepperell, 31). Culture plays a large role in the ways fish and fishing are viewed and treated across the world. As human population increases, the relationship between the benefits for humans and potential harm for pelagic species must be examined.

Pelagic fishes are ones that that tend to live away from shore and also away from the bottom of the ocean. They live in both the vertical and horizontal middle of bodies of water and can be saltwater or freshwater (Pepperell, 3). This essay will focus on saltwater species because they are more widely fished. Pelagic species are highly targeted because they are easy to catch and are usually larger than other fish. There is a great demand for these fish due to taste and availability. Pelagic fishes are being pushed to the biological limit for the uses of humans (Overfishing). To what extent do the impacts of commercial fishing on Pelagic fishes in the ocean compare to the potential benefits of commercial fishing for human society?

II. Historical Context and Modernization of Fishing

Commercial fishing is defined as the “occupation of catching, processing and selling fish and other aquatic animals” (Commercial Fishing). Fishing has been around since ancient times mainly to provide food and materials for tools. Nets, hooks and spears have been used for hundreds of years to

make fishing easier. Boats were used to find and catch the Pelagic fishes (Pepperell, 26). Other more advanced methods were also used such as setting nets in specific areas of Bluefin Tuna migration patterns (Pepperell, 25). The Bluefin would swim into the nets and become trapped. The fishermen would collect the trapped fish (Pepperell, 25). As time went on, methods improved but the ideas were the same. Human ingenuity developed technological advances to ensure survival of humankind.

Ancient fisherman had very different views of fish than we do today. Fish evoked stories as well as legends and were praised by humans. In early Hawaiian culture, catching a large tuna was seen as a feat (Pepperell,27). There are records of billfish attacking large commercial ships as early as 1625 (Pepperell, 28). In early history, billfish were drawn with exaggerated features and were almost seen as mythical (Pepperell, 28). Early fishing methods and views allowed for fishermen to have respect for the fish and limited the catch size.

Mass commercial fishing started after World War II. The industry started to boom after World War II because technology had increased and mechanized vessels were used to harvest saltwater Pelagic fishes (Pepperell,31). Fish supplies seemed endless during this time because of the vast numbers caught by the mechanized vessels. Since then the commercial fishing industry has grown as have the population of cultures that depend on fish as a major food source. Most cultures worldwide depend on fish in some way. Modernization of fishing has caused stress on the fish stocks themselves as well as on the ocean ecology. New processes of fishing are being used now to meet the large demand of food for our increasing population. Longline fleets are groups of vessels that use long metal cables (50km) with branches of baited hooks to target specific species of Pelagic fishes (Pepperell,31). These fleets can catch thousands of fish in a very short amount of time. Purse Seining is another modern fishing method where a large net is used to scoop up a large group of fish. (Pepperell, 31). These fish are then processed and stored in a large freezer. The ships that hold the fish can be as large as 500 feet long and weigh as much as 4000 tons (McGoodwin,101) . These ships can also haul 500 tons of fish with the capability of

processing 250 tons a day (McGoodwin,101). FAD's (Fish Aggregating Device's) are machines that aggregate and draw fish in the middle of the ocean (Webster,90). Modern fishing practices are complex and effective in harvesting fish populations. Modernization is the main cause of why a greater number of fish are being caught each year.

Modern cultures tend to have different views of the fishing industry. America's fishing industry is sizable but the public view of it is relatively negative due to its effect on the oceans. Americans tend to blame the commercial fishermen, because American fisheries have workers that are uneducated in the true result of what they are doing (Arguments for and against the Common Fisheries Policy).

Mechanized societies rely on commercial fisheries for food and to boost the economy. Small fishing practices are about 90% of all fisheries but only account for 50% of the global landings (Kittinger,135). Small fishing industries are the only sustainable fisheries because they must control the fish population to ensure survival (Pauly, 105). Small scale practices are now being sharked by commercial industries. For example, commercial industries invading costal African waters in search for fish and are taking fish that belong to the people of Africa (McGoodwin,11). Fish populations are being diminished and therefore developing countries with small scale fishing practices are resorting to extreme methods to feed their people. Dynamite fishing is a result of commercial fisheries taking fish from poor countries (McGoodwin, 19). Dynamite fishing is using dynamite to blow up parts of the coral reef. The explosion concusses the fish and then they are harvested. Larger more powerful fisheries are not often convicted of illegal fishing practices because they have immense economic power (Webster, 242). American culture views fishermen as hurting the environment while developing countries rely on fishermen to feed the people. Because of the lack of law enforcement, large scale fisheries also fish in waters outside their own. As a result of this small-scale fishing practices cannot fish sustainably and resort to extreme measures to feed the country's population. Cultures and different fisheries look at

fishing differently. Historical context can show how fisheries and views of fisheries have changed due to modernization of practices.

III. Oceanic Pelagic and Costal Pelagic Species Data

Various oceanic Pelagic species are “targeted” by fishing but thousands of other fish are caught through bycatch (Wild Seafood). Tunas and Cod are the pelagic fishes most commonly fished. Cod are large fish that tend to live in colder waters. Cod and Pollock have a white flakey meat and are used in most fish sandwiches (Our Food, Your Questions | McDonald's). Tunas are large, fast pelagic fishes living in both oceans. They are sought after because of their delicious flesh. Larger Tunas such as the Bluefin are close to extinction due to overfishing. Six hundred thousand tons of Tuna and Billfish were harvested in 1950 (Pepperell,31). In 2007 that number increased to 6.2 million tons (Pepperell,31). Larger fish such as billfish and Bluefin take longer to spawn and they are often caught before they are able to spawn. If they were able to reproduce instead of being caught while they are juveniles, fish stocks could rise.

Bycatch is fish accidentally caught when targeting another species (Pepperell, 32). Bycatch catches not just fish but other types of marine life such as turtles and mammals. Many sharks are threatened or endangered mainly due to bycatch. About 80,000 to 100,000 sharks were caught per year in 1991-1999 (Pepperell, 32). Over 87% of the sharks caught are still alive when caught and are seen as a bonus to the fishermen or they are thrown back due to regulations (Pepperell, 32). About 15% of all shark species are threatened by extinction due to bycatch (Wild Seafood). The sharks are finned and thrown back into the ocean to drown or bleed to death. Bycatch can corrupt the ecology of the ecosystem. This is due to all different types of fish and animals being caught unintentionally including keystone species, or species that are important to the ecosystem. Keystone species can be nearly wiped out due to bycatch.

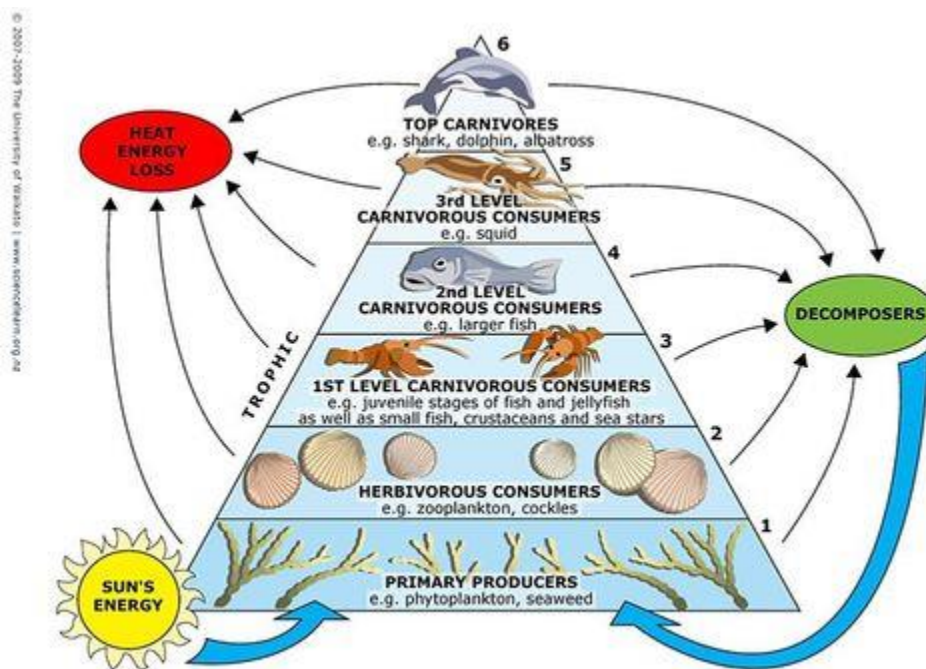
Menhaden, a coastal Pelagic species, is the most fished species in the entire world with a total of 0.5 billion tons taken every year by fishermen (Greenberg). Menhaden eat a specific type of algae that is very high in omega-3's. They are relatively small fish and have many predators due to their high amount of omega-3's. Humans are their main predator because they consume the fish oil from Menhaden that contains omega-3's. This nutrient is heart healthy and helps with diseases such as asthma, arthritis and ADHD (Omega-3 Fatty Acids Facts). Menhaden are also used in fish meal because they are easily processed. The fish are used in cat foods, dog foods, lipstick, salmon feed, paint, buttery spread, salad dressing and vitamins (Greenberg). Due to the exploitation of this species more of the algae is growing. When the algae dies a bacteria breaks down the dead algae, and the bacteria uses oxygen found in the water. This creates areas of low oxygen (dead zones) where marine life can't live due to low oxygen. Menhaden is primarily caught in cold waters and bans are in place to slow the exploitation of the species. Two states are still fishing the species heavily and they are North Carolina and Virginia (Greenberg). Most states have stopped fishing Menhaden due to the decreasing numbers of the species but it is still being heavily fished by the rest of the world.

IV. Trophic Levels and Falsification of Data

"Fishing down the food web" (Pauly, 31) is an analogy of how humans are fishing the ocean. Trophic levels are levels in which a species is classified by productivity and how it fits on the food web. Energy is transferred between trophic levels but only 10% is transferred, this is due to the 2nd Law of Thermodynamics (Wilkin). Primary producers create their own energy from the sun and they include most plants. Primary producers obtain 100% of the energy from the sun. Consumers are organisms that consume other organisms to get energy. Consumers are divided into three main categories. Primary consumers eat primary producers and are mainly herbivores. Primary consumers only get about 10% of the energy from the producer (Wilkin). There is a large loss in energy from the first to the second trophic

level (Palomera). Most of the energy is lost by the producer through waste and normal activities. Secondary consumers eat the primary consumers and are mainly carnivores or omnivores and because only 10% is transferred meaning they get 1% of the energy from the producers (Wilkin). Tertiary consumers are usually carnivores and eat the secondary consumers, again only 10% of the energy is transferred to the tertiary consumer. Quaternary consumers are at the top of the food web eating the tertiary consumers. Most Pelagic species are tertiary or quaternary because they eat fish or squid that eat algae or smaller fish. Commercial fisheries tend to target these higher-level predators because they are larger and can be easier to catch. The problem is that the higher-level predators require a lot of energy to produce.

Figure 1 Marine Trophic Pyramid



(Marine Trophic Pyramid)

If commercial fisheries targeted a species in one lower trophic level, then yield would be 8.3 times higher (Pauly, 32). A problem with this is that consumers demand fish from the higher trophic

levels. Trophic levels are complex and oceanic species can change trophic levels due to season. This is called taxonomic resolution and can complicate the situation of fishing down or up the food web because of energy transfer differences between seasons (Pauly, 49). Commercial fisheries will have to start moving down trophic levels because of the overexploitation of tertiary and quaternary consumers (Pauly, 50). The species in the higher trophic levels are some of the most important because it keeps other populations steady. Jellyfish are low in trophic levels and some believe that humans might have to start eating them (Pauly, 59).

Data reliability is another issue that can sway the perceptions of the health of fish stocks. Recently China fabricated data to make fish stocks seem healthier than they actually are (Pauly, 63). China has reported that various harvested stocks have an increasing rate while in reality the stocks have been decreasing. China reported that 4 million tons were caught in the 1980's and that 15 million tons were caught in 1999 (Pauly, 63). Actually, the fish stocks in China's fishing grounds have decreased by more than 10% from 1988 to 1998 (Pauly, 63). When confronted, China didn't admit to fabricating the data and denied all accusations. This is important because other countries could potentially be doing the same thing to limit regulations on fishing due to low stocks. Countries creating false data could be detrimental to solving the issues of overexploitation of pelagic species. Transparency of data collection fosters a practical approach to fishery management.

V. Impacts: Depletion, Animal Cruelty and Waste

The impacts of overfishing are extensive. The data points to the main problem being that too many fish are being caught and processed too fast. The populations don't have time to recover and become healthy due to constant pressure from fishing. Some stocks don't have the ability to recover due to such low numbers or constant fishing. The highest yield of fish ever was in 1989 at 90 million tons and since then lower numbers of yield are being reported (Overfishing -- Pristine Seas -- National

Geographic). However, some species do recover with help from governmental policies. About 12% of 232 strongly depleted fish stocks fully recover in 15 years (Kittinger, 27). It takes time to replenish species that have a long maturity time and a small population. A prime example of this is the Porbeagle Shark which has an estimated recovery time of 70-100 years (Kittinger, 27). Sharks are often looked as a marker species of the health of the ocean and currently they are suffering. Shark populations are down 96% to 99% in the last 50-200 years (Kittinger, 14). Bycatch of sharks and billfish is endangering many different pelagic keystone species.

Cruelty of fishing is often not considered; however, fish feel pain just like any other animal species on the earth. Fish on longlines are hooked and left there for hours or days. The fish struggle to get away but the hooks rip their flesh while the fish often doesn't escape. Fish are usually dead when brought up to be processed but it is a slow painful death. If the fish are not dead when they reach the boat they are killed or left to die due to asphyxiation. Turtles and other air breathing animals such as birds are also caught and drown after being unable to reach the surface. Some turtles are saved but often die due to the imbedded hooks or are killed on the fishing boats.

Shark fins are the main reason for catching sharks due to the popular dish, shark fin soup. Sharks are caught like other fish but they are often alive when they reach the boat. Fishermen then cut the fins of the sharks and throw them back into the ocean. Sharks rely on fins for movement and to pass water over their gills to allow them to breathe. Without the fins, they sink to the bottom and drown.

VI. Benefits: Economic Growth and Recreational Fishing

Positives of commercial fishing also need to be considered to truly understand the situation. Commercial fishing allows for smaller countries to have a food source and it can potentially be done sustainably. Some fish stocks even seem to be rebounding (Tide Turning in Fight Against Overfishing).

This fishing may not be for a profit but for the survival of a country. Fishing allows for a cheap and easy way to feed the population (McGoodwin, 20). Fish stocks are replenishable, and if managed correctly they can last for years.

In almost all nations the commercial fishing allows for economic stability or growth (List of 12 Big Pros and Cons of Overfishing). Commercial fishing stimulates the economy of poorer countries. The commercial fishing industry is worldwide and trade can allow for the betterment of developing civilizations. Larger countries rely on fishing to employ workers and to help feed the massive populations. About 3.5 billion people depend on fish for a dependable food source (List of 12 Big Pros and Cons of Overfishing). Eating fish is often a cultural tradition and can bring happiness to people. Cultures centered around fish use them to bring people together. Mobile applications are now being created to help people understand where their fish come from. These applications such as “Seafood Watch” allow users to find the best and most “Ocean Friendly” option to eat (Kittinger, 260). Applications like this can help consumers understand what they are eating and if it impacts the environment. Most of the positives are human-centered.

Recreational fishing is a new industry that seems to be benefiting both humans and fish. Game fishing seems to have little impact of fish stocks because only small amounts of fish are being harvested and catch and release fishing is more common. Game fishing is often conducted in underdeveloped countries and can influence economic growth. Recreational fishing is now conservation oriented, meaning that many big game saltwater pelagic species such as Blue Marlin are electronically tagged and released producing scientific information (Pepperell, 32). Recreational and commercial fishing practices are beneficial to human survival.

VII. Current Policies and Possible Solutions

NOAA (National Oceanic and Atmospheric Administration) has created a policy to help stop conflicts for fishing territory and stop illegal fishing. The policy implements catch shares which are shares of a specific stock of fish (NOAA Policy Encourages Catch Shares to End Overfishing and Rebuild Fisheries). A stock is split up fairly between countries and is intended to limit exploitation while allowing countries to harvest. Over 14 fisheries have applied this policy and it is managed by 6 councils (NOAA Policy Encourages Catch Shares to End Overfishing and Rebuild Fisheries). Communication between fishermen of different countries has allowed for a holistic understanding of a particular fish stock (NOAA Policy Encourages Catch Shares to End Overfishing and Rebuild Fisheries). This policy is new and so far, has been a huge success.

MPA's (Marine Protected Areas) are becoming a possible solution to overfishing of many pelagic specie (Kittinger,140). A Marine Protected area is an area where fishing is illegal to help the species found in the area regrow its population. They are specific to certain areas where species breed and live in. MPA's are found around reefs due to their high amounts of biodiversity and diminishing species and coral (Kittinger, 141). One of the problems with MPA's is that it is difficult to enforce law around an invisible barrier. MPA's need enforcement to ensure success but they seem to be helping with increasing the populations of depleted species'.

More MPA's are needed to allow fish populations to grow (Kittinger, 141). Illegal fishing can be regulated and enforced with new policies (Overfishing -- Pristine Seas -- National Geographic). Fish can be caught in cycles and allowed to grow and spawn before being killed for food (McGoodwin, 116). Recreational fishing should be monitored and used primarily with scientists to allow for accurate data. The fishing industry is not just overseen by the government, there are organizations such as SeaWeb

who hold conferences to help decide the direction of the sustainable fishing industry (SeaWeb - Related Writings).

VIII. Conclusion

Based on the data above, the negatives of overfishing and the data behind it make a strong case that there is a problem that needs to be fixed. Fish stocks are falling and species are nearly going extinct. There are few positives of commercial fishing and saving the oceans should outweigh them. Humans need to understand that measures must be taken. Our own selfish benefits should not dictate the health of many species as well as the health of our oceans. The state of our oceans can have an impact on humans and could cause a major food crisis if stocks become too low. Now is the time to look at overfishing and make a change before the population decrease of Pelagic species cannot be reversed.

All of this data seems to be accurate because various sources are exhibiting similar numbers and seeing the same problems. It is hard to be sure about the nature of the numbers because of the complexity of the oceans as well as the reports from commercial fishing. Most of the data acquired is from scholarly articles and scientific journals. The data is from scientists that genuinely want to study the problem at hand. Few people argue for more commercial fishing.

Not all aspects of commercial fishing are examined in this analysis due to the complexity of the operations. This essay doesn't look at all fish stock but focuses on pelagic stocks and how they are decreasing. It is difficult to incorporate all aspects of fishing because the ocean is vast and the data is always changing. Many countries are examined as well. The essay focuses on main aspects of commercial fishing but there are many more to consider. Therefore, there are limitations to the scope of this essay. The essay addresses the specific problem of fishing pelagic species, but the ocean faces

many other potential challenges. There are many other issues to examine to create a holistic view of the health of the oceans.

IX. Works Cited

"Arguments for and against the Common Fisheries Policy - Debating Europe." *Debating Europe*. N.p., 19 Apr. 2012. Web. 13 Aug. 2016

This is an article that produces both sides of the common fisheries policy. A policy that allows the government to control fisheries policy's. The article is a debate about whether or not the CFP is helping or hurting with overfishing. A public voice is what is created because it has two points of view of the same article. In the article stats and facts are used to support both sides of the argument. It is really helpful in that it produces a counterargument to overfishing and a policy to help stop it. The article is relatively credible in the use of facts and stats. All the claims are supported.

"Commercial Fishing." The Free Dictionary. Farlex, n.d. Web. 11 Sept. 2016.

This was used for the definition of commercial fishing.

Greenberg, Paul. "A Fish Oil Story." *The New York Times*. The New York Times, 15 Dec. 2009. Web. 12 Aug. 2016.

This is an editorial that has opinions of the harvesting of Menhaden. However, it has some facts about the overexploitation of Menhaden. It creates a reasoned argument about changes that need to be made to save an important species found off the coast of the Atlantic states. Most of the article is explain how Menhaden is being used in Omega-3 vitamins. Some of the article also deals with the policies that are trying to save the fish. There is bias found in the article but it is supported by facts. The source is credible because it is from the New York Times.

Kittinger, John Nils, Loren McClenachan, Keryn B. Gedan, and Louise K. Blight. *Marine Historical Ecology in Conservation: Applying the past to Manage for the Future*. N.p.: n.p., n.d. Print

This is a book about the history of fishing and how past trends can be used to predict the future of the fishing industry. The book is really specific in that all it really talks about is the history and how it can be used. Information from the book can be used to create possible solutions to the problem of overfishing. The resource is credible because various other sources from Marine Biologists were used for facts and to make points. Almost all of the arguments are backed by facts and statistics.

"List of 12 Big Pros and Cons of Overfishing." ConnectUS. N.p., 09 Aug. 2015. Web. 13 Aug. 2016

This is a source that tells very broad pros and cons of overfishing. It uses statistics to prove the pros and cons. The article is not really useful because it has some credibility issues. It is from a blog site meaning it could be biased and not helpful. The only reason this will be used is to get an overview of the public's view of the pros and cons of overfishing.

"Marine Trophic Pyramid." *Science Learning Hub RSS*. N.p., n.d. Web. 28 Oct. 2016

Used for trophic pyramid image. Figure 1

McGoodwin, James R. *Crisis in the World's Fisheries: People, Problems, and Policies*. Stanford, CA: Stanford UP, 1990. Print.

This book had three main parts contemporary fisheries, fisheries management and future fisheries management. The contemporary fisheries talked about commercial as well as small scale fisheries. It also explained the culture of various fisheries. The fisheries management section focused on what is currently being done as well as what could be done. Lastly, future fisheries explained possible strategies and fixes to problems. The book is credible due to the various other sources referenced as well as the numerous facts used to support claims.

"NOAA Policy Encourages Catch Shares to End Overfishing and Rebuild Fisheries." *NOAA*. N.p., n.d. Web. 17 Aug. 2016.

This is an article about a policy implemented by NOAA. The catch share policy is one that has been working for 14 stocks and is implemented by 6 management system. The article goes into detail about catch share policies. It was published by NOAA and the policy is by NOAA so all the facts are there. Credibility is no issue because NOAA is a highly acclaimed association about ocean and atmospheric problems.

"Omega-3 Fatty Acids Facts." *WebMD*. WebMD, n.d. Web. 02 Jan. 2017.

Used for further information on Omega-3 fatty acids.

"Our Food, Your Questions | McDonald's." *Our Food, Your Questions | McDonald's*. N.p., n.d. Web. 29 Oct. 2016

Used for fish sandwich fact.

"Overfishing." *WorldWildlife.org*. World Wildlife Fund, n.d. Web. 17 Aug. 2016.

This is an article by an organization who is a leading contributor to help global environmental problems. In the source specific species are studied. This is monumentally helpful because it gives the species that are in the most trouble and how they got to that point. Some suggestions of what to do and what are being done by WWF are also found in the article. There seem to be little problems with credibility because all the claims are provided with facts. The facts are all true and match up with other sources. Surprisingly there is little bias all the points are concrete and true. This will be a great source to use.

"Overfishing -- Pristine Seas -- National Geographic." National Geographic. N.p., n.d. Web. 10 Aug. 2016

This is a national geographic article about the general facts of overfishing. This source is helpful in that it tells me the predicted year that fish stock's will collapse. It also gives a brief explanation of fishing down the food web. The last important info this article has is the proposal of aggressive tactics to prevent overfishing of certain species. The article is credible because it holds facts not opinions and it is produced by a credible environmental source.

Palomera, Isobel, Marta Coll, Simone Libralato, Sergi Tudela, and Fabio Pranovi. "Ecosystem Overfishing in the Ocean." PLOS ONE. N.p., n.d. Web. 12 Aug. 2016

This is an academic journal based on a formula on how to calculate how a marine system is functioning. The formula actually finds the second productivity of a marine ecosystem which can be used to find out how well the ecosystem is doing. This number can then be used again to find the probability that the ecosystem will survive. A lot of figures are used to show this and are helpful to my research. This source is credible because it is from a scientific website and the numbers are from the national catch numbers. This is a really great source for visuals.

Pauly, Daniel. *5 Easy Pieces: How Fishing Impacts Marine Ecosystems*. Washington, DC: Island, 2010. Print

This source is about the five aspects that fishing has on a marine ecosystem. The first is about production of energy and how it is transferred between trophic levels. The second is how fishermen are fishing down the food web and further destroying the ecosystem. Third, talks about the lies and deception of various cultures when confronted with the issue of overfishing. Four and five talk about sustainability in fisheries and the future of fisheries. This source helped me understand all the different impacts a fishery can have on an ecosystem. This is a credible source because it is produced by Island Press. Island Press is a company devoted to exposing environmental issues to the public using facts and reason to prove their points. The book has little bias because facts are mainly used to prove points.

Pepperell, Julian G., and Guy Harvey. *Fishes of the Open Ocean: A Natural History & Illustrated Guide*. Chicago: U of Chicago, 2010. Print.

This is a book written by an esteemed Marine Biologist and Oceanographer. Guy Harvey is one of the most influential and popular Marine Biologists. He has written various books on species of fish as well as conducted research along with other scientists. This source is beneficial to my research because it holds information and statistics of the history of overfishing. It also helps me understand the most important species in the Pelagic ecosystem as well as the most overfished species. There seems to be little bias in the book and it is filled with facts about different species and overfishing. Overall this is a great resource for statistics of overfishing and the history of fishing.

"SeaWeb - Related Writings." SeaWeb - Related Writings. N.p., n.d. Web. 10 Aug. 2016.

This is an article by Sea Web which is an association devoted to having and protecting a healthy ocean. This helped my research because the source focused on the effects of overfishing on the different types of diversity. Them being species and genetic diversity. The article is credible because it was written on behalf of a sea orientated organization. It also talks about a conference that is for sustainable sea food.

"Tide Turning in Fight Against Overfishing." CBSNews. CBS Interactive, n.d. Web. 13 Aug. 2016.

This is a news article stating that some fish stocks are rebounding and efforts to stop overfishing seem to be working. The article goes against my paper in that not enough is being done to save fisheries. Many quotes from Marine Biologists are used for credibility and to prove various points. Only some statistics are used. The article seems to be very bias but it is a good counterargument for overfishing. It seems to be relatively credible.

Webster, D. G. *Beyond the Tragedy in Global Fisheries*. N.p.: n.p., n.d. Print.

This book is a lot like the others but it had some new information. New statistics as well as new ideals that are interesting ways to look at the problem. Unfortunately, this book only briefly helped with the research. The book is bias but most of the claims are supported well with facts making it relatively credible.

"Wild Seafood." *Effects of Bycatch from Fishing for from the Seafood Watch Program at the Monterey Bay Aquarium*. N.p., n.d. Web. 18 Aug. 2016

This is an article on bycatch and the impacts of it. Bycatch is catching fish that are not the target species. It is one of the main stressors on fish stocks because many fish are caught accidentally and can't be released. Bycatch is the main reason sharks are going extinct. This article is helpful in that it gives information and stats on bycatch. The article is credible because facts are mostly used to support claims. There also seems to be little bias but instead just facts.

Wilkin, Ph.D. Douglas, and Ph.D. Jean Brainard. "Trophic Levels." *CK-12 Foundation*. CK-12 Foundation, 29 Aug. 2016. Web. 29 Oct. 2016.

Used for help with trophic levels.