

Xinyao Ye
MSWI-270C
Professor Jensen
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The Effects of Overfishing

"The last fallen mahogany would lie perceptibly on the landscape, and the last black rhino would be obvious in its loneliness, but a marine species may disappear beneath the waves unobserved and the sea will seem to roll on the same as always. (1)" There is a long history to the fishery industry. On account of the long history of this industry, people seemed to believe that marine resources are unlimited so that they catch fish or marine resources without control. However, with the rapid development of electronic, chemical and shipbuilding technology, modern fishing methods enable fishermen to catch more and more fish in a short time, all of which finally lead to one of the serious environmental issues today: overfishing. Even though no marine species are known to be extinct solely due to fishing, the Atlantic gray whale was hunted to extinction and many other marine species are endangered mainly because of overexploitation(1). According to my research, the ecological extinction caused by overfishing precedes many other anthropogenic activities which influence the coastal ecosystem, such as pollution, degradation of water quality, and anthropogenic climate change(4).

My project is going to focus on overfishing and to see how this kind of anthropogenic activity could influence our ecosystem and even influence human life. Specifically, I will look at the history and the current condition of the overfishing issue. Through research on the background of overfishing issue, I wish to point out what the reasons of overfishing are and how this issue can impact our environments in different aspects, such as its influence on specific species, biodiversity, marine ecosystem, and climate change.

Overfishing occurs when fishermen catch fish at a faster rate than fish can replace their population by reproduction, all of which will finally lead to the decline of fish stocks in the world and even cause the extinction of specific marine species(1). Based on my research, the decrease or extinction of any kind of marine species will cause the decline of marine biodiversity, and then influence the balance of the food web of the ecosystem(3). Nowadays, even though more and more people realize the limitation of natural resources, the issues of overexploitation, overhunting, and overfishing still exist and even get worse since many people do not have the concept of how terrible the effects of overuse of the natural resources are. The overexploitation of natural resources will not only influence the environment, but also seriously influence human life and the economy at the same time.

According to the research about the overfishing issue, it is not a new problem. Truly commercial whaling likely began in western Europe around the eleventh century when Basque fishermen began to hunt North Atlantic right whales in the Bay of Biscay(9). In Japan, that kind of whaling even started at least in the seventh century(3). Before we had advanced industrial technology, the natural resources could be overexploited. In the nineteenth century, humans sought blubber for lamp oil and killed a large number of whales, which caused irreparable harm to the whale population(2). At that time, fishermen were still dependent on hand-thrown harpoons, sail, and the strength of a man's rowing arm. Although they did not have many efficient inventions at that time period, at the end of the nineteenth

century, some populations of the slower whales, such as sperm whales, humpbacks, grays, rights, and bowheads had already reduced drastically(9). Meanwhile, there are also some fish that we eat such as Atlantic cod and herring and California's sardines which were harvested to the edge of extinction by the mid-1900s. By 1989, "when about 90 million tons(metric tons) of catch were taken from the ocean, the industry had hit its high-water mark, and yields have declined or stagnated ever since(2)". Many popular species such as orange roughy, Chilean sea bass, and bluefin tuna have collapsed.

The history of overexploitation of whales illustrates how fishery developed into larger scale and shows us the vicious circle of this industry. Tracing back through history, without industrial technology, harvesting could cause species which are easy to catch to become endangered or even extinct. In the 12th century, Basque whalers were active and they preferred to catch the northern right whale since this kind of whale moves slowly and does not sink when killed(3). As time went by, after they almost hunted all the right whales near their habitats, they moved to farther sea areas. These whalers had more advanced technology at shipbuilding and they had more effective method to catch whales. These whalers not only killed the right whales, but also these whales' relatives, all of which finally caused the collapse of the whale population in the world(3). Fishermen usually start by catching the most vulnerable and close species and then the fisheries of new population or species would be developed because of the local declines. The decline or disappearance of one or two species in the marine ecosystem would then cause some relative species' proliferation or drastic decrease. This kind of change would break the balance of the whole food web and impedes the flow of energy.

With the support of modern technology, this industry could catch far more fish from with more effective methods. First, "the steam engine suddenly gave whalers the power they needed to chase and catch even the fastest whales(9)". At the same time, the introduction of the explosive harpoon—developed by the Norwegian Svend Føyn—provided a means to much more efficiently kill whales. Therefore, the effects that are caused by overfishing become more and more obvious and serious. Besides the decline of species' population, the size and habits of some species also changed for adapting the extremely fast speed of human exploitation. To recover the fast loss of population, some species have to make some evolutionary change such as, speed up their reproduction and shorten their growth cycle, which would cause the overall size of the species to get smaller and these species would get mature in a shorter time(1). To achieve such great change, the overall quality and life span of the fish species would become lower and shorter. This change usually not only changes the fishes' size but also makes the issue of overfishing become more terrible since fisherman need to catch more fish to reach their goals. The decline in fishes' body size has occurred in the intensively exploited stocks of Atlantic cod, *Gadus morhua*, off Newfoundland and Labrador, Canada. According to the research, in the last century, the size of cod measured 5 foot 5 inches(165.2cm) and weight 60 pounds(27.22kg). By contrast, the average size for the oldest age class(17 years) captured in 2005 was 97.10cm and 8.43 kg. This great change shows the 41% reduction in length and a 69% reduction in weight(6), which vividly show the effects caused by overfishing. This kind of consequence would not only influence the fish species itself but also influence the fishery economy greatly.

There are many people who live in coastal communities and rely on the fishery as their way of life. Hence, the collapse of specific fish species that caused by overfishing will impact these people's economy system greatly. The tragedy of Canadian cod is one of the examples of how overfishing influence people's economy and life directly. "On July 2, 1992, the Canadian Minister of Fisheries and Oceans John Crosbie announced that the cod fishery of Newfoundland and Labrador was finished(3)". This 500-year-old fishery is the economic backbone of the Province of Newfoundland and Labrador. Even before Columbus came to America, Basque fishermen sailed to the Grand Banks to fish for cod while cod was the reason for the settlement of Newfoundland. After 500 years' fishing, the numbers of cod was reduced from millions of tons to a small remnant of tens of thousands of tons. The collapse of cod leads to serious social upheaval. It suddenly makes 20,000 people out of work. The Newfoundland's economy nosedived and Canadian taxpayers paid over \$1 billion CAD per year in support payment to offset the loss(3). The heavy price of overfishing in Newfoundland gave people a class about the economic effects caused by overfishing and the significance of building well-managed fishery.

Overfishing will also cause a great effect on the overall ecosystem and even influence our climate. The change of any species in the ecosystem may also cause the cascading effect which would even change the structure of food web and energy flow then finally influence human's life(9). To be specific, fishing played a significant role in the collapse of Caribbean coral reef ecosystems. The decline of herbivorous fish left sea urchins as the only grazer to control microalgae. "When a disease affected the sea urchins during the early 1980s, brown fleshy algae rapidly encrusted the reefs, replacing the corals and inducing the radical change of the ecosystem at all levels(8)". This change would bring about the issue called eutrophication(4). Eutrophication leads to the growth of algae on the surface of coral reefs. Overfishing has reduced fish population while the reefs are heavily dependent on fish to remove algae. An increase in the number of algae could change the status of the microbial population on the coral, all of which would influence the health of the coral. Besides, when coral build reefs, corals will absorb a large amount of carbon dioxide which reduce the greenhouse effect of the earth. Therefore, the collapse of reefs is not only the decrease of a specific kind of plant but also an important factor that would cause climate change and further influence human communities and life(4).

It is time that humans really need to take some actions on the overfishing issue. A study of catch data published in 2006 in the Journal of Science grimly predicted that if fishing rates continue apace, all the world's fisheries will have collapsed by the year 2048(2). Dealing with the overfishing issue does not means stop or greatly reduce the fishing industry. Humans could change the ways of management appropriately to better regulate the fishery(5). There are many marine protected areas which aim to protect the biodiversity, however, the illegal fishing activities really reduce the effectiveness of that the protection(7). Hence, the government needs to strengthen the management of these parts while illegal fishing activities are always aimed at some precious fish species. Besides, the ways of fishing also need to be improved since fishery is always aimed at the most easy-to-catch and close species, which would cause the imbalance of the food web and energy flow.

For my artwork, as a fashion student, I am planning to design a collection of garments and employ the variations of silhouettes with the different colors distribution to show how

overfishing becomes an ecological issue and how can it influence human's own life if we do not come up with new methods or measures for the issue. In my collection, to show the effect that caused by overfishing, I would use five looks to represent five stages of the development of fishery. Based on my research about whaling, I define the five stages as the time before industrial and commercial fishing; the beginning of commercial fishing; the later stage of commercial fishing without modern technology; the beginning of industrial fishing and the possible "end" of industrial fishing. For the silhouettes and colors, I would choose organza fabric to better to have the texture of seawater and the silhouette would also be very drapery to have a sense of flow. I divide all the looks in the collection mainly into two colors: blue and red. The blue color represents the marine environment that was not yet influenced by the fishing industry. The red color represents the marine environment that is influenced by the fishing industry which could also reflect the numbers of fish species and population that fishermen caught.

To be specific, at the time before the industrial and commercial fishing, the marine ecosystem is not influenced a lot by external factors. Even though there were some fishing activities, the species itself could replace the small numbers by reproduction in a short time. Hence, in this look, the main part of the garment will be a blue drapery piece in organza fabric. Then I will do some embroidery of some marine animal species which are now endangered or even extinct to create contrasts with the other looks which represent different stages. In the second look, at the beginning of commercial fishing, as I mentioned above, human have higher demands on fish and whale. Therefore, to pursuit for profit, the fishing industry began to develop. In this look, there would be a small part of red organza under the blue organza to indicate the beginning of the fishing industry and the beginning of the overfishing issue. Then, for the third look, as the development of the fishing industry and human's higher demand for marine resources, there will be more exploitation of marine species. Even earlier fishermen did not have the modern fishing technology at that time, they still cause great effect on specific species which are easier to catch, such as sperm whales, humpbacks grays, rights, and bowheads. For the fourth look, the beginning of industrial fishing is a significant point that causes upheavals on marine resources. At this point, the red organza will be on top of blue organza and the blue organza will be less than the red one since human's fishing invention enable them to catch fish in an unexpected speed. Meanwhile, many species such as orange roughy, Chilean sea bass, and bluefin tuna have collapsed due to overfishing(2). Hence, there will be more embroideries of marine animals on red organza and fewer embroideries marine animals on the blue one. When taking a look at these looks, viewers could see how overfishing influence our marine environment and ecosystem in a short time. For the last look, I want to only use black organza to show the possible "end" of industrial fishing. According to my research, if fishing rates continue to improve in current speed, all the world's fisheries will have collapsed by the year 2048(2). Hence, I employ black color to represent this collapse. On this look, I will leave it without any embroidery and burn some parts of the black organza to create the sense of destruction, all of which would imply how dark and terrible our life would be if the whole fishing industry collapse. From my collection, I wish to point out that only when the resources are protected well, we could get more from it.

Scientific Ideas	How it is incorporated into project
<p>1)Overfishing is not a new issue. Truly commercial whaling likely began in western Europe around the eleventh century(9). Even before human had the modern fishing technique, the fishing industry had already cause drastic decrease of many marine species which are easy to be caught. Then, the beginning of industrial fishing leads overfishing issue into a worse condition. The high speed of industrial fishing has already caused many species' decrease in numbers.</p>	<p>In my fashion collection, I use five looks to represent five stages of fishing industry. The five stages are the time before industrial and commercial fishing; the beginning of commercial fishing; the later stage of commercial fishing without modern technology; the beginning of industrial fishing and the possible “end” of industrial fishing. I would mainly employ different distribution of blue and red parts in my collection to show human’s influence on marine environment, all of which could show viewers how and when overfishing issue start and develop into today’s condition.</p>
<p>2)The unlimited fishing activities influence the biodiversity and the issue will get worse and worse if human do not take any action. According to my research, overfishing has already caused the collapse of orange roughy, Chilean sea bass, bluefin tuna, sperm whales, humpbacks grays, rights, and bowheads. A study of catch data published in 2006 in the Journal Science grimly predicted that if fishing rates continue apace, all the world's fisheries will have collapsed by the year 2048(2).</p>	<p>The natural resources is not unlimited. However, many people could not realize it. In my project, I would use the embroidery on the garment to visually show how does overfishing cause the lose of biodiversity. I will embroidery some species on the different colors of organza. The embroidery on blue organza means than this specie is not yet influenced by fishing industry while the embroidery on red organza means this species has already reduced in population or even collapse due to overfishing. As the fishing industry developed, there will be less species on the blue organza and more species on the red organza, all of which could show the reduce of biodiversity that was caused by overfishing.</p>

Annotated Bibliography

Lee, Mercedes, and Carl Safina. “*Effects of Overfishing on Marine Biodiversity.*” *The Journal of Marine Education*, vol. 13, no. 5, ser. 9, 1995. 9, aoc.rain.org/impacts/content/biodiversity.html.

1. This resource introduces the concept of overfishing and provides information about how overfishing could influence fish species: to adapt the pressure from humans’ intensive fishing activities, some fish evolve so that they could change their habits and the ways of reproduction to better keep their species population.

“*Overfishing.*” National Geographic, 27 Apr. 2010, www.nationalgeographic.com/environment/oceans/critical-issues-overfishing/.

2. This resource introduces the effect of overfishing with some existed data. Meanwhile, this article points out that the overfishing is not a new issue in the environment and provides an example of how humans’ fishing activities influence the marine species before. Based on the previous history and existed data, this article pointed out the prediction by professionals that the fishing industry would collapse in later years if we do not take any actions.

Hilborn, Ray, and Ulrike Hilborn. *Overfishing: What Everyone Needs to Know*, Oxford University Press USA - OSO, 2011. ProQuest Ebook Central, <https://ebookcentral.proquest.com/lib/pratt/detail.action?docID=886462>.

3. This article talks about what overfishing is and give many examples of overfishing to show the effects of this issue. Also, it provides many historical backgrounds of this issue to show how the condition of this issue change. Meanwhile, there is also some introduction of the fishery industry which point out several reasons for overfishing and then provide some objective suggestion of how can we take some actions to deal with the overfishing issue. “The history of whaling illustrates a phenomenon seen in many of the world’s fisheries known as sequential depletion. Fishing starts close to home ports and on the most vulnerable species. As the initial target species or areas are depleted fishing moves farther afield. Fisheries of new populations or species are developed in response to local declines.”

Jackson, J. B. C. “*Historical Overfishing and the Recent Collapse of Coastal Ecosystems.*” *Science*, vol. 293, no. 5530, 2001, pp. 629–637., doi:10.1126/science.1059199.

4. This article introduces a term: eutrophication, which is caused by overfishing and influences fish and coral species greatly. The decline of fish species would also influence other species and even cause the change in plants’ population, all of which may finally become part of the reasons for the climate change. What is more, this article also introduces some historical reference about the influence of overfishing, which provides a more comprehensive view of the issue.

Murawski, S. “*Definitions of Overfishing from an Ecosystem Perspective.*” ICES Journal of Marine Science, vol. 57, no. 3, 2000, pp. 649–658., doi:10.1006/jmsc.2000.0738.

5. In this journal, the author discusses the definition of overfishing from an ecological perspective, which provides knowledge about how to correctly define overfishing and how to better manage this industry instead of just talking about “overfishing”. There are many people too sensitive about the words like “overhunting”, “overfishing”, which would disturb the industry’s conventional development.

(Pratt Library) Palkovacs, Eric P. “*The Overfishing Debate: an Eco-Evolutionary Perspective.*” Trends in Ecology & Evolution, vol. 26, no. 12, 2011, pp. 616–617., doi: 10.1016/j.tree.2011.08.004.

6. This resource illustrates how overfishing or overexploitation could cause the evolution of some marine species. To be specific, some fish species would change the speed of reproduction and shorten their growth circle to recover their lose population. With the change in these habits, the size of the species would usually get smaller and their life span would also get shorter.

(Pratt Library) Harasti, David, et al. “*Illegal Recreational Fishing Causes a Decline in a Fishery Targeted Species (Snapper: *Chrysophrys Auratus*) within a Remote No-Take Marine Protected Area.*” PLoS ONE, vol. 14, no. 01, Jan. 2019, pp. 1–20. EBSCOhost, doi:10.1371/journal.pone. 0209926.

7. In this article, the author discusses the illegal fishing activity in the Marine Protected Areas, which states some difficulties of controlling and managing the issue of overfishing and how the professionals deal with these issues, all of which provide a more comprehensive view of the overhunting problem and effectively introduces different technological ways to deal with the illegal fishing issue.

Scheffer, M, et al. “*Cascading Effects of Overfishing Marine Systems.*” Trends in Ecology & Evolution, vol. 20, no. 11, 2005, pp. 579–581., doi:10.1016/j.tree.2005.08.018.

8. This article introduces the cascading effects of overfishing and provides much information about how overfishing causes the reduction of specific fish species, and then further influences the population of other relative species. The explanation of how energy and nutrient flow change when the population of a specific fish species changes shows the significance of the overfishing issue. “A particularly striking example is the role of fishing in the collapse of Caribbean coral reef ecosystems [6,12]. Depletion of herbivorous fish left sea urchins as the only grazer to control macroalgae. When a disease affected the sea urchins during the early 1980s, brown fleshy algae rapidly encrusted the reefs, replacing the corals and inducing the radical change of the ecosystem at all levels.”

Clapham, P.J. 2016. *Managing Leviathan: Conservation challenges for the great whales in a post-whaling world*. *Oceanography* 29(3):214–225, <http://dx.doi.org/10.5670/oceanog.2016.70>.

9. This article introduces the background of whaling. Meanwhile, the author points out that the whale is an example of how human misuse natural resources. From the 11th century, the real commercial whaling began in Western Europe, which creates great influence on the world's whales' population. The author also introduces some rules and policies that were built to protect whales population to better show the terrible condition of whales population and the result of human's immoderate exploitation: the reduction or extinction of whales species.