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Ocean Overfishing under the "Tragedy of the Commons" Theory

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Abstract: Today's poor overall marine environment and severe overfishing have led to some negative impacts around the world. The topic of this research is the effect of overfishing and how to solve the problem of overfishing. Besides, this paper used the literature research method to study this topic. The survey results show that overfishing has a negative impact on the local environment and the ocean in all three locations, Qingdao Jiaozhou Bay, Newfoundland fishery, Gulf of Aardvark. We should pay attention to this problem and start to deal with it. The paper argued that overfishing can affect marine biodiversity, reduce species or even lead to species extinction. In addition, overfishing increases the world's carbon emissions, which ultimately leads to global warming.

Keywords: overfishing, tragedy of the commons, global warming, biodiversity, environment

1. Introduction

On the one hand, excessive fishing refers to the insufficient survival of a certain fish species in the ocean in human fishing activities and cannot reproduce and supplement. The number of marine creatures caught in modern fisheries exceeds the number of ecosystems that can balance the ecosystem. Therefore, the ecological environment of the entire marine system has deteriorated. Excessive fishing is now a very serious problem in the entire world. On the other hand, there are some life examples to introduce the tragedy of the commons, such as overgrazing, air pollution, etc. This paper wants to examine is the overfishing part of the tragedy of the commons. What is the tragedy of the commons? Hadin gives a specific example of a group of farmers facing a pasture open to them. Each farmer wants to raise one more cattle because the increase in revenue is greater than the purchase cost, but the average amount of grass decreases, which may decrease the unit revenue of cattle in the entire area. Each farmer may add one more cattle, and the grass may be overgrazed, thus not satisfying the cattle's diet and causing all farmers' cattle to starve to death. Later, this paper described what the tragedy of the commons is, the dangers of overfishing and how the tragedy of the commons solution can be used to solve the problem of overfishing. The paper used the literature research method in it. Let this issue be taken seriously and addressed as much as possible.

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2. The Dangers of Overfishing

2.1. Reducing Marine Biodiversity

On the one hand, overfishing undermines the stability and biological diversity of the original ecosystem, which has a direct impact on fisheries recovery and degeneration and, indirectly, creates a chain reaction that irreparably damages the entire marine environment. Here is an illustration. The biological species in Qingdao Jiaozhou Bay have drastically decreased during the past 40 years. The eastern section of Jiaozhou Bay's biological species declined from 141 species in the 1960s to 17 species in the 1980s and less than 10 species in the 1990s, according to statistics, and the top part of the bay has turned into a non-living environment [1].

In short, the most serious consequences of excessive fishing are the extinction of species, the embarrassment of fish -free fish in a fishing ground, the collective unemployment of local fishermen, and huge economic losses. An obvious example in this area is the situation where it happened in Newfoundland, Canada. The Newfoundland fishing ground is famous for its backs that can be stepped on a group of cod in the water. But after more than ten years, the most abundant fishing ground in cod resources suddenly became the past. In 1992, the fisheries on the island were suddenly completely interrupted because no cod appeared in the fishing season. This is the consequences of the local fishery sector that allows excessive fishing [2]. The fishing ground was completely destroyed when large-scale automated dragging net fishing vessels entered the Gulf of Newfoundland in groups throughout the 1950s and 1960s. They scoured the ocean floor with their massive fishing nets, making it difficult for fish, turtles, and crabs to move about. The fishing boats in the sea-wide sky can work on the spot, equipped with contemporary refrigeration equipment, and can complete freezing fresh fish operations in one stop, so they do not need to transfer the "results" back to the shore this time. These fishing boats operate simultaneously day and night, through wind and rain, regardless of when the fish are spawning. Statistics show that this large-scale fishing vessel can catch 200 tons of fish in an hour, which is more than a regular fishing vessel could catch in a season in the sixteenth century. The avaricious nature of the Canadian government remained unaltered. It didn't spare any effort to support its own fishery firms because it only saw the money cod provided. These government-supported industrial groups become even more shadier in order to make money. The ecological habitat of the area was destroyed by the use of contemporary ice-breaking boats, high-tech electronics, and sound technology, which left the remaining cod with nowhere to go. The number of cod had declined to 2%20 years by the 1990s, the lowest level ever. The number of cod plummeted to 2% in the 1990s, the lowest level in recorded history. The Canadian government was compelled to outlaw fishing in Newfoundland in 1992. This has been Newfoundland's greatest industry for the last 500 years, and approximately 40,000 fisherman have lost their employment as a result. The Newfoundlanders who perished were compelled to flee their home country, and the island's population fell by 10% in less than 10 years. Indirectly, this led to the dissolution of numerous families as well as the abandonment of numerous villages and towns on the island. The Canadian government must find a solution for the livelihood and re-employment of jobless fisherman in Newfoundland due to the $ 400 million compensation plan each year. Another illustration is the depletion of Adovak Bay's fisheries owing to the fishing of oceangoing fishing vessels in numerous nations. This circumstance dealt a fatal blow to the fishing industry in Somalia and, in part, contributed to the emergence of piracy in the area [3] [4].

2.2. Negative Effects on Global Warming

Marine fish, jellyfish, and octopus, on the other hand, frequently float to the surface of seawater for a short period of time to feed, then resurface to the depths, where they provide a food source for deep-

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sea fish. Following such a food chain, the carbon accumulated in the predated fish is transferred to the deep-sea fish, completing the carbon storage conversion. Although the carbon is released again when deep-sea fish die, the dead fish serve as food for other fish, so the vast majority of the carbon is retained in the deep sea. Although the capacity of deep-sea fish carbon sinks is small, it is still important in mitigating global warming [5]. And if fisheries are allowed to overfish, the consequences will be far-reaching. Trawling will indiscriminately catch deep-sea fish, but they are not a source of food for humans, and these fish will not survive and will be discarded at will, with the carbon stored in their bodies being released back into the atmosphere. This leads to global warming.

This is a point that has rarely been made before, and this paper has not experimentally proven it by measuring the temperature of an ocean after and before it has been overfished. Later in the paper, this research will prove that increased carbon emissions from overfishing cause global warming and compare the temperature around the ocean before and after fishing to prove the point.

In the above survey, in the cited literature it can be found that overfishing can lead to the reduction or even extinction of marine life, and then the death of marine life in the ocean can lead to elevated carbon emissions, and changes in carbon emissions are associated with global warming. So is the paper then able to correlate overfishing with global warming?

From previous sources, there is already a direct correlation between overfishing and changes in carbon emissions, and this paper only need to prove that carbon emissions are directly related to global warming to indirectly prove that overfishing is related to global warming. As shown in the graph below, according to the material, when carbon emissions are high, the global temperature is higher, with an overall upward trend [6].

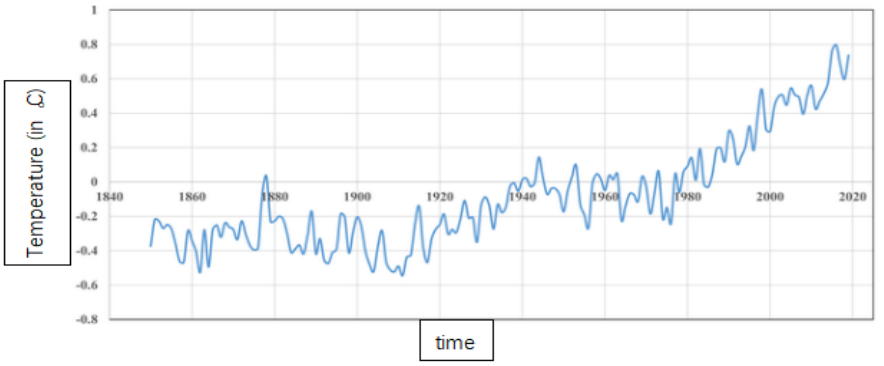

Figure 1: Global temperature change.

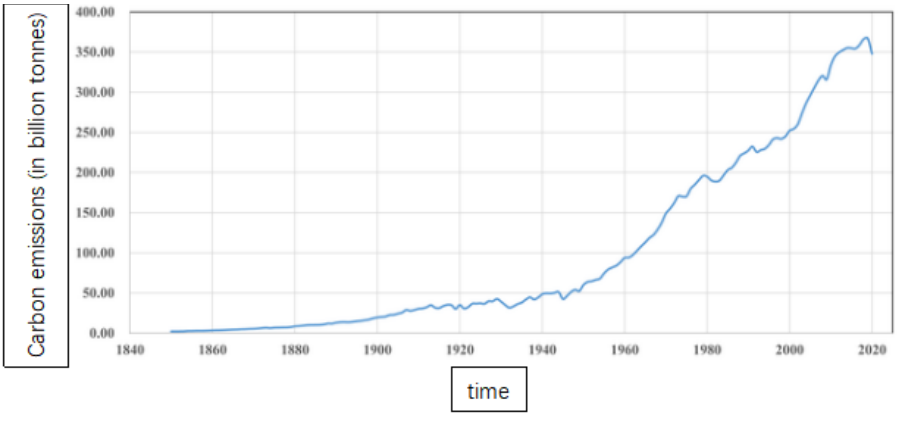

Figure 2: Global carbon emission trends.

So this would prove that overfishing is also a contributor to global warming.

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3. The Solution to Overfishing

This is a very big issue and it can be approached from two perspectives, one is a policy model and the other is a cooperative model.

3.1. Policy Model

On the one hand, from a policy standpoint, the Transferable Quota, which is similar to creating a market for public goods, is a very popular model that is being promoted in many developed countries. Simply put, a quota determines how many fish can be caught in a given area based on stock size and growth rates. This share is then distributed to the local fishermen, who can trade their quotas among themselves. The success of this model is dependent on two factors: an accurate assessment of the overall resource situation in the area and the corresponding economic impact, and the government's ability to enforce it, i.e. accurately measuring each vessel's catch on arrival. So far, cases show that this approach is effective in restoring fisheries resources and is also the least expensive approach without significantly affecting fisheries revenues [7]. Furthermore, this model is effective not only for commercial fish, but also for so-called bycatch, which are fish of low commercial value caught by chance. Of course, this method is not a cure-all. Marine Protected Areas can be used to protect critically important ecosystems, such as those with high biodiversity or severely degraded populations. This is the same as a protected area on land, and it must be fully protected, accompanied by marine police enforcement and the like. Many international organisations such as the United Nations and the World Bank are promoting community-based cooperative fishing, as many countries do not have that much government capacity. Because often the people who fish in an area are local people, and in these countries the traditional local communities are often very strong. The so-called 'tragedy of the commons' is largely due to lack of understanding and communication. Therefore, all these international organizations must do to let local fishermen recognize the seriousness of the problem, and at the same time give full play to the power of the community, and to restrict the problem of over -fishing through the autonomy and coordination of fishermen [10]. This method is not so accurate, but under limited budget and implementation capabilities, this model can alleviate the problem. Finally, aquaculture is now also being promoted in many countries as an alternative to wild capture, although there are of course problems with aquaculture, such as the fact that many fish cannot yet be kept, the impact of aquaculture on the marine environment, and the regulation of aquaculture markets. But it must be said that aquaculture could be the fundamental solution to the problem to a large extent.

3.2. Cooperative Model

On the other hand, there are cooperative models. The one that is already well established is the Regional Fisheries Management Organizations (RFMOs), which focus on fisheries resources in public waters, especially highly migratory fish, such as tuna. There are about 17 RFMOs in existence, each with a different profile [8]. Generally speaking, there is a scientific committee and a consensus among the member countries to manage the fishery resources of the region. In practice, the results have been mediocre, firstly because there is no effective regulatory mechanism, as it is inherently difficult for countries to cooperate in enforcement, and secondly because you cannot limit the ability to accurately assess the ecological impacts in such a large area, so you have little incentive to target fishing reductions, or to reduce revenues. Going back to the 'tragedy of the commons' mentioned earlier, this is still a problem of lack of awareness and poor communication. So relatively speaking, Europe is doing quite well because of the close cooperation, for example in the Mediterranean and the Bering Sea, the United States and the Caribbean countries are doing OK, and East Asia, for various reasons, lacks the necessary cooperation and is a little bit worse, while in many other places it's just

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not there. However, these problems are slowly improving. For example, led by the United Nations Development Planning Department, the China -Korea Yellow Sea Ecosystem project jointly funded by the World Nature Foundation and China and South Korea is not specifically targeted at fisheries, but for the entire Yellow Sea marine ecosystem. Both sides promised some goals, such as reducing 25-30%of fishing, reducing waste emissions, protecting marine habitats, etc. They hope to achieve these goals in the future.

In summary, both solutions can be effective in addressing the problem of overfishing in the tragedy of the commons, but both have their own drawbacks; can we find a way to solve the problem in a near-perfect way? Combine the two approaches or find a new one? It is worth continuing our research and thinking.

4. Conclusion

Firstly, the tragedy of the commons is a phenomenon in which all parties benefit to the detriment of the commons. The dangers of overfishing are twofold: firstly, it reduces marine biodiversity and even makes some organisms permanently extinct; secondly, it may lead to increased carbon emissions and thus to global warming. This paper presents two approaches to solving the problem of the tragedy of the commons: one is through policy and the other is a cooperative business model. The policy model is more suitable for countries with limited budgets to mitigate the problem, while the cooperative model is more suitable for developed countries to solve the problem. In addition, there are some shortcomings in this research. Firstly, there should be more ways to address overfishing, and this paper has not presented many details of the two solutions mentioned in the research. Secondly, this paper did not compare the two solutions to choose the best solution for the current marine environment. Finally, the paper has only used references to speculate on the link between overfishing and global warming and has no evidence from fieldwork to prove that the two are related. In future research, the paper will add that measuring the amount of fishing, carbon emissions, and temperature in a given area. The lack of actual data will be added to this gap.

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References

[1] *Dong, L. (2010, June 16). Overfishing has decimated wild fish, with some populations showing signs of extinction. Dazhong Online. Retrieved August 24, 2022, from http://sd.dzwww.com/shrx/201006/t20100616_5662151.htm*

[2] *Wenku China. (2020). The dangers of overfishing. https://wenku.baidu.com/view/91a56fd9a78da0116c175f0e7cd184254b351bdf?aggId=a2bf81a687868762caaedd3383c4bb4cf7ecb7a4*

[3] *Chen, H. (n.d.). Impacts of overfishing on international fisheries. Social Science Literature Press. Beijing.*

[4] *Fang, R., & Zhang, L. (2022, April). Global marine environmental governance in the light of the "tragedy of the commons" theory. China Knowledge Network. Retrieved August 22, 2022, from https://kns.cnki.net/kcms/detail/detail.aspx?dbcode=CJFD&dbname=CJFDLAST2021&filename=ZGHS202004005&uniplatform=NZKPT&v=ZLPhfyRiy97q2ejUKWIGkfS3pVRKBUZMjvRmU2rt7W6PCXR3jz7_Ia4godsxJlxy*

[5] *Chang, X. (2014, June 16). Overfishing endangers deep-sea fish. People. Cn. Retrieved July 20, 2022, from http://env.people.com.cn/n/2014/0616/c1010-25153708.html*

DOI: 10.54254/2754-1169/14/20230817

[6] *What the data tell you: The relationship between global warming and carbon emissions. (n.d.). Baijiahao. Retrieved August 24, 2022, from https://baijiahao.baidu.com/s?id=1722723133398887894&wfr=spider&for=pc*

[7] *Ye, D. (2016). Suggestions for China's natural resource property rights system in light of the "tragedy of the commons. Journal of Higher Education.*

[8] *What are the ecological consequences of overfishing? (2020, August 15). Yebaike.Com. Retrieved July 20, 2022, from https://www.yebaike.com/22/470310.html*

[9] *Exploring the links between oceans and biodiversity | UN Convention on Biological Diversity Science Post. (2022, June 24). Thepaper. Cn. Retrieved July 18, 2022, from https://www.thepaper.cn/newsDetail_forward_18721387*

[10] *Huang, S. (2022). Recent developments in the international fisheries management system and the challenges faced by China's fisheries. China Knowledge Network. Retrieved August 2022, from https://kns.cnki.net/kcms/detail/detail.aspx?dbcode=CJFD&dbname=CJFD1998&filename=SSDB199803006&v=R6Jx27H0Rz9Pye8lYCvHjdjy3SLIM6FLhOZb4p3JDPHF-EkQODIOwdYmvLI4kYiY*