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Analysis of the Ecological Restoration and Economic Impact of the 10-year Fishing Ban Policy in the Yangtze

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Abstract: This essay will mainly assess the Yangtze 10-year fishing ban in general and its effects up until now from the perspectives of both environmental economics theory, and policy implementations. Featuring areas such as improvements in fish populations, recovery of endangered species, effects on the fishing industry and fishing households that was put on pause, and how governments use other economics related policies to sustain them. Using a variety of both qualitative and quantitative sources, and cost-benefit analysis on them. However, it also requires balance by mentioning limitations that caused the plan to not function as expected. Such as dams that restricted the breeding and feeding grounds of both endangered and commercial aquatic species usually consumed for food, and the threats brought by climate change on an already vulnerable ecosystem. Overall, the essay will mainly comment and analyze its success, but limitations and what could've done better are included to show balance and enough critical analysis.

Keywords: Environment, Yangtze, Climate change

1. Introduction

The Yangtze is the longest and the most important river in China, but also the third longest river in the world with a length of 6300 kilometers. It is home to over 378 species of animals and 183 species that are endemic to the river. Making it one of the most biodiverse rivers in the world with the Amazon River and the Mekong River, and a cradle of life. Featuring towering mountains, major lakes, and gorges, to the estuary in the lower course of the river. Moreover, the Yangtze also serves its importance of human development. With many megacities with high economic development located in its flood zones. Such as Shanghai, Nanjing, Wuhan, and Chongqing [1].

In this case, a growing population would mean a high demand of fishery. In fact, the Yangtze has been a source of fish for thousands of years, and it is still the case today, as many fish species found in the river are either caught or farmed and are used for economic and scientific purposes. However, majority of the fish are not being caught directly from the river, as recent introduction and increase in industrial and illegal fishing methods such as the use of electronic nets, toxins, and many more [2]. This has greatly reduced the number of balanced fishing stocks available in the river, and large dams constructed that stops fish from breeding and spawning. Moreover, waste and noise pollution has also killed many fish in the river. This does not only have negative impacts on people and fish that are widely consumed, but also on endangered species in the river. Because of lack of food and habitat destruction, a few of these creatures faces the threat of extinction. For example, the Chinese

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Paddlefish was declared extinct in 2022, and the Dabry's sturgeon being extinct in the wild on the same year [3].

Therefore, the Chinese government has placed a 10-year fishing ban policy on the Yangtze River, its tributaries, estuary, and major lake-river systems in its floodplain in 2021 to recover the number of fishing stocks to a sustainable level by 2031. But also working on the conservation methods of animals that are critically endangered to save them from the risks from extinction Moreover, in terms of fishery, the government would place policies to save them from losing their jobs by granting subsidies or reallocate them to anywhere else than the area that are not in the fishing ban area.

The main purpose for writing this paper is to deepen the knowledge on the theory of environmental economics in China and make estimations and predictions on how this mainly biocentric policy can influence recovering the once healthy biodiversity of the Yangtze, as well as helping people who depends on the river without too many losses. Since the policy has only been set for just 3 years and has reportedly seen significant results on recovering the population of commercial fish and exotic species, whether prey or predators. Moreover, this paper also contains parts that questions the policy whether it can save the Yangtze in a long-term, and how climate change can alter this. Which is believed to be another major issue China and the world is facing right now.

2. The reasons for the 10-year Ban and Impacts on Biodiversity

Before 2021, the Yangtze River was known to be the most industrialized and polluted river in the world. Along with the title of the most overfished river. The river is home to 44 million people, and overfishing is often associated with the demand and supply of fish for human settlements along the river. The Yangtze's high biodiversity and abundant fish population has led the river to be a food source for over thousands of years, and it still is with modern fishing methods whether illegal or legal. This has led to a drastic decline in fishing stocks in the river. As a result, a reduction in fish also led to the reduction of predators that feeds on the fish, such as the finless porpoise which also feeds on most fish species in the Yangtze. Hao Yujiang, an associate researcher at the Chinese Cetacean (Whales, Dolphins, and relatives) Conservation Biology Section of the Institute of Hydrology in Chinese Academy of Sciences. Was shocked by the number of declines in finless porpoise population to 1040 since 2012. Compared to 1800 in 2008 according to International Investigation. In fact, finless porpoise, along with other predatory fish, act as keystone species that regulates fish population in the river. A loss in primary and secondary consumers would mean a reduction in the population in predators too. Therefore, giving an almost irreversible impact on the Yangtze food web. The Yangtze's annual catch in 1954 used to be 4 hundred and 27 thousand tons a year but reduced to just one hundred thousand or less a year prior to the policy. The most common economic fish species (Bighead, Grass, Black, and Silver Carps), are also nowhere to be seen, and 94% of their supply comes from artificial breeding farms rather than wild caught [4].

Therefore, the Chinese government has put an eye on rescuing the Yangtze from biodiversity loss and let fishing resources recover to a sustainable level within a ten-year period. This all began in 2018, with a conference that was held by the Chinese government to come up with more effective and long-term policies to save the Yangtze's biodiversity. This is because fishing ban policies itself aren't new to the Yangtze: with a three-month long fishing ban policy during spring months (March-June) already set since 2002. But proven to be unsustainable as the river will be overfished again after the 3-month period, and strongly restricted the growth and development of newborn fish populations. Therefore, a fishing ban of at most 10 years would recover the number of fishes in the Yangtze to a sustainable level, because most species that are commonly fished usually mature at 3-4 years old. A 10-year fishing ban would enable them to reproduce 2-3 generations further. Along with providing sustained and enough food sources for both humans and animals in the river for a long-term [5].

DOI: 10.54254/2754-1169/64/20231540

As of now, the third year since the fishing ban, the Yangtze has already seen some strikingly good improvements. Not only did the number of fishes that are commercially consumed, but also exotic and endemic species that hasn't been recorded for a long time has returned to the Yangtze River. For example, the Chinese high-finned banded shark (a species of carp endemic to China). Leiocassis longistoris, Japanese grenadier anchovy, and Ochetobius elongatus---a rare carp species—was once again rediscovered after almost 20 years. This would suggest that this policy has made a good start, as the biodiversity of the river has already seen a slight recovery because fish that were once rare or overfished are starting to reproduce at the natural rates again, and therefore further increase the fish population in the future for both scientific and economic use, as they all reached their natural maturity age. Furthermore, predators such as the Finless Porpoise have also benefitted from the fishing ban due to an increase in abundance of food sources. The number of these animals has increased to 1249 in total since March 2023, a historical turning point according to the Ministry of Agriculture. Giving hope to save these critically endangered cetaceans from the brink of extinction [6]. Therefore, this policy did have a major impact on recovering fish population in general, and restoring the food web of the Yangtze that caused the increase of endangered predatory species.

3. The Economic Impacts and Solutions

As there is a fishing ban policy being imposed for 10 years, it would mostly impact households that have their sources of income associated with fishery the most. Since there is nowhere to fish and can lead to a complete fall in their revenue. But on the other hand, the 10-year fishing ban can bring potential benefits to these households because this policy is meant to recover fish stocks in the river to a sustainable level. In fact, many households that rely on fishery (up to 230000) has had more difficult times before any policies were set as the number of fishes in the river was extremely low. Therefore, the local and national governments already have policies and solutions in mind to sustain these households before the policy was set. For example, in the first quarter of 2023, the national government of China, along with local governments surrounding the Yangtze and its tributaries. Have funded in total of 27231 Chinese Yuan in compensation and subsidy funds to fishing households, and many fishermen either retired or economically active, have found jobs other than fishing in the Yangtze. Such as farming fish in large fish farms [7].

Taking Ma'anshan City, Anhui Province as an example. Most fishermen that once spend their time fishing in the Yangtze live on boats with extremely poor conditions. Therefore, after the fishing ban policy that has led a temporary retirement for some, the local government have provided low rent housing to those fishermen, and public rental housing with basic household equipment's to ensure their quality of life to increase following this transition period. In terms of insurance, 80% of the fishermen did not participate in endowment insurance. As a result of this, the local government of Ma'anshan stepped into action once again by giving all fishermen who met the insurance conditions a three levels of endowment insurance. Ranging from 1500 to 3000 Yuan. Moreover, everything is being payed by the government, meaning that these fishermen would not lose too much of their profit while still having endowment insurance.

Furthermore, the Chinese national government, along with the Agricultural Ministry, has set a survey to over 3000 households in all Yangtze provinces every year since 2021 to ensure their livelihood dynamic status. Because these policies pose risks such as stagnation development of livelihood, some fishermen still not being able to find new jobs, and stability challenges caused by prolonged period of transition. The survey will be helpful to a great extent on both local and national scales to evaluate what difficulties fishermen face during their temporary retirement before Yangtze is once again allowed to be fished [8].

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4. Limitations of the 10-year Fishing Ban and Associated Issues with Climate Change

On the other hand, the fishing ban is only a policy set to recover the basic food web of the Yangtze and re-establish a sustainable level of fish available for economics and scientific use in the future. This is because the Yangtze already has some irreversible problems that are much worse than overfishing and has led to many aquatic species becoming critically endangered. For example, the build of dams of sluices in the upper and middle course and reclaim of land across the river. The most well-known dams include the Gezhouba Dam, the Three Gorges Dam, and the newly constructed Baihetan dam. Figure 1 shows the number of dams constructed in the river's middle to upper course [9].

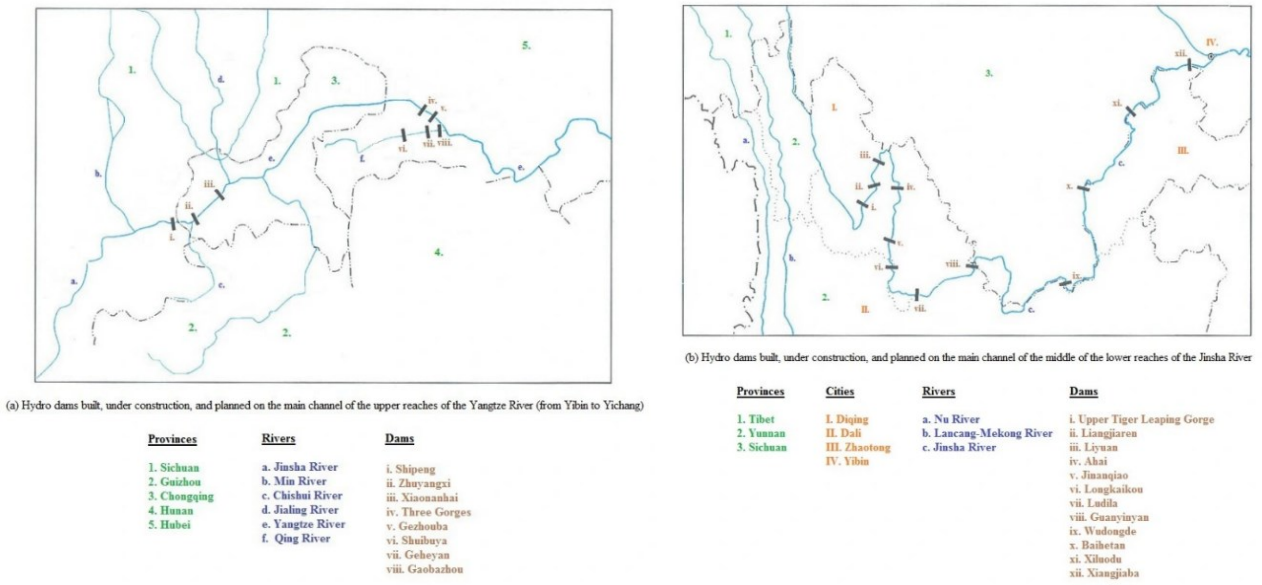

Figure 1: The number of dams constructed in the river's middle to upper course

As a result, dams have totally blocked the migration routes of animals in the river, either to feed or to spawn. Because of this, the population of these animals have declined dramatically. For example, sturgeon species like the Chinese and the Dabry Sturgeon which migrates annually from the East China Sea to the upper course of the Yangtze to spawn. With dams being built, many cannot reach their breeding grounds that caused a decline in sturgeon populations. For example, their larvae, who did eventually hatch, finds it much more difficult to swim to the estuary and the sea due to similar reasons. As a result, they became critically endangered as confirmed by IUCN, and many carcasses of these animals were found below these dams, and the population has remained the same since 1983, when Gezhouba Dam finished construction [3].

Figure 2 are show the change of Chinese Sturgeon individuals [10]. There were over thousands of sturgeon individuals who migrate from seas to inland rivers. Furthermore, less than 100 survived as surveyed in year 2013.

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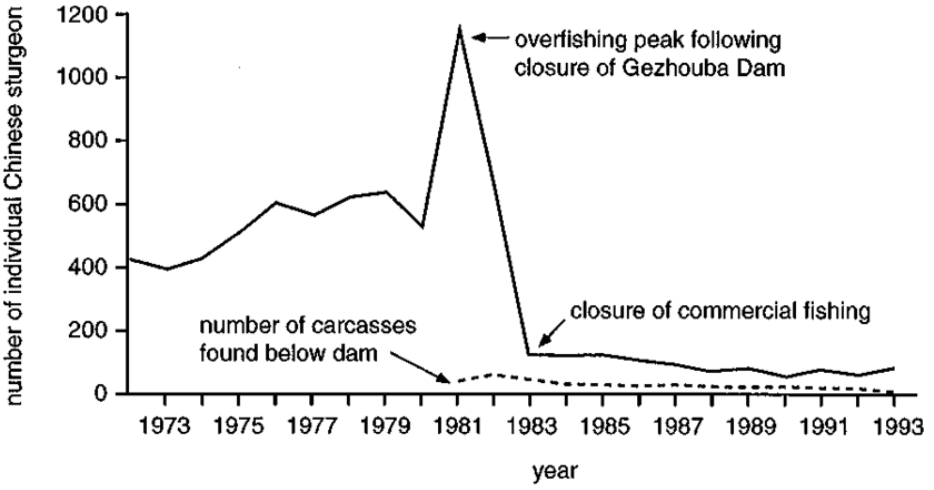

Figure 2: The change of Chinese Sturgeon individuals

In addition, new dams are constantly being built in the upper course in the future, turning once flowing river into a group of still reservoirs to a greater extent. The Chinese government has planned to construct 15 new hydroelectric dams. Some like the Xiluodu will be towering up to 280 metres high, a highest that no fish can ever jump over. In fact, the upper course is the traditional spawning ground of sturgeon species native to the Yangtze, making migration of these species impossible in the future [3].

Not only did the endangered migratory fish like sturgeons are affected by dam construction in the Yangtze River, carp species that are commercially consumed are also the victims of such an issue. Most carp species in the Yangtze River are known to be river-lake migratory, to breed and feed. With the construction of dams and sluices in the Yangtze, its tributaries, and its lakes. It acts as another boost factor in the reduction of carp population as the access of breeding and feeding locations are being blocked. [9] Therefore, it is difficult to say whether the population of fish will return to the original level in the 1950's following the 10-Year fishing ban [11].

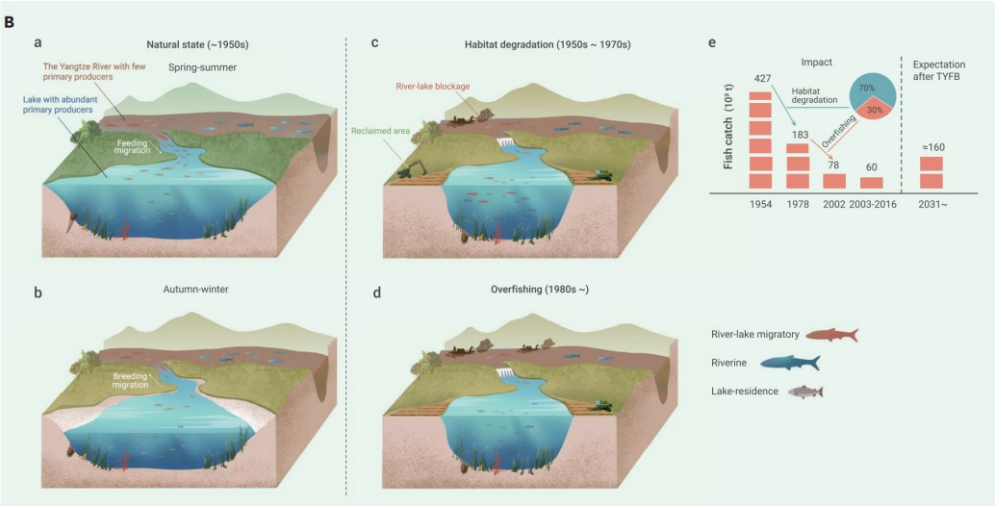

Figure 3: The impacts of dams on fish migration and population [11]

In figure 3, land reclaiming and the building of dams is accountable for 70% of loss in fish population. Because has greatly reduced the accessibility and availability of food sources for fish population that are river-lake migratory and must compete more with fish populations that are riverine

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and lake resident. Overtime, with an even more scare food sources in lakes, majority of the fish species that cannot compete well would often die. Leading to a drastic decline of fish population from 427 tonnes of 1954 to just 60 tonnes.

Furthermore, the impacts of climate change are the latest and one of the biggest problems the Yangtze River have ever faced, as the global temperature increases overtime due to the enhanced greenhouse effect. The Yangtze will experience more extreme weather events such as flooding and droughts respective to wet and dry years. This has led to some parts of the river basin and lakes drying up more quickly, and a rise in the temperature of water of the Yangtze. For example, the impacts of glacial melt in the upper course of the river due to rising global temperatures. While an increased melting in glacial water in the headwater regions (Tibet-Qinghai plateau) can cause a rise in water increasing in the hydrosphere of the Yangtze and increased erosion. Moreover, these effects are only in the short term because as more ice are melted in the future, less water supplied to the river. Leading to a fall in the water levels for the long-term. A loss in water can put heavy pressure on the native species like carps and dolphins, but also humans that will be consuming them after the 10-year fishing ban. [12].

However, hope is remaining for these critically endangered animals as conservation methods to back up the construction of dams has already been set to save these animals from extinction. Although the quality may not be as great as expected. It is still an innovative step to save them from the brink of extinction. Newly planned spawning ground are being made under the Gezhouba dam with perfect temperature and water flow that matches the sturgeon's preferred spawning condition, and artificially bred larvae of the endangered Chinese sturgeon are regularly being released into the estuary of the Yangtze to re-establish a flourishing population that can reproduce more offspring. The same goes for commercial fish like carps. The Three Gorges group have already tested environmental flow regimes since 2021 b y releasing the dam's water during flood peaks, and to let the carps migrate upstream [3].

5. Conclusion

In conclusion, the ecological restoration and economic impact of the Yangtze 10-year fishing ban have great impacts on the Yangtze to a great extent, but only within a short term. This is because the time for this fishing ban is limited to 10 years, and the rate of fish being caught after the fishing ban is currently unknown. Furthermore, things such as dams and sluices will certainly have a continuous impact due to increase in demand for hydroelectric electricity and the need for flood defences. Making migration of fish yet another problem that can have long-lasting impacts. On the other hand, this policy will be beneficial for fishermen since there is a increase in fish population to a sustainable level, and new methods such as breeding programmes of endangered species, patrol on illegal methods, and the construction of fish ladders in some dams with the appropriate heights to reduce the limits dams once brought to these species, and enable more fish to be able to migrate and breed freely in the river so that the fish population is on a balanced number.

This research is especially important in the theory of environmental economics, sustainable development, and challenges associated with anthropogenic factors on climate change. Because the current global climate is still changing quickly and has already led to events that harm both humans and other species alike. This essay would not only act as a review paper, but also contains some suggestions that might be useful for local governments to analyse and make better solutions from it. Lastly, what could be done better is that there is a limit in solutions to other problems that caused a decrease in fish population apart from overfishing. Such as analysis on claiming land for farming from large lakes, industrialization, and noise pollution. Furthermore, since this policy has only been set for just 3 years. The long-term economic and environmental impacts are still not visible, because most of the data that supports this often comes from predictions. Data such as annual catch ten years

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later, fish prices, fishermen incomes, and the future number of endangered species are currently unavailable. Therefore, it is recommended to do such in a suitable time like halfway through the fishing-ban length or further into the future to see if it has a significant impact.

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