Threat Factors and Protection Measures of Finless Porpoises in the Yangtze River, China

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Abstract: As a critically endangered cetacean, finless porpoise does have a wide-spread distribution over the Indian and Pacific Oceans, as well as the freshwater basin of the Yangtze River in China. In recent decades, the finless porpoise's population has experienced a great decline globally, primarily due to water pollution caused by a variety of sources, including industrial pollution, agricultural runoff, and daily waste. Containments in the water could have negative impacts on the porpoise's physiology status and their reproductive system. Therefore, a complete and comprehensive understanding of the causes and solutions is essential. The Yangtze finless porpoise's habits, survival, and reproduction are the main topics of this essay. The present state of existence of the Yangtze finless porpoise is investigated and assessed using an analysis of scientific research and cases. Additionally, the implications of these findings for species conservation and management are discussed. Conservative Policies such as the Yangtze River Fisheries Administration and the Yangtze River Protection Law of the People's Republic of China were evaluated. This study highlights the urgent need for a combined effort of government, institutions and all the individuals to address water pollution and protect habitat in the Yangtze River Basin.

1 INTRODUCTION

The finless porpoise, scientifically known as Neophocaena phocaenoides, are a type of the cetacean that mainly inhabit in Asian Oceans and some freshwater basins. Their population has declined dramatically in recent years as a result of habitat destruction, bycatch from fishing, and the possible consequences of excessive vessel traffic. However, water pollution has a wider impact on the porpoise habitat, as well as their health condition, resulting in the need in more urgent attention.

For instance, the Japanese finless porpoise that inhabits in inland water bodies is suffering from massive chemical pollution. High levels of toxic chemicals were known to accumulate in finless porpoises of the Inland Sea.e.g. their blubber may contain up to 132 ppm of total DDT, 320 ppm of total PCB, and 10 ppm of total butyltin in their liver. These pollutants might be the fundamental causes underlying the decline in the porpoise population, due to their potential harmful effects on survival and reproduction. Moreover, even though the Japanese government effectively controlled the runoffs of organic matter, the amount of phosphorus and nitrogen still remain at a high level since 1978, which might be an underlying factor in the population reduction of porpoises, but the effect of eutrophication on their survival remains to be investigated (Kasuya, Yamamoto and Iwatsuki, 2002).

The Yangtze finless porpoise is the only freshwater cetacean in the world, is also affected by water pollution. They have been listed as "Critically Endangered" on the International Union for Conservation of Nature's (IUCN) Red List since 2013 (Wang et al., 2024). As Yangtze River Delta developed rapidly in the past 20 years, there has been severe disruption and impact on the Yangtze finless porpoise's living environment. While the pollution from excessive traffic contributes to the pollution hugely, agriculture, chemical toxins, and daily debris also result in serious consequences on the water life, food supply, and wetland regulations of Poyang Lake (Yuan et al., 2024), which may indicate the cause of the notable drops in YFPs from over 2,500 in 1991 to

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1,040 in 2012 (Nabi et al., 2018). However, the Yangtze River contains the most stable and abundant population of the Yangtze finless porpoise. Additionally, large quantities of research have been conducted and estimated on these porpoises. Therefore, this paper takes the Yangtze finless porpoise as the focus, analyzes and evaluates the existing conservative approaches and the policies that the Chinese government proposed.

2 INFLUENCE FACTORS ON YANGTZE FINLESS PORPOISE

2.1 Hydraulic Engineering

The basin of Yangtze River, together with lakes and subchannels that connect it, is home to the majority of the Yangtze finless porpoises (Chen et al., 2020). Initially, the Yangtze River and its substream were tightly connected, and the Yangtze finless porpoises were able to migrate along the mainstream of the middle and down waterways. However, the Yangtze River was severely disunited shortly after the dam and dike building in the middle of the 20th century, which greatly divided the Yangtze finless porpoise population. Currently, only the Dongting and Poyang Lake remain connecting with the major steam of Yangtze River (Li et al., 2022), and thus, the porpoise's habitat was largely reduced. It means that the shortage of available resources and habitat had been a serious factor that threatened their continued existence.

What's more, large quantities of disruptive activities still operate near the benthic zone of Yangtze River, where approximately 80% of the Yangtze finless porpoises are concentrated (Chen et al., 2020). Even though intensive sand degradation in the Yangtze River had been banned since 1998, it was restarted in 2001 in Poyang Lake, a reserve with the highest Yangtze finless porpoise density (Nabi et al., 2018). Furthermore, the construction of the Three Gorges Reservoir also contributed hugely to the degradation of the Yangtze finless porpoise' habitats. Due to the increase in the sediment concentration, the river exhibited a high level of turbidity. In this case, Yangtze finless porpoise sonar system is seriously disrupted, which makes it difficult for them to navigate, detect prey and flee from danger, and migrate between the Yangtze River and Poyang Lake (Nabi et al., 2018).

2.2 Chemical Pollution

In recent years, areas near the Yangtze River are experiencing significant developments. The Yangtze River is a busy "golden waterway," full of docks, man-made barriers along the riverbanks, and recently extended agricultural land—even in areas reserved for porpoises (Chen et al., 2020). Hence, Yangtze water is severely contaminated by both organic and inorganic substances from recent, extensive industrial, agricultural, and residential developments (such as metals, fertilizers, and Pops) (Yang et al., 2012). These human activities cause the shrinking of porpoise's habitat, degrading available areas that the porpoise could inhabit, which explicitly challenges efforts to keep the Yangtze finless porpoise in conservation.

Since 1992, aquatic organisms in the reservation zone of the Yangtze River have been constantly exposed to high levels of pesticides and agricultural runoff from nearby farmland. Six Yangtze finless porpoises died at Dongting Lake between April and June 2004 as a result of improper use of chemical pesticides (Wang, 2009). This is because the pesticides have adversely effetcs on the liver's function and other physiological processes in Yangtze finless porpoise (Nabi et al., 2020).

The Yangtze River Delta region received 6,642,000 tons of agricultural fertilizer, 197,010 tons of pesticides, 297,840 tons of plastic film, and 8.856% and 22.672% of the nation's total agricultural COD and agricultural ammonia nitrogen in wastewater discharges, respectively, according to data from the 2020 China Environmental Statistics Yearbook (Yuan, Xu and Kong, 2023). As a result, these runoffs likely leak in the waterways since the cultivated lands are located close to the Yangtze River main stem, meaning that the porpoise's habitat is significantly altered due to the excessive amount of nutrients.

Despite the impacts that agricultural land use bringing about, in the framework of fast urbanization and industrialization, the growth of construction land and dams are also the greatest threats to habitat patches (Yuan, Xu and Kong, 2023). In the Three Gorges reservoirs, the concentration of heavy metals such as coopers, leads, and cadmium frequently rises by more than 25% with increasing water depth (Yang et al., 2012). On the top of that, the Yangtze River also exacerbated water pollution by trapping sediments from hydropower impoundment reservoirs that constructed in the upper region (Yang et al.,

2012). Toxic chemicals can directly contaminate the waterbody and result in biochemical harm to the Yangtze finless porpoise. The sedimentation could also lead to the decrease of albedo, causing the river's temperature to rise, and eventually contribute to the formation of dead zones, which might then become a major threat to the finless porpoise's survival.

Additionally, the overall increase in the amount of shipping also contribute to the worsening of the Yangtze river's water quality. As a rapid developing region, areas near the Yangtze River in developing in a boosting pace. In consequence, the demand of river transportation had grown significantly. In 2000, 400millions tons of cargo were transported on the Yangtze River, and recent research suggested that the number had increased up to 5 times in 2006 (Nabi et al., 2018). As a result, the possibility of oil spilling had mainly increased, which is a threat for the porpoise habitat, porpoise's motor agility and their insulative ability.

2.3 Population Expansion

The swings that occur in carbon emissions within the ecological urban agglomeration surrounding Poyang Lake are significantly impacted by population growth (Yuan et al., 2023). This is significant since, according to research, the Poyang Lake and the Yangtze River that it borders have the largest density of finless porpoises (Wang, 2009). Increasing carbon emissions may cause the water's concentration of dissolved oxygen to drop, which may worsen the conditions that support Yangtze finless porpoises.

For organisms like Yangtze finless porpoise, water acidification can negatively impact their reproductive rhythms, slow down their growth, and decrease their resistance to infectious diseases (Nabi et al., 2020). In spite of the lake's ability to replenish its own dissolved oxygen, the free carbon dioxide combines with the water to create carbonic acid, which then decomposes into bicarbonate and a hydrogen ion. Consequently, the PH value of the waterbody drops and the acidification harms aquatics organisms, which are sensitive to acidity, disrupting the food chain. To be more specific, the calcifies that the Yangtze finless porpoises fed on rely on were unable to form their shells due to the lack of carbonate ions, so the numbers of the calcifies drop, leading to a decrease in the accessibility of food resources.

3 POLICIES

As a major threat to the Yangtze Finless Porpoise, excessive vessel traffic has always been a problem that has not been fully mitigated yet. Despite physically harming the porpoise, cargo ships and other vessels (including fishing boats, passenger ships, etc.) could also release water pollutants into the Yangtze River; hence, oil spills might occur, which contaminate the water and directly poison the aquatic animal's respiration system and ability to perform insulation. In addition, runoff from nearby cultivated lands or agriculture sites is also a major source that contributes to the worsening of the water quality in the Yangtze River. In order to address this problem, the Chinese government established laws and constraints that restrict the shipping industry in the Yangtze River region. In 2014, enforcement of fishery laws such as the Yangtze River Fisheries Administration was established, supervising the fishing activities in the Yangtze River, which helps lower the number of vessels traveling through the Yangtze River every day. Furthermore, the Yangtze River Protection Law of the People's Republic of China was established by the Chinese central government, which also imposed limitations on the use of fertilizer and pesticides in agricultural areas close to the Yangtze River. These conservation strategies are effective for the overall protection of the porpoise species. By limiting the usage of man-made pesticides and fertilizer, banning the majority of fisheries, and setting up stricter enforcement, fewer harmful chemicals are polluted into the river, which ensures the safety of the porpoise. However, there are still some limitations hidden behind these policies.

First of all, setting up restrictions is only a short-term solution. As long as a large number of transportation needs still exist in the Yangtze River, water pollution remains a significant problem in the protection of the porpoise population. As a rapidly developing region, the Yangtze River is the central channel that vessels rely on, meaning it is hard for the porpoise to really stay out of zones that have the possibility of being contaminated. As a result, the government might need to consider transforming the main transportation method from shipping to land transportation, which is helpful in reducing the number of pollutants released by ships traveling in the Yangtze River. Still, transporting on land might be more expensive compared to the shipping fee, meaning that the government needs to consider the financial effects that this policy brings about. More

importantly, the government needs to estimate and compare the environmental consequences of land travel with shipping, such as the amount of air pollutants released during transportation and the level of energy consumption between land vessels and ships.

Secondly, even though the policies restrict the public from dumping trash or releasing toxic chemicals into the river, man-made trash and daily waste (including plastic bags, glass water bottles, and food waste) are still the majority of the pollutants that lead to the decline in water quality in the Yangtze River. Submerged contaminated soil and growing human activity continue to be major contributors to toxic pollution, which drastically lowers the quality of the water. Under this circumstance, not just the habitat of the porpoise is contaminated and polluted; the porpoise directly suffers from the trash, increasing the risk of the porpoise being tangled in trash like plastic bags. In conclusion, the government might need to set up reinforcements that aid with the laws, such as setting up digital cameras to monitor regions where trash dumping occurs the most, and the people who violate the restrictions should be charged a fine. Additionally, the government can provide funding to local organizations that support the preservation of Yangtze finless porpoises. For instance, the institutions can organize weekly events that promote the urgency of stabilizing the porpoise's population while raising public awareness of this problem.

Lastly, the Yangtze River Protection Law of the People's Republic of China suggested that local people's governments at or above the county level in the Yangtze River basin should instruct a well-documented overview of future development projects with precise arrangement and procedures. This regulation makes it very evident how the government will regulate construction applications; it prohibits the development of chemical parks and projects within one kilometer of the bank of the Yangtze River and its subchannels With the establishment of this policy, there would be less industrial waste being released into the Yangtze River, meaning that it would be less likely for the porpoise's habitat to be damaged by chemicals, which enables the porpoise to inhabit a relatively secure environment.

A recent research paper suggested that the growing numbers of YFPs in the Yangtze region is most likely the result of individual and governmental efforts working together (Huang et al., 2020).

4 DISCUSSION

Despite efforts, the issue of habitat fragmentation persists, leading to an increase in trapped and injured finless porpoises alongside the growth of their natural population. Consequently, enhancing protection and rescue capabilities has become imperative. On March 9, 2024, the Zhenjiang section of the Yangtze River inaugurated a "porpoise hospital" to provide timely assistance to stranded and injured porpoises. To bolster emergency relief efforts, the government plans to leverage an intelligent monitoring system within the protected area and the Yangtze River Porpoise Rescue Base, establishing a comprehensive mechanism for monitoring, rescue, and protection. This initiative integrates manual patrols, AI-powered cameras, and 5G inspection drones to create a robust three-dimensional network for porpoise rescue. Such measures ensure swift detection of distressed porpoises, enabling prompt activation of emergency response protocols.

The government's regulations were effective in protecting the Yangtze finless porpoise overall, as demonstrated by the data and research results listed above. Nevertheless, issues and gaps still need to be resolved to guarantee the species' long-term survival. It is crucial for the government and the public to address non-environmental-friendly problems caused by shipping, water-related projects, and various human activities that have long-lasting effects on the habitat of the Yangtze River porpoise, compounded by extreme weather and other natural factors. On top of that, questions remain about the genetic diversity and long-term viability of the Yangtze finless porpoise populations. It is important to monitor and manage genetic diversity within the population and to ensure the sustainability of different methods that aid in lessening the negative effects of fragmentation in the Yangtze finless porpoise population.

5 CONCLUSION

The Yangtze finless porpoise, a symbol of the Yangtze River Basin's ecological health, faces a severe threat to its survival. Their critically endangered situation was caused by the enhancement of water pollution in the shorelines of the Yangtze River. Based on all the pre-existing studies and data analysis, this paper briefly summarizes the current research status of the Yangtze finless porpoise. By

focusing on the causes of the decline in the porpoise population, this paper discusses multiple major sources that lead to water pollution in the Yangtze River: man-made pesticides, agricultural runoffs, industrial wastes, construction of Hydropower impoundment reservoirs, and decrease in dissolved oxygen level caused by excessive carbon dioxide emission. The reproductive health, survival, and behavior of the endangered Yangtze finless porpoise species are severely impacted by these risks.

Consequently, comprehensive conservative measures have been applied to address current issues. The Yangtze finless porpoise and its habitat are protected by laws and regulations that are effective, such as the People's Republic of China's Yangtze River Protection Law and the Yangtze River Fisheries Administration. Stricter enforcement of vessel traffic, industrial runoff, pollution from agriculture, and the development of chemical parks are some of these restrictions. In this paper, the controversial parts of these policies were discussed, highlighting an urgent need of well-refined and more advanced conservative strategies.

However, the effectiveness regarding to the preservation of the finless porpoise of Yangtze requires a combined effort from all relative parties, including government, private institutions, as well as the individuals. More significantly, public awareness needs to be increased in order to observe the population of Yangtze finless porpoises over the long term. This could ensure the Yangtze finless porpoise's survival for upcoming generations, making it a symbol of a more healthy and sustainable ecology along the Yangtze River.

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