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THE STATUS OF FISHING TRENDS IN WEMBERE WETLAND FISH RESOURCE IN TABORA REGION

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Abstract: About 10% of Tanzania's area is covered with wetlands, and some of these wetlands are very rich in fish resources. However, there is little comprehensive documentation of the status of fish catches given that since the 21st century there has been an increase in human population and gigantic innovation in fishing gear, something that may affect fishing in wetlands. This study was conducted in the Wembere wetland to investigate the fishing trends in wetland fish resources. A sample of 94 respondents was picked through simple random sampling, and six were purposefully sampled. The results show a very slight increase in the total catch of fish while the number of fishermen increased dramatically, implying a decline in wetland fish resources. Moreover, 97.3% of respondents expected catches per hour to fall to less than 10 kg/hour in 2016, while ten years ago, catch per hour was answered by 89.5% of respondents. The study concludes that the increase in fishermen with the increase in innovation in fishing is a timing bomb for fish resources as the increase of fish in the wetlands is limited. It is recommended that a land evaluation be conducted in order to set a new land use plan in the wetland to rescue fish resources. Also, conservation and protection measures should be strengthened at the local level in order to save wetland fish resources.

Keywords: *Fish, Fishing catch, Fishing trend, Fishery resources, Wembere wetland.*

1.0 Introduction

Wetland ecosystems represent 4% of the Earth's surface (Gosselink and Mitsch, 2000; Ramsar, 2006; Seyedahmadreza, et al., 2011). Wetlands provide spawning grounds for fish and habitat for mammals, migrating birds, and reptiles (Gattenlöhner, 2004; USDA, 2013). Approximately 40% of the world's species depend on these wetlands for survival (Millennium Ecosystem Assessment Report, 2005; Gray et al., 2013). As for fishing, wetlands form a major inland fishing resource in the world (Raburu, Okeyo-Owuor, and Kwena, 2012; FAO, 2014; URT, 2015). However, wetland ecosystems are declining globally (Raburu et al., 2012; URT, 2015; Saifullah et al., 2021), putting pressure on the fishing activities that are vital to communities' livelihoods globally.

The majority of people in Tanzania who reside close to wetland ecosystems rely heavily on fishing as a source of income and food (Hamido, 2012; URT, 2014; WIOMSA, 2019). But in Tanzania, knowledge of fisheries resources is primarily focused on fish stocks in large lakes and the ocean, leaving minor water bodies under- or uninformed (URT, 2015). Due to the dearth of knowledge about these crucial resources, this resource is still subject

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to open access regimes, while minor freshwater fish stocks and wetlands are still at risk from socio-economic activities (URT, 2003; URT, 2007; URT, 2015). Similar to this, a variety of stakeholders are becoming increasingly concerned about the decline in overall catch in some of the main fishing areas (Salum, 2007). Fishermen, processors, researchers, and fisheries administrators are those who have urged action to guarantee the long-term sustainability of the fishing resource (URT, 2015). Despite having an abundance and diversity of fish, Tanzanian wetlands, particularly these small water bodies, have only partially been documented in terms of their fish resources and the level of catch. Anthropogenic factors like fishing activities, rice cultivation, mining, deforestation, and grazing pose a threat to this abundance and variety of fish (Hoverman and Johnson, 2012; WIOMSA, 2019).

Human activity on the Wembere wetland in Tabora has grown due to the area's growing population, which has led to wetland degradation (URT, 2003; URT, 2015). Various scholars in Tanzania have provided documentation of these impacts (Moirana and Nahonyo, 1996; Kikula et al., 1999; Kashaigili and Mahoo, 2005; Kato, 2007; McCartney et al., 2010; IWMI, 2014; Mathew eta al., 2020). Socio-economic activities like farming, notably rice cultivation and grazing, and grazing have a negative impact on wetlands, particularly hydrological systems. There is, however, little research that identifies patterns in fishing catch. Since the situation is unknown, the growing socio-economic activities in the Wembere wetland, primarily rice cultivation, grazing, fishing, and deforestation, may have had an effect on the wetland fish catch. This paper particularly revealed the types of fish present in the wetland and evaluated the trend of fish catch for the identified species to examine the fishing catch trends of the Wembere wetland in the Tabora region.

2.0 Methodology

2.1 Study Area

The study was conducted in Miswaki ward in the Uyui district of the Tabora region. The Miswaki district was chosen as the case study because it is located next to the Wembere wetland, where fishing is the main activity. The ward borders the Wembere wetland on the eastern side of the district, enabling it to be one of the districts that produces rice from the wetland in its wards, such as Loya and Miswaki. As the wetland extends from north to south, it borders the Rungwa game reserve. The Nyahua River originates from this protected area, and it pours its water into the Wembere wetland, making it a very important reserve of fish resources. Due to the presence of swamps and pools that permanently and seasonally retain water, the community in this region relies on Wembere as a source of livelihood, primarily for fishing. The ward contains four villages, but the three selected (Miswaki, Igudi, and Mwamdalagwiwe) are the only ones where the majority of the population depends on wetlands for fishing and rice farming. Additionally, Miswaki ward was selected due to the fact that the majority of fishermen reside there and that fish

Received February 2022
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Available online July 2022

harvests are dispersed throughout the ward (URT, 2010). Therefore, it was easy to obtain information about wetland fishing.

2.2 Data Collection and Analysis

By surveying the 94 fishing households in close proximity to the wetland, data on the trend of fish stocks in the wetlands in account of their total catch quantity were gathered. Through questionnaire surveys, opinions on the catch per unit effort trend were gathered from locals engaged in a range of fishing-related activities in the villages. Yamane 1967 provided the sample size for the 94 respondents from 1464 households.

Using the Yamane formula;

Total Number of households =1464

N = N/(1+N〖(*e*)〗^2)

Whereby *n*=Sample size (?) *N*=total number of the household/population e was level of Precision (0.1)

1464/(1+1464 〖(0.1)〗^2)= 93.6~94 P - Total population (households) which was selected.

Additionally, site trips were made to gather data on fish landings at various fishing locations. Similar information was available regarding surveys of catch landings that were made at particular wetlands landing locations. The village office, the ward office, the district fishery documents, the district council reports, fish traders and processors, and other sources all contributed to the collection of this data over time. All of this data was gathered through documentary reviews in order to obtain precise figures on the number of fish caught each year in the years 2006 through 2016. Both descriptive and regression analysis were used to examine the data that had been gathered. Graphs, quotes, and figures were used to present the analyzed data.

3.0 Findings and Discussion

3.1 Occupation of the Respondents

According to statistics from Wembere about wetlands, shown in Figure 1, about 55.3% of respondents fully depended on wetlands for their fishing activities. This suggests that exploitation of the wetlands' natural resources, such as their forests, fisheries, wildlife, and agricultural resources, has been and continues to be a major source of livelihood for many Tanzanians who reside in wetlands ecosystems as also posited by Ntupwa, (2010). Additionally, Magembe (2000) and Mathew *et al*., (2020) disclosed that the majority of people in many Tanzanian wetlands depend on fishing and farming for a living.

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Figure 1: Primary occupation of the respondents.

3.2 Types of Fish Available in the Wetland

The species of Mudfish (Clarias sp.), which is the most prevalent fish in the wetland and was named by 95.7% of the 94 respondents, makes up the fish resources of the Wembere wetland. They outnumber other species in the wetland due to their proliferation. Additionally, research shows that Lungfish (also known as "*Kamongo*") are abundant nearby mudfish (figure 2). Due to this, Lungfish and Mudfish are the two fish types that are most frequently found in the Wembere wetland. Less common species in the wetland were described as being Tilapia and Ningu.

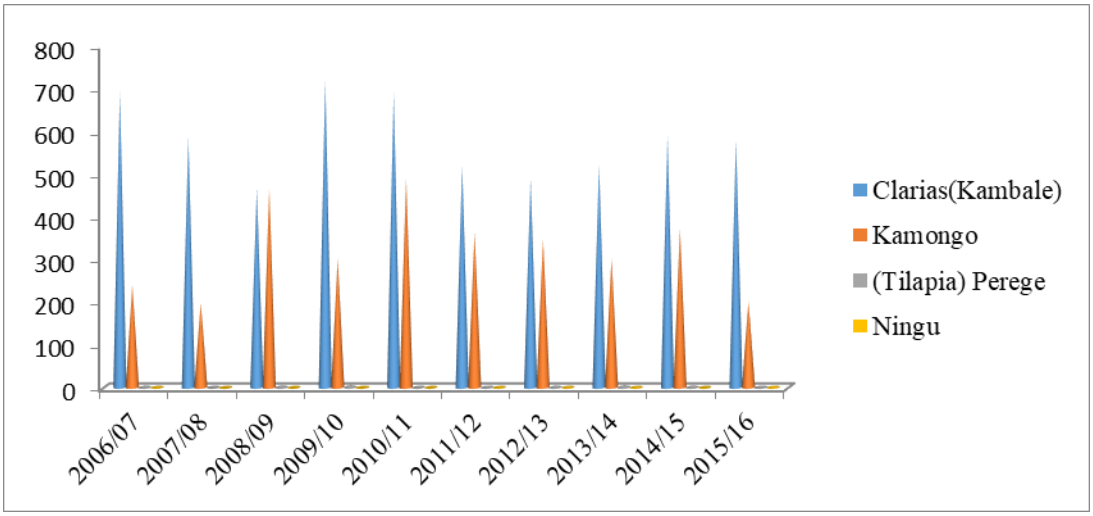

Figure 2: Fish species of the wetland.

The district receives very few tons of fish from these two Oreochromis species (Ningu and Tilapia), but those tons have a major impact on the community's intake of protein. They are therefore in great demand despite their limited availability. This finding is not dissimilar

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to those made by Katikiro et al., (2013) and Mbogoro and Mwakipesile (2010), who claimed that the primary fish genera in minor waters include *Oreochromis* and *Clarias*.

3.3 Trend of Fish Resources Harvest in Wembere Wetland

The overall catches from the wetland of all species between the years 2006/2007 and 2015/16 are shown to have fluctuated throughout the period but have slightly increased (r2=4.9%) as presented in figure 3. Fish catches decreased from 939.8 metric tons in 2006-2007 to 787.95 metric tons in 2007-2008. The quantity of catch increased in 2007–2008 before declining again in 2011–2012 and the following years, despite a slight increase in catch in 2014–2015. As a result, this situation calls for investigating the catch per unit effort trend described in sub-section 3.3.1 below.

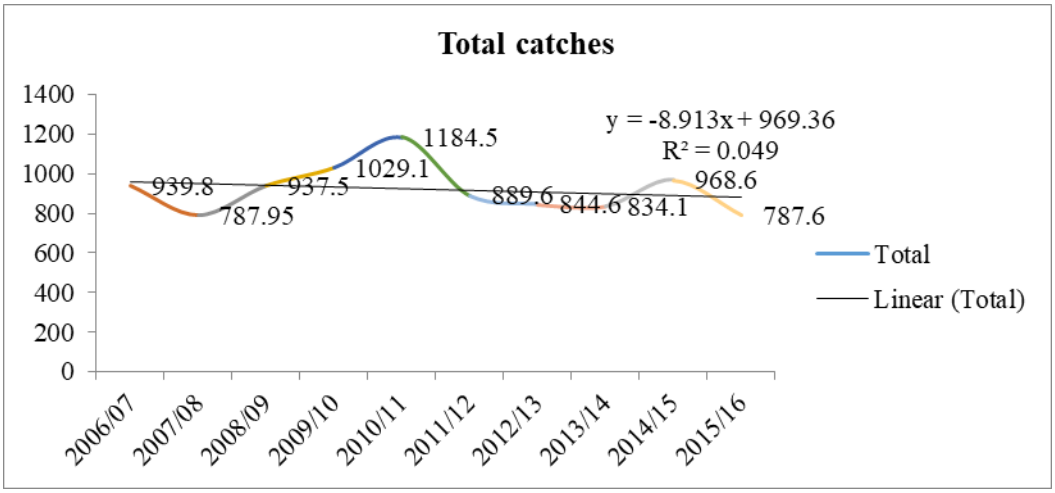

Figure 3: Trend of total fish catch (**in tons**). **Source**: Field data, 2017

3.3.1 Trend of Catch

Key informant interviews indicate a decline in catch statistics and related effort in the wetland. In all villages, the catch per hour in 2006 was usually higher than it had been ten years earlier. Results show that 18.2% of respondents said that the catch per hour ten years ago was more than 20 kg/hour while 23.9% said that the catch per hour ten years ago was between 20 kg/hour and 15 kg/hour; 47.4% said that the catch per hour was between 14 kg/hour and 10 kg/hour; and 10.5% said that the catch per hour was less than 10 kg/hour (Figure 4).

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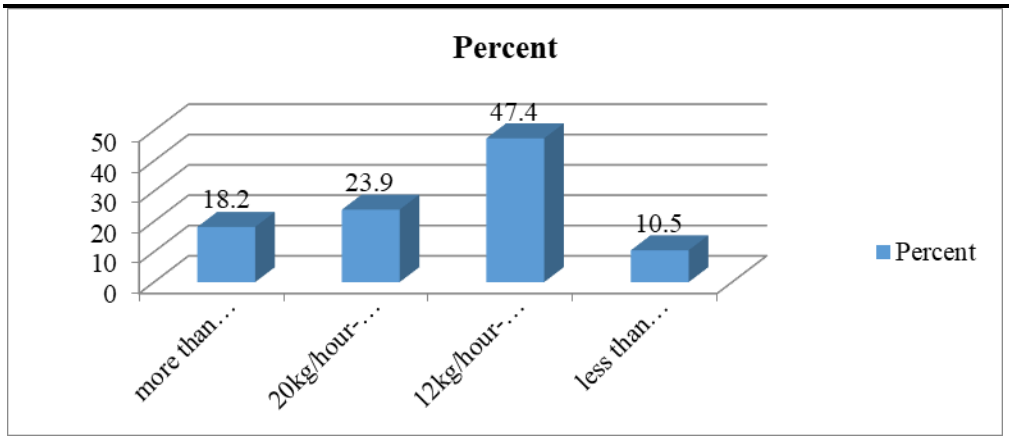

Figure 4: Amount of fish catch in Kg per hour.

When asked to provide the hourly catch sum for 2016, the respondents responded as follows: 1.3% of respondents stated that the catch per hour was greater than 20 kg/hour ten years ago, 0.7% stated that the catch per hour was between 20 kg/hour and 15 kg/hour ten years ago, 1.7% stated that the catch per hour was between 14 kg/hour and 10 kg/hour, and 97.3% stated that the catch per hour was less than 10 kg/hour (see figure 5).

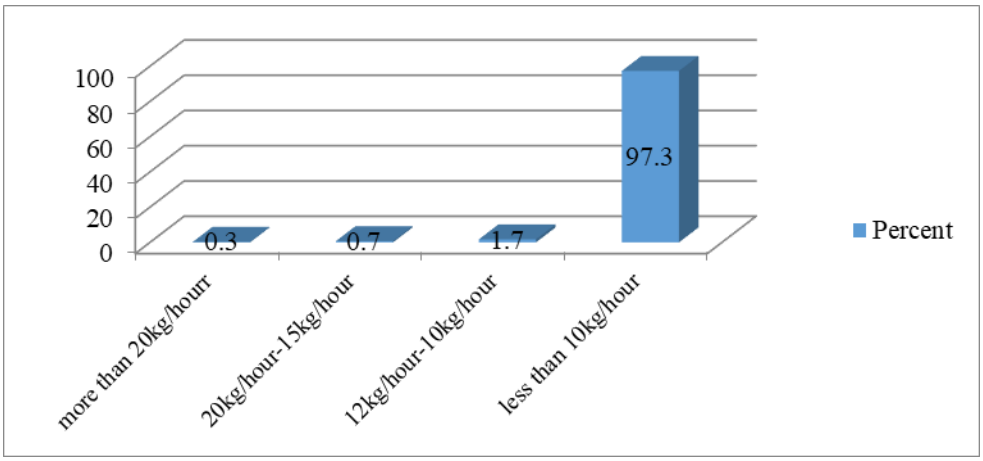

Figure 5: Amount of fish catch in Kg per hour in 2006.

The decrease in catch per hour indicates a decrease in CPUE as well as wetland fish stocks. This is due to the fact that while the quantity of fish caught has stayed constant, the time required to catch a given number of fish has increased. According to Hamido (2012)'s research, CPUE is a reliable indicator of stock abundance; this means that the fishery resources have likely hit their full potential for exploitation and that any additional effort will not result in an increase in catch. A lack of fish for household use is also revealed by data from FGD. Discussion participants lamented the difficulties of living as a result of the scarcity of fish for food in recent years as compared to earlier years. "Ohh, the life is now harder; fish harvests are declining, depriving fishermen's income too," one

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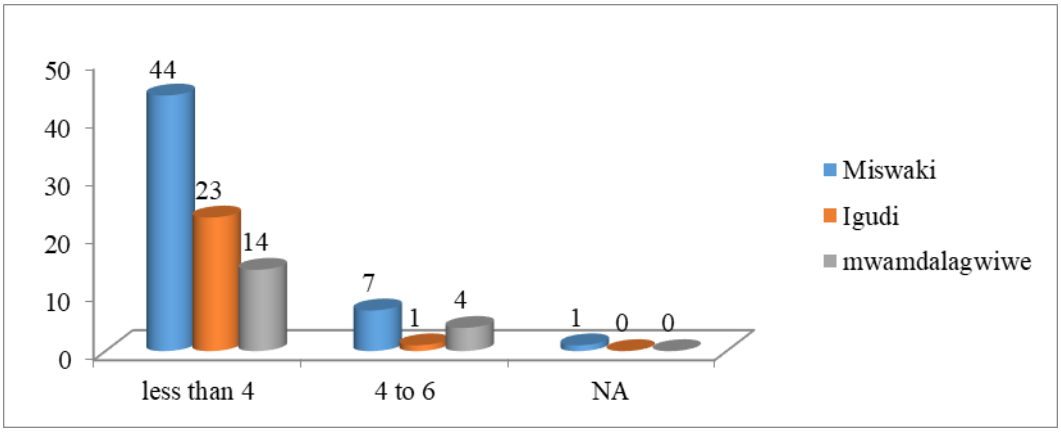
participant said. Most of the respondents assertively responded that the shortage was caused by a decrease in the quantity of fish when asked if the commoditization of wetland fish played a role in it. According to URT (2015), Tanzania's main water bodies are producing less fish, which is a reflection of the state of the fishery resources in the hinterland wetland areas. The theory of resilience, systems thinking, and adaptive governance all stress the need for fishers' resilience to adapt to the trend of decreasing catch in order to guarantee their survival from the wetland (Pisano, 2012; Mathew *et a*l., 2020).

3.3.2 Trends in Wetland Fishnets and Catches

In the village of Miswaki ten years ago, 7% of fishers owned four to six nets, compared to 44% of fishermen who owned fewer than four nets. The other two villages had a similar scenario, showing that few people owned more than four fishing nets while many fishermen owned fewer than four. In contrast, the wetland saw an increase in the number of fishnets possessed per fisher in 2016 (see Figure 6). Four or more fishnets were cited by 37% of respondents, while the percentage of respondents who said they owned fewer than four fishnets has decreased from 44% ten years ago to 9% today. In the village of Mwamdalagwiwe, the proportion of fishermen who own four to six nets rose from 4% to 9% between 2006 and 2016, and a new number of nets has reportedly been discovered in recent years. This demonstrates that, in contrast to recent years, CPUE was extremely high in the previous ten years.



NA* *Not Answered*

Figure 6: Ten years past respondent's fish nets amounts possession.

The statistics in Figure 6 above demonstrates that, in comparison to the current, the number of fishnets owned by fishermen over the previous ten years was extremely low. This suggests that when fish were plentiful, it was superfluous to own numerous fishnets. The ecology of the wetland was more stable than it is now, which added to the fish abundance. Contrary to what was predicted ten years later (see figure 7), this data shows that there were significantly fewer fishnets in the marshes in 2016 than there were in 2006.

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Consequently, fishing operations also increased. The presence of more fishing gear in a wetland indicates an increase in fishing activity, which leads to an increase in fishing pressure. This scenario suggest that Wembere wetland will begin to be affected by conflicting demands for use, especially in relation to food security, fisheries, and livestock activities, which have been seen to increase in the area.

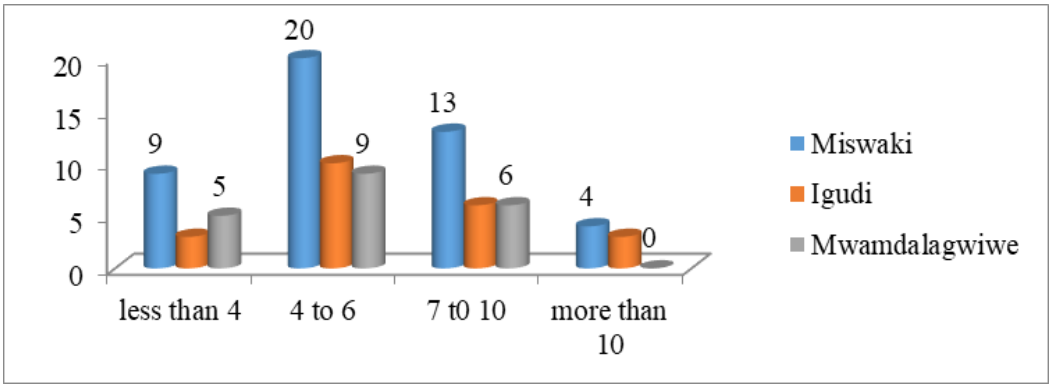

Figure 7: Current respondent's percentage of fishnets quantities.

According to district fishery officer data, there were 1845 fishnets listed in the wetland in 2006 and 2721 in 2016. The wetland's fish resources decreased as a result of this rise. Thus, increasing the number of fishnets appeared to be a solution to sustain CPUE (catch/net). This dynamism supports the hypothesis put forth by Katikiro et al., (2013) and Ojea, et al., (2020) that fishing communities continuously adjust to environmental changes by changing the variables that affect a fishery's dynamics. Such modifications to a fishery might include a drop in fish supplies, a collapse of the market, or the disappearance of a significant species.

During in-depth interviews, the district fishery officer revealed that there has recently been a rise in the market for commercialized fish in the Wembere wetland on a regional and national level. Wetland fish resources have been promoted for trade by both local and international fish traders. The increase in all-year roads that cross the wetland has also added to this. He echoed the statement that; "*fishery resources in the wetland have become commoditized and are now preferred by the majority of people*," which was also stated by another speaker. Wetlands now draw more people for fishing as a result of this commercialization, but ultimately some of them start engaging in other activities like rice farming. The results of Pramod et al., (2014) and Daniel et al., (2022) in the wetlands of Nepal and Nigeria respectively also mentioned this diversification of livelihoods.

Additionally, it was commonly mentioned during FGD in all villages that it was difficult to find traditional canoes for fishing. Since the government has limited the use of these trees in the construction of canoes to protect these trees, which are primarily impacted and take time to regenerate, fishermen have switched from using large tree-carved wooden canoes,

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known as "*Mihama*," to simple timber canoes (Figure 8). The same issues were brought up in research on artisanal fishing gear in Tanzania by Sobo (2004) and in the Fiji Islands by Singh et al. (2005). As a result, choosing to use more fishnets has been a mitigating strategy for the shortage of fishing gear.

Figure 8: Traditional canoe made of big tree ('*Mhama*') in Wembere Wetland.

Despite the very slight increase, the number of fishing vessels has usually remained constant in recent years. This is a result of the local woods' decline, which has affected the production of canoes. In contrast to the wetland, where Hamido (2012) found that despite trends in fish value rising, the number of vessels has stayed constant, the number of vessels in coastal wetlands has been increasing, with a sharp increase coinciding with those trends. This suggests that the quantity of fish caught at a particular amount of effort is a linear function of the fish stock and is therefore proportional to it.

4.0 Conclusion and Recommendations

This study provides a contribution to our understanding of the trend of fish catch in a wetland. The study found a very slight increase in the number of fish caught landing in a wetland. The comparison between the trend of the amount of fish caught and the trend of the number of fishermen provides a clear picture that, although the amount of fish landed has slightly increased, the number of fishermen is rapidly rising. This is possible as far as human-nature interaction theory is concerned because, despite natural or man-induced shocks, interactions between humans and nature are indispensable. Also, despite the increase in catch, CPUE has declined in the wetland; fish for food has become very scarce compared to 10 years ago. All this evidence suggests that Wembere's fish resources have declined. Therefore, ongoing human activities on the Wembere wetland

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affect the fish resource and may lead to its collapse if things are left as usual. Based on the findings of this study, it is recommended that conservation and protection efforts be stepped up nationwide, not just at Ramsar sites, in order to preserve wetland fish resources.

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