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EXACUTIVE SUMMARY

Fishery resources in Malagarasi river catchment are under threats. In the 2006 endemic Karomo tilapia “*Oreochromis karomo*” reported a critical endangered fish of the world. Afterward, there is no conservation initiatives taken towards fishery resources in Malagarasi river and its catchments. Updates on the current population status of critical fish and its habitats are missing. The present study aimed to increase awareness of the local community on environmental conservation and initiate conservation actions towards the critically endangered *Oreochromis karomo* in river Malagarasi and Lake Nyamagoma. Conservation education on sustainable resources uses disseminated to the local community from Uvinza District. Fishery survey was conducted to observe the occurrence of critical fish in the river and the Lake. The community in Uvinza had no understandings on the threats to the fishery resources and no conservation measures previously taken towards fishery resources in Malagarasi catchment. There was no critical fish observed in the river Malagarasi, showing that the river ecosystem does not support existence of the endangered fish. There was high variation in the number of occurrences between *Oreochromis karomo* and other fish species in the Lake. The critical fish observed in the lake Nyamagoma showed importance of the lake ecosystem for the fish to inhabit. Assessment on the population trends and progressive fisheries monitoring on in Malagarasi catchment is a vital to update population status and produce baseline information of the resources including *Oreochromis karomo*.

Keywords: *Oreochromis karomo*, Malagarasi river, Lake Nyamagoma, Conservation education

1.0 INTRODUCTION

Malagarasi river catchment represents one of the largest and most significant transboundary natural ecosystems in Africa. The catchment constitutes about one-third of the catchment area of Lake Tanganyika (Ramsar, 2000) and contains ecosystems both nationally and internationally important for water, food, medicine and energy for socio-economic development of the surrounding communities. The ubiquitous and abundant supplies of many resources in the past have resulted in minimal concern about their conservation and sustainable utilization. However, in Malagarasi wetland aquatic ecosystems and their resources are threatened due to unsustainable human developmental activities within the catchment.

The community in Uvinza District is among the dependent of the Malagarasi catchment for agriculture, livestock keeping, salt extraction, forestry for building poles, timber, wood and charcoal, and fisheries activities. All these are the cause of threats to Malagarasi wetland and its resources. Continuous destruction of aquatic plants along Malagarasi River have been contributing to conversion and deterioration of the habitats and severely, loss in breeding and nurseries grounds for fish. The challenge emphasizes importance of providing environmental conservation education to the community in Uvinza District to increase awareness and understandings on the fishery resources use and conservation. During implementation of the study the catch assessment survey was conducted in Malagarasi river to asses on the presence of a critical endangered *Oreochromis karomo* and its critical habitats. Recently, the threats on the sustainability of fishery resources become a serious issue as at present, it's difficult to find a critical endangered *Oreochromis karomo* in Malagarasi river. Consequently, presence of other economic and ecological important fish species is reported to be unknown. Therefore, the challenges emphasized expanding the study area to increase awareness and conservation understandings of the local communities and further, conducting assessment survey on availability of *Oreochromis karomo* in other parts.

2.0 METHODOLOGY

2.1 Description of the study sites

The study conducted in Malagarasi river and the lake Nyamagoma. The sites are the part of Malagarasi Wetland Ecosystem which is at the height of 1,069 m above sea level. Malagarasi Wetland occupies about 4.5% of the Tanzania total land mass. The wetland consists two known lakes namely, Lake Sagara (open with maximum depth of ca 3.5m) in the south and Lake Nyamagoma (choked with microphytes with maximum depth ca 2.5m) in the north (Nkotagu and Athuman, 2008). The lakes are reported by the local community to exist since 1930s. According to their reports, in 1990s the Lake Nyamagoma undergone drying due to severe drought. Revolution in the depth and size of this lake observed in late 1990s following change in the rainfall regimes from which the lake is extremely receiving water from Igombe, Kigosi, Moyowosi, and Malagarasi rivers. Malagarasi river fills and empties water to and from Lake Nyamagoma during rain and dry seasons respectively. The inflows and calm conditions contribute the lake an important habitat for mammals, migratory and resident birds, fish and

variety of plant species. Fishery resources from Lake Nyamagoma are important for direct use of about four connected Districts i.e. Uvinza, Kibondo, Kasulu and Kaliua in Kigoma and Tabora regions.

Lake Nyamagoma is located about 200 km North East of Lake Tanganyika. The lake found at the Geo location between 4°57'53.47"S, 30°56'22.12"E and 5°0'8.22"S, 30°57'41.34"E and 5°3'3.64"S, 31°15'27.77"E and 4°56'12.93"S, 31°17'1.10"E. The Lake Nyamagoma is drained by annual and perennial rivers namely, Igombe, Kigosi and Moyowosi along with Malagarasi River. During the dry season, the lake empties the water into the Malagarasi River direct to the Lake Tanganyika while, during the wet season Malagarasi river overflows into lake Nyamagoma. The noted maximum depth of the lake is at 3.1 metres. The lake is approximately 55 Km² and occur within the boundaries of the Malagarasi-Muyowozo Ramsar Site (MMRS), the country's first Ramsar Site and third-largest in the world (Ramsar, 2000).

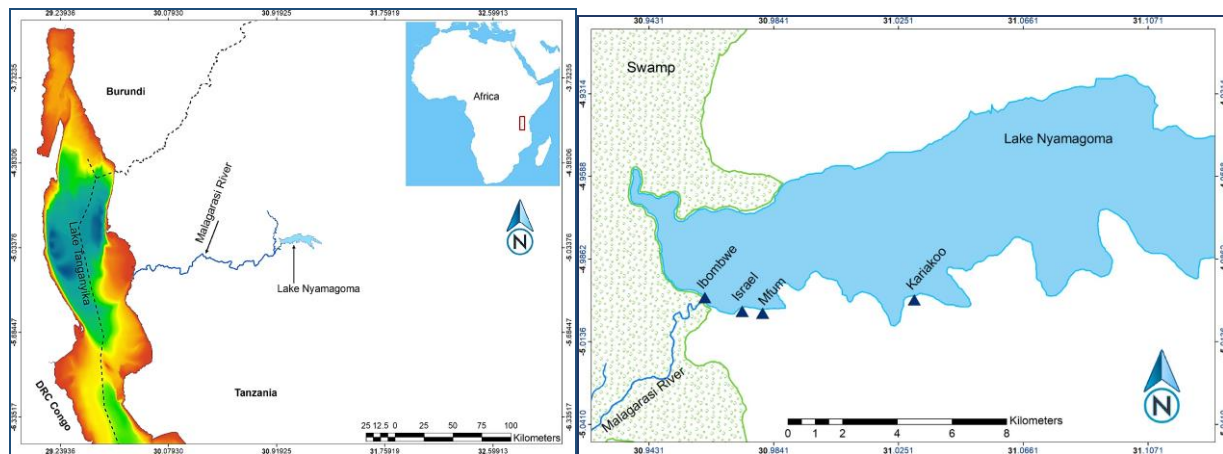


Plate 1: Map showing the location of the surveyed Lake Nyamagoma and sampling sites

The vegetation supported by these permanent swamps around Lake Nyamagoma is dominated by emergent sedges (*Cyperaceae*, most notably *Cyperus papyrus*), grasses (such as *Vossia cuspidata*, *Leersia hexandra*), 'African wild rice' (*Oryza barthii*, *Andropogon africanus*), reeds, *Hemarthria natans*) and cattails (also called *bulrush*, *Typha* species) (Plate 2)



Plate 2: Some species of macrophytes vegetation dominating Lake Nyamagoma and the local made vessels commonly used during fishing activities in the lake.

3.0 RESULTS

During this study period, a critically endangered *Oreochromis karomo* was among the fish species reported in the catches by the local community from Kasisi and Mtegowanoti wards. The fish has been occasionally caught from some of the fishing sites in the lake Nyamagoma including Lake Sagara. The species is currently, moving from the river to the lake. Its movement contributes to change in its area of extent. Change in habitat of this species (from the river to the lakes) is an influence of sheltered conditions of the lakes Nyamagoma and Sagara. Therefore, as a part of Malagarasi wetland Fish Catch Assessment Survey was also conducted in Lake Nyamagoma covering the landing sites namely, Kariakoo, Mfum, Israel and Ibombwe to determine presence of *Oreochromis karomo*.

3.1 MAJOR ACTIVITIES

3.1.1 Improve community awareness and understandings towards sustainable resources use, conservation and management of fishery resources in Malagarasi catchment.

In Uvinza District a discussion meeting was conducted with the governmental leaderships purposely to introduce research activities taking place in their district. District Executive Officer and the Resources managing Officers was the key persons involved to discuss on the challenges facing Malagarasi wetland and the status of freshwater resources. At Mtegowanoti and Kasisi Wards awareness meetings with fishery community (fishermen and Beach Management Units (BMU) members from four landing sites namely, Kariakoo, Mfum, Israel and Ibombwe (Figure

3) were also, conducted. This awareness meeting contributed to explore further ideas and thus, provided a baseline information on the availability of the critical fish species in Lake Nyamagoma. Therefore, visiting to the landing sites was done for the collection of primary information and confirmation on the availability of Karomo tilapia fish in the lake.

3.1.2 Formation and use of Beach Management Units (BMU) as citizen scientists for collaborative monitoring and management of fishery resources

Three Wards namely, Kasisi, Mtegowanoti and Chagu have 138 BMU members (of them 22 are females), 107 BMU members (of them 22 are females) and 151 BMU members (of them 38 are females) respectively. Discussion meetings with BMUs were conducted to identify achievements, challenges and way forward towards management of fishery resources in Lake Nyamagoma. Strengthening resources management team for Lake Nyamagoma is possible to collaborate on the management works towards conservation activities. The BMUs insisted to participate on the conservation work through influencing other fishers to use legal fishing gears and even joining them in the management of the resources in the lake Nyamagoma. The members are at present capacitated by few and small local made boats (carry only five (5) persons) for use during resources management in the lake, and facilitated on the fishery data collection by the use of electronic data entry system so that understanding the capacity of the lake through determination of catch per unity area and harvesting efforts.



Illegal fishing, lack of knowledge to know how, and poverty of the local communities are the primarily reported challenges to perform management and monitoring activities. Presence of Crocodiles is also reported of which in the past one (1) year about 93 fishermen attacked to death and loss. Absent of modernized fishing vessels and gears i.e. outboard engine and protective gears are also leading to failure to fulfil their duties. Unfortunately, it is very difficult for the BMUs to work under these circumstances to drawback illegal fishing and overexploitation of fishery resources in Lake Nyamagoma.

To overcome the challenges this study suggests on provision of modern fishing gears and vessels as an alternative way for the better of mankind and management of fishery resources including the critically endangered *Oreochromis karomo*.

3.1.3 Training on establishment of sustainable resource use and resilience economic activities

During a training meeting the major economic activities (agriculture, fishing, firewood and charcoal production) practiced by local community in Uvinza District were reportedly to be conducted in the community. The activities observed to be unsustainably conducted. This report agrees Kashaigili (2010) that an increase in anthropogenic activities have had negative impacts to Malagarasi catchment resources including fisheries resources. Agricultural expansion continues to be the main driver of deforestation, forest fragmentation and the associated loss of biodiversity (FAO and UNEP, 2020). Following this observation the community is advised to improve the use of available resources through application of agroforest technique (cultivation crops with trees in the same farm) and avoid conducting agricultural activities along the river bank. Fish farming techniques was also introduced to inform the community on the possibility to produce some fish species in cages and ponds for their own uses. Additionally, training of the youth from three (3) primary schools was done and then, organized to form a representative group to network for conservation activities through production and raising trees nursery to be planted around their homes, school compounds and surroundings.

3.1.4 Formation of conservation networks to collaborate on management and monitoring of fishery resources in Malagarasi river

Beach management Units (BMU) members who previously worked in different landing sites of Lake Tanganyika were used to form conservation network. The groups were before not actively working. Thus, through the project fishery community called to form active BMU groups that will collaborate and work on the management activities in Malagarasi river. Conservation network is therefore, working together for conservation of the river and the lake Nyamagoma. For effective functioning of the team Fisheries Officer from Uvinza District assigned to lead the groups and help on providing of important guidelines for them performing well. Due to some difficult to find the critically endangered *O. karomo* in the river, the same members were assigned to work as *citizen scientists* who will help to collect the information on availability of the fish. Thereafter, available information will be submitted to the research team for further actions.

The youth from three primary schools (Ilagala, Kabuyange and Tanganyika) were also trained on resources use and environmental conservation activities. After this training the youth organized to form conservation networks for continuous working on their surroundings. The groups were initially prepared to working as the conservationists. A total of 7 Kilograms of Gmelina trees seeds provided to the joining three schools for the production and rearing of trees nurseries to be planted at school compounds as initial procedure to manage conservation works. Under close supervision of their teachers the youth advised to produce tree nurseries. A total of 1120 Orange trees and 1000 teak trees were provided to three schools (Ilagala, Tanganyika and Kabuyange primary schools) for planting in the open areas of their school compounds. The trial is effectively expected to impact the youth growing with trust to conserve the environments.



3.1.5 Fishery survey to assess current status and critical habitat for the Critically endangered *Oreochromis karomo* in Malagarasi river and Lake Nyamagoma

During this field work, under the support of BMU members from Kasisi, Mtegowanoti and Chagu Wards fishery survey was conducted in nine (9) fishing sites to assess occurrence of the critically endangered *Oreochromis karomo* in the lake. The group of BMU members who are working on the fishery management and presentation of the information to the fisheries officer was also formed. The locally made dugout canoes, hooks and fleets of monofilament gillnets of mixed mesh sizes in the range of 2.0 – 6 inches were used for fishing in the lake. Fishing nets were arranged in a way that ensured representation of all possible habitat characteristics in the study area and covering as much of the depth profile as possible. Fishing was also, done at the inshore water approximated 50m to 100m away from the shoreline at average depth of 1.2m over night. About ten (10) hours were spent for fishing to hauling. Different fish species including *Oreochromis karomo* were collected and photographed. The fishes were locally identified and biometric data (length, weight) for *Oreochromis karomo* were taken (Table 2) for further assessment.





Plate 3: *Oreochromis Karomo* fish caught in Lake Nyamagoma

3.1.6 Establishment of suitable conservation and restoration strategies, suggest creation of protected sites

It was properly presented to Uvinza District leaderships for consideration and preparation of the discussion on the alerting status of the Malagarasi River ecosystems, decline of fishery resources and ways forward for the future. This project provides a primary information on the areas where the critical fish can be found and help to determine important procedures before actions towards the site-specific conservation of water bodies and its resources in the Malagarasi catchment. Therefore, further monitoring to assess critical areas, abundance and distribution of the *Oreochromis karomo* through environmental DNA is suggested due to some of the difficulties in during settings of the fishing gears in the river and the lake. At the end of the project activities a policy brief will be dedicated to the authorities suggesting on the improvement of Management and monitoring on the status of the fish and habitat within the area of extent and any newly discovered sites.

3.1.7 Publicize the results for information and scientific use

This annual report is for the publication in the species conservation website. Further the report for publication in any selected international journal will be followed after completion of its preparation.

4. CONCLUSION AND RECOMMENDATION

This project helped to discover low understandings of the local people and intensive resources use, poor participation in conservation of fisheries resources, low proportion between the *O. karomo* and other fishes, movement of the critically endangered fish species beyond the extent area and poor strategic conservation approaches. To overcome the current situations for the resources sustainability including the critically endangered *karomo* it is recommended to:

- Establish monitoring and evaluation systems to determine fish stock, distribution, and diversity of the endangered species and others, determine the rate of its recovery.
- Define boundaries: due to change/increase in extent area of the fish. Assessment on fishery resources and determination of its movement should include Lake Sagara and other small and nearby water bodies.

- Develop local rules such as specifying period time, techniques and levels of harvesting the resources. It will help to avoid overfishing and undersize fishing.
- Sustain provision of environmental conservation education and public awareness programs for youth and fishery communities around the Lake Nyamagoma for understandings and participation in management.

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