

Final Evaluation Report

Your Details				
Full Name	Joshua Mwendwa Benjamin			
Project Title	How do anthropogenic activities influence fish and macroinvertebrate communities in the Mara River Basin?			
Application ID	38881-1			
Date of this Report	10 th Jan 2024			



1. Indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
What is the status of			\checkmark	
fish, particularly				
Labeo victorianus, in				
the Mara River				
Basin?				
What are the trends			\checkmark	
of			-	
macroinvertebrate				
composition and				
distribution along the				
longitudinal gradient				
of the Mara River?				
What is the status of			\mathbf{V}	
trace elements in the			v	
Mara River?				

2. Describe the three most important outcomes of your project.

- a) Labeo victorianus, which is critically endangered in the Mara River Basin, is, in fact, the most abundant fish in the river system.
- b) During the expedition in the Mara River, we discovered an interesting phenomenon between the mayfly (Tricorythidae larvae) and the blackfly (Simuliidae pupae), known as phoresy. This is the first record in Africa that has yet to be documented elsewhere. Phoresy in the Mara River was observed in the Tricorythidae taxa, with the Simuliidae pupae latched on the head of the host organism. The phoretic association between Simuliidae pupae and Tricorythidae larvae in the Mara River was only observed at site M9 (New Mara Bridge).





Figure 1: Lateral view of Tricorythidae with pupae of Simuliidae attached to the head segment in Mara River.

c) Thirty-four macroinvertebrate taxa were recorded in the Mara River between 2021 and 2023. Differences in benthic taxonomic composition were evident among the Mara River sites (**Figure 1**). The macroinvertebrate composition in the Mara River's upstream reach differed from the downstream. The benthic composition in the middle reach had similarities to that of upstream and downstream reaches. The PERMANOVA test indicated that taxonomic composition between the Mara River reaches differed significantly (p<0.001, number of permutations 999). However, the taxonomic composition was not significant based on the year or month of sampling (p<0.101 and p<0.582).



Figure 1: NMDS of the macroinvertebrate composition across different river reach. The blue, green, and red dots represent sites within distant reaches of the Mara River



3. Explain any unforeseen difficulties during the project and how these were tackled.

Initially, the plan was to conduct the sampling from the headwaters to the mouth of the Mara River in L. Victoria. Sampling in Tanzania was challenging since the permitting process took quite a long time. The permits were granted early this year, 2024, and we will soon be sampling in Tanzania this summer.

4. Describe the involvement of local communities and how they have benefitted from the project.

To foster conservation efforts in the Mara River Basin, I have actively collaborated with local environmental and conservation entities, including the Mara River Water Resource User's Association and the Maasai Mara Wildlife Conservancy Association. Our joint initiative involves training local community groups to monitor environmental health in the Mara River Basin regularly. An integral part of this initiative is the creation of user-friendly invertebrate identification guides tailored for this ecosystem. These guides, paired with the South African Scoring System technique (SASS5), will enable comprehensive evaluations of the Mara River's health and integrity. Our insights will guide stakeholders toward effective conservation strategies, emphasizing the significance of these taxa as environmental health indicators for the Mara River.

As part of the broader impacts of my current research, I have conducted workshop training in 3 pilot universities in Kenya, including my alma mater, Karatina University, and Egerton University. I also conducted training at Maasai Mara University since it's the only University around the Maasai Mara ecosystem where we conduct our research. I have established networks in these institutions and primarily trained undergraduate students.

5. Are there any plans to continue this work?

Yes. Since I have developed macroinvertebrate biomonitoring techniques for the Mara River Basin, I would like to continue engaging the local communities in monitoring the water quality in this system using macroinvertebrates. Furthermore, this biomonitoring technique can be upscaled nationally to monitor other rivers in Kenya. Implementing this technique nationally can help Track water quality and help restore degraded habitats and river catchments in the face of a changing climate. I will seek other funding to continue this work in the Mara River, a critical basin in the Maasai Mara-Serengeti ecosystem, and other rivers around the Lake Victoria Basin.

6. How do you plan to share the results of your work with others?

I will present this work at the University of Cambridge during the Student Conference on Conservation Science (SCCS) in March 2024. This will be a great audience to share this exciting research. Additionally, I have several manuscripts lined up for



publication. Two of the manuscripts about macroinvertebrates will be out potentially by the end of 2024. I will also present my findings at several Kenyan universities and University of Florida universities. In June 2024, I will present at the National Museum of Kenya during the 1st international scientific conference.

7. Looking ahead, what do you feel are the important next steps?

I want to continue investigating the causes of fish kills in the Mara River annually. This phenomenon severely threatens the dwindling fish population in the Mara River. If not urgently addressed, it may further decline these species in the Mara River Basin. Below are images showing the annual fish kill that occurs in the Mara due to the issues related to pollution and especially changes in the physicochemical parameters of water, i.e., dissolved oxygen levels and water temperature.



Furthermore, the unforeseen dangers of climate change might exacerbate conditions in the Mara River, thus impacting the biodiversity in this basin.



8. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the Foundation receive any publicity during the course of your work?

Yes. I used the logo during my presentation at the International Congress on Conservation Biology (ICCB) 2023 in Kigali, Rwanda, and during other subsequent presentations at the University of Florida and in Kenya.

9. Provide a full list of all the members of your team and their role in the project.

10. Any other comments?

This expedition has been one of the best in the Mara River. While sampling, we noted that fish did not occur in the upstream reach of this river, characterized by high altitude. This river is one of the biggest within the Maasai Mara and Serengeti ecosystem. Being the only perennial river system in this catchment, the Mara River supports a huge wildlife density. However, the river is also home to several crocodiles and hippopotamus populations, which might pose a danger while sampling. Thus, sampling was conducted carefully and with the aid of additional security offered by the rangers at Mara Conservancies. Also, sampling was majorly restricted on the Kenyan side of the Mara River due to the available permits in Kenya, and it took some work to sample in the downstream section of the Mara River in Tanzania due to the need for more permits. The permitting in Tanzania has taken some time, but we finally acquired the licenses. Therefore, future expeditions in 2024 will majorly focus on the Tanzanian section of the Mara River. The annual crossing of the wildebeest in the Mara River is an event that could add wildlife subsidies to the river and likely alter the nutrient levels, which could, in turn, influence the fish and aquatic insect biodiversity in this river.