

Final Evaluation Report

| Your Details | |
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| Full Name | Alex Nehemia |
| Project Title | Increase livelihoods opportunities by monitoring fish population and human activities in the catchments along the Lake Nyasa and Ruhuhu River, Tanzania |
| Application ID | 30015-1 |
| Grant Amount | £5,984 |
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| Date of this Report | 5/1/2021 |

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 |
|---|--------------|--------------------|----------------|---|
| To assess the historical impact of degradation of catchments and unsustainable fishing practices on the livelihood opportunities of local communities nearby the Lake Nyasa and Ruhuhu River and the neighbour town centres | | | | Social survey was used to collect historical information on the impact of catchment degradation and use of illicit fishing and farming activities on the livelihood opportunities of local communities. The results of survey indicating that catchment degradation has caused fish mortalities and migration as a result fish catch has been declined. |
| To identify catchment areas along the Lake Nyasa and Ruhuhu River which are impacted by deforestation and extensive, uncoordinated farming activities | | | | We managed to identify four catchments which have been degraded because of deforestation mainly due to illicit farming activities. In these areas we found elevated concentration of total phosphorus and nitrogen compared to other catchments which acted as control in this research project. |
| To assess whether the degradation of catchment and overfishing has altered the effective population size, gene diversity, and gene flow within and among populations of <i>Opsaridium microlepis</i> . | | | | The results indicate that catchment degradation have negative effect on the patterns of gene flow and effective population size. |

2. Please explain any unforeseen difficulties that arose during the project and how these were tackled.

During the first field campaign, we could not survey many catchments to identify problem of degradation because of the outbreak of Coronavirus (COVID-19) disease. The residents along the catchment areas were afraid to be interviewed because they thought that they could contact Coronavirus disease. During the field work high rainfall in the study area affected our movements to different catchment areas and we could not be able to get enough tissues samples of *Opsaridium microlepis*. For that case, we were forced to plan for another sampling trip that increased the cost of sampling. Other challenges include delaying of delivering of the laboratory consumables. Sometimes it took about 3 months for a supplier to

deliver some of the laboratory consumables. To tackle this, we were supposed to reschedule some of the project activities.

3. Briefly describe the three most important outcomes of your project.

- i. This project has contributed to increased awareness on the need of involving the community in all steps of decision making. For instance, some members of the community from Nyasa district were complaining that their leaders were not involving the members of local communities in solving their problems. This has contributed to poor land-use planning allowing farming in the catchments area and therefore nutrients and other agrochemicals are eroded in water bodies causing devastating effects on fish productivity. Involvement of the community from the study area in this project helped the research team to identify various factors that have contributed to the degradation of the catchment areas that act as spawning habitats for various fish species. Among the factors pointed out by the community is poverty and lack of the knowledge on the link existing between the catchments and fish productivity.
- ii. Enhanced livelihood opportunities to the local community as the knowledge given to students at primary and secondary level and the local community in the study area will improve management of habitats areas of various species. The research team educated students and the other members of the local community on the importance of the catchments on fish productivity. The team advised them to refrain from all illicit farming activities (see Fig 1 and 2) that degrade the spawning habitats of fish. Proper management of the fish spawning areas will increase the fish catch and will contribute to increase in income generation and food security in the area.
- iii. Improved knowledge on the effects of nutrients from agricultural activities on the genetic diversity of *Opsaridium microlepis*. The results indicate that the concentration of total phosphorus and nitrogen was higher in degraded catchments areas. Heterozygosities were also found to be low in degraded catchments areas compared to relative pristine catchments. It might be true that other various fish species might be negatively affected with the on-going catchment degradation along the shore of Lake Nyasa.



Figure 1: Newly catchment area cleared for agriculture at Lituhi along the Lake Nyasa.



Figure 2: A catchment area transformed to rice farm at Hinga along the Lake Nyasa.

4. Briefly describe the involvement of local communities and how they have benefited from the project.

Despite the challenges of a Coronavirus disease that affected the participation to some extent, the communities were happy with this research project. Local communities participated in household surveys, focus group meetings (Figure 3), and key informant interviews. In total 100 questionnaires were provided to different group of communities including, fishers, households, students and extension officers.



Figure 3: A research team conducting discussion with fishers and some residents of Lituhi on the importance of conserving catchment area along the Lake Nyasa

The project involved also some members of the communities during sampling of sediments and tissues of *Opsaridium microlepis*. The research assistants from the community were benefited financially from this project. In some areas of the catchments, it was their first time to see researchers who provided awareness to them on the importance of conserving the catchments areas that acts as spawning areas for various fish species. They were not aware that if they clear trees and bushes along the shore of rivers and lakes, they may be causing decline of fish catch resulted from the reduced genetic diversities, effective population size and changes in the migration patterns for various fish species. Our research team provided to them knowledge on the importance of preserving the natural habitats in the catchments. From the knowledge gained, they assured us that they will stop clearing of the trees and bushes for agriculture. This will help to improve the habitats

of fish species and hence fish productivity. The community will benefit from increased fish catch that will improve their income and nutritional security.

5. Are there any plans to continue this work?

During the fieldwork, the team discovered that apart from illicit farming and illegal fishing activities, the effluents from coal mining might potentially contribute to the reduced genetic diversity and effective population size observed. There is some coal mining located on the upstream of the rivers that discharges effluents into Lake Nyasa. The research team and the communities along the catchments proposed this investigation to be carried on. The team therefore recommended continuing with further research to specifically identify the contribution of coal mining effluents on the reduced genetic diversity, effective population size and patterns of gene flow for various fish species.

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

Currently the reports of two special research projects from two BSc students who worked on the part of research project objectives are deposited at Sokoine University of Agriculture and other students are able to access the reports. However, we are preparing the manuscript for presentation at the international conference and publication of the conference proceeding and international peer-review paper.

7. Timescale: Over what period was the grant used? How does this compare to the anticipated or actual length of the project?

The period planned for this project was supposed to be between February 2020 and February 2021. However, due to unforeseen factors mentioned in above, the grant was used between February 2020 and April 2021. It was used to support social survey and fieldwork, laboratory work and analysis. The factor contributed to the extension of the period for this project is the impact of COVID 19 that caused the Ludwig Maximilian University of Munich in Germany to stop the fragment analysis service for a while because of the lockdown. Consequently, the fragment analysis findings led to the project's delay in completion.

8. Budget: Provide a breakdown of budgeted versus actual expenditure and the reasons for any differences. All figures should be in £ sterling, indicating the local exchange rate used. It is important that you retain the management accounts and all paid invoices relating to the project for at least 2 years as these may be required for inspection at our discretion.

| Item | Budgeted Amount | Actual Amount | Difference | Comments |
|-----------------------|-----------------|---------------|------------|-------------------------|
| Institution overheads | £614 | | -£614 | We were not charged the |

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| | | | | institutional overheads. This fund was planned for other research project activities |
| Nutrient analysis | £689 | £799 | +£110 | The extra amount was used to pay technician |
| Stakeholder meetings | £473 | £473 | | Was used as budgeted |
| Fragment analysis | £731 | £265 | -£466 | We planned to analyse four plates. The price for the analysis included the price of LIZ size standard and Formamide. The LIZ standard and Formamide were given with offer. The first two plates planned for determination of the effects of dilution were analysed. The cost for fragment analysis was reduced and the extra fund was allocated to other research project activities. |
| Collecting of sociological data and tissues sampling of <i>Opsaridium microlepis</i> | £1306 | £2162 | +£856 | |
| Application fee and transport to Dar es Salaam | | £22 | | We were not charged the application fee. The difference indicated was planned for other research project activities |
| Lodging and food during field work for two researchers | | £1450 | | Because of the pandemic COVID 19 virus and high amount of rainfall during the first field campaign, we had to plan for another field campaign to collect sociological data and sampling of sediments and tissues of <i>Opsaridium microlepis</i> . |
| Allowance for field assistant | | £240 | | The cost became high due to the second field activities |
| Car fuel | | £450 | | The cost became high due to the second field activities |
| Purchasing reagents and consumable materials for molecular analysis | £2081 | £2323 | +£242 | |
| Sampling bottles | | £166 | | Used as budgeted |
| 5L of 99.9 % ethanol | | £63 | | Used as budgeted |
| DNA extraction kits | | £294 | | The difference was due to discount offered by the supplier |
| Multiplex kit | | £492 | | The difference was due to high |

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| | | | | price from the supplier |
| Agarose powder and DNA ladders | | £148 | | Used as budgeted |
| 500ml TAE | | £57 | | The cost was reduced due to discount offered by the supplier |
| Unlabelled and Labelled primers | | £765 | | The difference was due to discount offered by the supplier |
| Microcentrifuge tubes, PCR strips and plates | | £119 | | Some of the tubes used were obtained in our laboratory. This minimised the cost |
| Postage charges | | £129 | | Was used as budgeted |
| Stationary | | £90 | | Was used as budgeted |
| TOTAL | £5984 | £6022 | +£38 | |

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

The present research project focused only on the impact of human activities on the productivity of *Opsaridium microlepis* species. However, Lake Nyasa is home to a variety of fish species, some of which are threatened or endangered. To ensure their conservation and save them from extinction, efforts must be made. As a result, it is important that this research project be expanded to include other fish species. We are looking to develop a mobile app that will be used to guide fishers in identification of the threatened and endangered fish species.

During social survey, it was revealed that lack of knowledge and poverty are the main factors contributing to illegal fishing in Lake Nyasa. Lack of market information at landing sites has made fishers to remains poor because they sell their fish at very low prices. To improve local fishermen's income, we're working on a mobile app that will link them with their customers. The information about fish catches and captured threatened and endangered fish will be sent through a developed mobile apps to fisheries officers responsible for management of water resources. This will enhance the sustainable contribution of freshwater fisheries to food security in the region.

10. 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?

The Rufford Foundation logo is indicated in the presentation being prepared to present during the international conference and the acknowledgement of the foundation is included on the manuscript being prepared. BSc students also used the logo during their special projects. During the fieldwork the researcher team and students informed, the community participated in the social survey that the research project was supported by Rufford Foundation.

11. Please provide a full list of all the members of your team and briefly what was their role in the project.

Dr. Mwakalesi Alinanuswe was responsible for performing the laboratory and data analysis of total phosphorus, total nitrogen and organic carbon. He was also involved in all other project activities such as social survey, sampling and report writing

Ms. Gloria Ansigar Kinunda was responsible for conducting interview with students from primary and secondary schools found along the shore of Lake Nyasa. She was also in charge of educating primary and secondary students on the value of conserving and managing the catchments to increase fish productivity.

12. Any other comments?

We would like to thank the Rufford Foundation for providing the grant that has enabled the research team to carry out its planned research activities. The project's outcomes will improve management of catchment area and conservation, resulting in improved fish productivity and livelihood opportunities for residents of Lake Nyasa. We ensure the foundation that we will maximise the grant benefits for the Rufford Foundation, Sokoine University of Agriculture, and the rest of the global community.