Geophysical Habitat Mapping for Fisheries Conservation at Nsumbu Tanganyika (Zambia)

*Geoscientists Without Borders Application: Q1Q2 2021*

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FollowUp Form

Basic Information

Project Name*
Name of Project
Geophysical Habitat Mapping for Fisheries Conservation at Nsumbu Tanganyika (Zambia)

Project Performers*
List all project participants. Include their title and affiliation.
Prof. Michael McGlue, Prof. Kevin Yeager, Njahi Mwangala (graduate student), Leandro Dominogs-Luz (graduate student), Kim Schindler (laboratory technician) (University of Kentucky)
Prof. Michael Soreghan, Elisha Miller (graduate student) (University of Oklahoma)
Craig Zytkow (project director) (Frankfurt Zoological Society)
Danny Sinyinza* (senior research officer) (Ministry of Fisheries, Zambia)
*Please note our original Ministry of Fisheries collaborator, Mr. Taylor Banda, transferred to a different district, so Danny Sinyinza is now acting as our chief collaborator.

Project Start Date*
Select the date when your project was started.
10/01/2021

Anticipated Project End Date*
Select the date when you expect the project to be completed.
09/29/2023

Report
Project progress reports are meant to be shorter than final reports, but should provide enough information to allow the committee to assess the project’s progress toward technical, humanitarian, education, sustainability efforts. They are expected to be written with the care and attention to detail that a published paper requires. Reports are published (with confidential information removed, including financial data) on the GWB website to help educate the public on the program and its impact. Reports should be proofread to ensure accuracy of language and data.

Figures and pictures should be original, high quality graphics and must include captions and appropriate scales. All maps should be oriented with north at the top. All field data and interpretations should be shown on logs, maps,
and sections within the same georeferenced projection system, datum, and scale. All maps and sections are to have distance scales in the same unit system. Include color legends, if appropriate.

If you would like additional guidelines to help you prepare your report, please email us at withoutborders@seg.org and ask for more specific instructions.

Reports that have not been written with the highest attention to detail and accuracy will be returned to draft status for editing and any pending payments will be delayed until an acceptable report is received.

Project Location and Geologic Setting*
In the space below, provide a description of the project's location, including its geologic setting. Using the upload button, attach a Word document, pdf, jpeg or preferably, a geotiff with a map of the area where the team is working. Include a bounded polygon around the area where studies are being conducted. Include the title “Project Location” at the top of the document.

Project Location.jpg
The project is being carried out on southwestern Lake Tanganyika. This area of the lake is found entirely within the country of Zambia. The geological setting is the western branch of the Cenozoic East African rift system. The southwestern area of Lake Tanganyika is influenced by large normal faults that influence lake depth and the composition of nearshore sediments. A larger river, the Lufubu, along with a number of smaller drainages, enter Lake Tanganyika near our project site.

Project Location continued*
Upload a Google Earth kmz file that outlines the boundaries of the project location. This file will be used to display the project location on a master map of GWB projects, including the project map on the GWB website.

GWB Zambia 2022.kmz

Humanitarian Need and Benefit*
Summarize the reason, need(s) and benefit(s) of the project (humanitarian, community, environmental, etc.)

Fish are vital for preventing famine among the impoverished coastal communities of Lake Tanganyika, one of sub-Saharan Africa's most important landlocked fisheries. Concern surrounding the sustainability of Lake Tanganyika's fisheries has increased due to the combined impacts of: (a) global warming on lake function, which curtails primary productivity (b) overharvesting, as more fishers and illegal gear (e.g., beach seines) become more common, and (c) onshore "slash and burn" deforestation that results in sediment pollution and fouling of nearshore benthic habitats. Collapse of the fishery would be a disaster for more than a million isolated/poor people that rely on fish for nutrition and cash income.

Project Goals and Objectives*
Describe the project goals and the milestone objectives set to accomplish each goal.

1) Map littoral and sub-littoral bathymetry and benthic substrates in the Nsumbu National Park conservation area and adjacent villages using single beam echosounding and side scan sonar.

2) Collect lake floor sediment samples in order to provide ground truth to guide classification and interpretation of side scan sonar images.
3) Collected sediment cores to assess sedimentation rates, in order to identify areas affected by sediment pollution.

**Progress Toward Goals and Objectives***

Describe the progress to date on planning, execution, project milestones accomplished and tasks still to be completed.

In the summer of 2022, the team visited Nsumbu National Park in Zambia for the first time. Prior to commencing surveying on the lake, the team held meetings with the Zambia Ministry of Fisheries, Nsumbu National Park officials, and Frankfurt Zoological Society representatives to determine priority areas for benthic substrate mapping and sediment pollution analysis. It was decided that the highest priority area for 2022 was Nkamba Bay (-8.585353, 30.542479), due to reports of human activities affecting that area of the park. We targeted our efforts by collecting >50 km of soundings (using a single beam echosounder) and side scan sonar data, along with 70 lake floor sediment samples. We judge the bathymetric mapping and sonar-based substrate identification to be 20% and the sediment sampling to be 50% complete, respectively. The evaluation of sediment pollution is 0% complete, as collection of sediment cores and radiochemical analyses will proceed next year (2023).

**Interpretation of Data***

In the space below, provide a summary of any interpretation of data that has been done to date, even if the data are raw and the interpretation is only preliminary and tentative. Use the upload button to attach a Word document or pdf appendix with any figures or pictures referenced in your summary, including captions. Include the title "Figures for Interpretation of Data" at the top of the document.

Address the following in your summary:

- Representative data; show display(s) of data;
- Evaluation of data quality and usefulness;
- Describe how data is being interpreted? Who is interpreting the data?
- Provide any pertinent preliminary results;
- Describe how the data support (or not) the goals, objectives and hypotheses?

Echosounding data and side scan sonar images, as well as lake floor sediment samples, were collected in August, and to date interpretations have not been attempted, because the data are still in the raw (field file or similar) format. Processing and initial interpretations will be undertaken this academic year by project M.S. student Njahi Mwangala, a Zambian national who has enrolled at the University of Kentucky; this research will be conducted under the guidance of PIs McGlue and Yeager. The data quality appears to be high, given what we observed on topside computers during acquisition, as well as the diversity of lake floor grab samples that were retrieved. These data will be used to develop lake floor substrate maps to inform conservation action and help park officials manage the ecosystem in a more sustainable manner, directly supporting the project goals set out in our proposal.

**Summarize Field Studies***

Summarize field studies that have been conducted to date. Identify which goal the studies are meant to be applied toward. Address the following questions:
What approach(es) was used?
Who is conducting the field work? (professors, students, locals, professionals?)
What pertinent results have you achieved to date?
What problems did you encounter in the field and what actions did you take to mitigate them?

Our first field campaign was completed in August 2022. In this expedition, we used single beam echosounding, side scan sonar, and ponar grab sampling deployed from small boats to complete our objectives in Nkamba Bay. The results of this effort were the acquisition of new data that will be used to construct habitat maps. The people conducting the field work were: Michael McGlue (University of Kentucky, professor), Michael Soreghan (University of Oklahoma, professor), Njahi Mwangala (University of Kentucky, graduate student), Leandro Domingos-Luz (University of Kentucky, graduate student), Craig Zytkow (Frankfurt Zoological Society project leader) and Cobbam Mazimba (Frankfurt Zoological Society/Nsumbu National Park designate). The problems encountered in the field were winds/waves, which usually limited fieldwork using small boats to 4-5 hours per day, and unexpected high costs associated with the global financial decline, supply chain delays, and inflation.

Human Element*
Describe the involvement of participants. Include all participants, such as college professors, professional consultants, students (either local or from outside the local region), local residents, local governments, and others.

The participants listed above (the Zambia Ministry of Fisheries participated in planning but elected not to send a representative to participate in fieldwork this year) planned field operations, acquired permits from the federal government (from the National Parks department and Ministry of Fisheries), acquired supplies and research equipment, conducted field research, trained project students and local residents, and engaged in outreach to the local citizenry, conservation organizations (Nsumbu Tanganyika and their "Conservation Day" event) and higher education organizations (University of Zambia).

Project Sustainability*
It is a goal of GWB that funded projects continue sustainably after their end dates. To receive GWB funding and achieve that goal, funded projects proposed sustainability goals and objectives to achieve them. Describe measures taken to ensure the sustainability of the project beyond the end date. What methods have been used and objectives accomplished to ensure project sustainability?

Donation of project equipment, including single beam echosounder, side scan sonar unit, and survey boat, outboard engine, and safety gear to the Nsumbu Tanganyika project, which is led by Frankfurt Zoological Society through Craig Zytkow. Craig is involved in all phases of the project, and he and his team will manage and maintain equipment resources moving beyond the project period. Additional habitat mapping and assessment activities will be possible using these tools and the training provided to the conservation project's personnel.

Education*
What educational institutions within the host country have been involved in the project? What other educational institutions have been involved? Describe any specific educational opportunities that have been provided during the project to any stakeholders (local residents, professionals, students, government officials, etc.) within the host country.

The project team engaged in outreach at the University of Zambia's geology department, and met with two professors in that program (Dr. Banda and Dr. Nyambe) to describe the project objectives. PI McGlue
provided a seminar on the GWB-Zambia project at the University of Zambia for a group of 20 graduate students studying water resources and environmental change in the country. This outreach is leading to the development of a memorandum of understanding between the University of Kentucky and the University of Zambia, which we hope to finalize and sign in the coming weeks. The project team conducted outreach to the Nsumbu Tanganyika and Nsumbu National Park personnel, to describe the project objectives and geophysical techniques that are used in fisheries conservation.

**Problems or Challenges Encountered***

Describe any problems or challenges that the project team has encountered and what actions have been taken to mitigate those problems.

1) Wind and waves: August proved to be exceptionally windy, which limited our time for surveying using small boats. Small boats are very sturdy and can manage fair weather waves without major problems, but sonar data quality suffers from heave. We modified our survey plans to work only in the early morning hours to minimize the affects of waves on our data. Next field season, we will start in June, when wind speeds are considerably lower.

No other major problems were encountered apart from shockingly high prices, particularly in the mobilization/de-mobilization phases of the field season; costs of food, hotels, and diesel fuel were comparable to prices in the USA or higher, which came as a major surprise, but we were able use cost savings from other areas to mitigate the expenses.

**Evaluation of project schedule***

Give an assessment of how the project is progressing according to the projected schedule. Is it on schedule? If not, what contributed to the delays? How will the schedule need to be adjusted to complete the project? What, if any, challenges with the adjustment(s) create?

The project is on schedule. We will adjust our field campaign start time next year in order to avoid the winds of August. Our survey times are likely to take longer than we initially planned, but we feel at this stage it will be possible to complete all of our tasks as planned.

**Access to Data**

As a program of the SEG, a society devoted to advancing an applied science, GWB encourages its project participants to foster transparency and further educational goals of the program by providing access to data
collected during the course of the project. In your final report, you will be asked to share the status of the availability of your project's data.

**Access to Data**

Below are the options you will be asked to consider on your final report:

- Data associated with this project are available and can be accessed via the following URL:____. Note: A digital object identifier (DOI) linking to the data in a general or discipline-specific repository is strongly preferred.
- Data associated with this project are available and can be obtained by contacting the following project participant:____ at ____.
- Data associated with this project are confidential and cannot be released for the following reason(s):____. Note: Confidentiality should be limited to 1 to 2 years after project completion.
- Your own custom statement of data and materials availability.

Please select the statement that best represents your planned approach to data availability, copy it and paste it below. Fill in blanks with any information that is known. For any unknown info, simply type TBD. If you choose "Your own custom statement...", please describe the approach to availability you plan to take.

At the completion of the project, data will be made publicly available through contact with Michael McGlue at michael.mcglue@uky.edu.
File Attachment Summary

Applicant File Uploads
• Project Location.jpg
• GWB Zambia 2022.kmz