

Current Status and Progress Report

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LAKE TANGANYIKA BIODIVERSITY PROJECT
SEDIMENTATION SPECIAL STUDIES
Arizona

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Objectives

Over the period of the contract, the main goals were the following:

1. Quantify benthic productivity.
2. Determine the effects, if any, of deforestation on benthic productivity.
3. Assist in training of local counterparts.

Methodology

Sites

Four sites were monitored throughout the year.

Mpulungu, Zambia:

- Mbita Island—rock incubations only. Any sandy areas in the proximity were not safe to dive in. One wet season (March) data set and one dry season (July) data set were collected.

Kigoma area:

- Jakobsen's Beach—rock and sand incubations. This site was used mostly to do preliminary work and establish methodology due to its convenient location.
- Mitumba, Gombe Stream National Park—rock and sand incubations. This site represented an undisturbed, 'pristine' watershed.
- Mwamgongo—rock and sand incubations. This site represented a disturbed, deforested watershed.

The Mitumba and Mwamgongo watersheds are adjacent to one another. Topography, catchment area, and geology are similar. Mwamgongo has a village of approx. 6000 people, and its catchment has been almost entirely deforested to provide fuel and to clear land for agriculture. Sampling occurred approximately every month throughout the year.

Procedures

Productivity was measured *in situ* using oxygen change in light and dark chambers that were placed on a rock surface or pushed into the sediments. Oxygen concentration was determined using Winkler titration. Incubations were done at depths of 2, 5, and 10 meters. Algal scrapings were taken from each rock chamber to determine biomass and for counts. Biomass was approximated using pigments (chlorophyll, carotenoids) extracted in 90% methanol.

In addition, light profiles were done at the Kigoma area sites. Water samples were taken to determine total suspended solids, and the algal scraper was also used to

collect samples for dry weight and ash free dry weight to determine the amount of sediment settled on the rock surface.

Results

A preliminary examination of the results shows the following:

- Epilithic productivity is approximately 100 times greater than pelagic phytoplankton productivity.
- Epilithic productivity is up to 10 times greater than benthic productivity in temperate oligotrophic lakes. The results compare favorably with the previous study on epilithic productivity by Takamura in 1989, and with the current work on Lake Malawi.
- Epilithic productivity is higher in the southern part of the lake than in the Kigoma area (by approx. $100 \text{ mg O}_2 \text{ m}^{-2} \text{ hr}^{-1}$). This is consistent with limnological observations, as there is less upwelling of nutrient rich water in the north.
- Productivity on sandy substrate is approximately half that found on rocks.

Mpulungu:

- Epilithic productivity responds to seasonal fluctuations in the lake's dynamics. The strong southerly winds in the dry season cause an upwelling of nutrient-rich water, which increases productivity, particularly at the shallow depths. Biomass specific productivity actually decreases at greater depths, as phytoplankton blooms decrease light penetration.
- The strong logarithmic relationship between gross productivity and depth suggests that light is important in regulating primary productivity and that there is no light inhibition.

Kigoma area:

- There appears to be no significant difference between annual average productivity (per unit area) at the two sites.
- Chlorophyll is greater at Mwamgongo than at Mitumba (by approx. 1000 ug m^{-2}).
- Biomass specific net productivity is higher at Mitumba than at Mwamgongo.
- Settled sediment and suspended sediment are greater at Mwamgongo than at Mitumba. Light profiles also show that more light is attenuated in the upper few meters at Mwamgongo than at Mitumba, although the lower depth limit of the littoral zone (1% incident light) is similar at both sites.

Training

Whenever possible, one of the local counterparts was used for a SCUBA dive buddy. In particular, Mr. Kimambo from Gombe Stream National Park, Mr. Robert ? from TAFIRI, and Mr. Shapola from the Zambian Fisheries Department were frequent assistants. In addition to being a dive buddy, they assisted underwater by carrying equipment and operating equipment as needed. The analytical methods used were the same as those used by the Pollution Special Studies whenever possible. Winkler oxygen titrations and pigment analysis are done by the TAFIRI station as a regular part of their sampling program. The Pollution Special Studies sampling program in Zambia is not as extensive, but pigment analysis is done regularly. Both stations have

the equipment to take algal scrapings.