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Lakeside

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The Quarterly Newsletter of the
Lake Tanganyika Biodiversity Project
UNDP/GEF/RAF/92/G32

Double-Issue



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'Pollution Control & Other Measures to Protect Biodiversity in Lake Tanganyika' -
'Lutte contre la pollution et autres mesures pour protéger la biodiversité du lac Tanganyika'

UNDP/GEF/RAF/92/G32

Foreword

Dear Reader,

I am delighted to be able to present this the second, double issue of "**Lakeside**" to all our friends and affiliates. As promised the majority of articles in this edition have been prepared by LTBP participants from the region. I trust you will agree that the articles provide a useful and easily digestible insight into the work of the project, ranging from the overarching Strategic Planning process, through specific scientific studies such as the isotope hydrology work, to the all important involvement of local communities, exemplified by the activities carried out during World Environment Day.

The need to keep all informed is a difficult but vital task in such a geographically dispersed project. This newsletter is but one means of achieving this, however, it is by no means the only one. First, it is worth noting that the project produces quarterly progress reports and although these are, of course, more formal in presentation I would encourage all those who are actively engaged in the project to read these reports. They will help keep you up to date with what is happening in other project fields and locations.

More immediate than the above and potentially much more effective is the project's website launched in January of this year. All project reports together with a host of other information are available on the website and for the many project participants who are not connected, but do have access to a PC, we are providing a complete portable copy of the website on CD-ROM, updated every 3 months. Your views on both are most welcome!

I hope you enjoy this newsletter but there is, of course, always room for improvement so please come forward with your ideas and comments. In addition unsolicited articles on any aspect of the project, the lake and its peoples will be gratefully accepted for consideration.

With best wishes



-Andy Menz
Project Coordinator

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"Pollution Control and Other Measures to Protect Biodiversity in Lake Tanganyika"
P. O. Box 1119, Bujumbura, Burundi
Tel: + 257 21 99 60
Fax: + 257 21 99 61
Email: ltbpuja@cni.cbinf.com
Internet: <http://www.ltbp.org>

Edited by the LTBP Project Coordination Unit
Layout & Design: Jerod Clabaugh
French Translation: Pierre-Claver Nzimpora

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Commemoration of World Environment Day in Kigoma, June 1998

by *Bartholomew Tarimo*

World Environment Day (WED) is an annual event which can be celebrated in many ways, including street rallies, bicycle parades, green concerts, essay competitions in schools, tree planting as well as recycling and clean up campaigns. WED is also a multi-media event which inspires thousands of journalists to write and report on the environment. It is a visual event with television documentaries, photo exhibits and poster displays. It is also an intellectual event for those who organize and participate in seminars, round-table meetings and symposia. All in all, WED serves to enhance public and political attention and action for the environment.

In this connection, Lake Tanganyika Biodiversity Project (LTBP), in collaboration with Kigoma Regional and District authorities, Government Institutions and Non-Governmental Organizations (NGOs) participated fully in commemorating this event.

The main aims and objectives were to:-

- promote environmental issues such as the benefits of nature and the great loss associated with environmental destruction, to the larger community.
- arouse public awareness of actions that promote and actions that harm the environment.
- carry out environmental management activities in collaboration with Regional and District authorities, NGOs and others.
- activate the role of informal education through such settings as role-playing during commemoration week.



The WED team and Scouts lead a village clean-up in Ujiji

The main activities in this event included: community clean-up of the Kigoma urban environment (market places), a parade culminating in speeches by regional authorities, displays of environmental posters, film presentations, environmental messages from school children, and traditional groups of musicians, dancers and drummers performing songs with environmental messages. LTBP took the lead role in aiding Kigoma authorities to coordinate these activities.

The activities were officially inaugurated on 30 May 1998 at Kibirizi by the former Kigoma District Commissioner (DC) Alhaj Ahmed Lugusha. The DC started by joining members of the Kibirizi community in their effort to clean Kibirizi market.

The importance of Lake Tanganyika in providing: water for domestic use, fish as a primary source of protein, employment, transport, and recreational uses like swimming and leisure were discussed. Threats to Lake Tanganyika, including: contamination by sewage and oil products, cultivation without any soil conservation measures leading to increased siltation and habitat destruction, and unsustainable fishing practices including the use of chemicals and small net sizes, were also the subject of many speeches and discussions.



Mr. Lugusha, former Kigoma DC, oversees the clean-up of Kibirizi Market.

Culminating a week of activities in different villages, on World Environment Day, 5 June 1998, a procession led by a brass band and followed by scouts, primary school children, Kigoma residents and other invited guests were received by the Guest of Honor, the Regional Administrative Secretary (RAS) on behalf of the Regional Commissioner.

Kigoma Town Council and Radio Tanzania Dar es Salaam in Kigoma were commended for being on the forefront in planting trees and spreading the message about the importance of conserving the environment.

It is hoped that WED will be commemorated every year along the lake shore and that Kigoma Town Council will ensure the sustainability of WED and WED activities. It was advocated that other stakeholders should prepare for the coming years by including WED costs in their annual budgets.

Bartholomew Tarimo is the LTBP Environmental Education Coordinator for Tanzania.

LTBP's New Recruits

As you tour the LTBP riparian stations these days, you will probably notice that our offices are becoming increasingly populated. During the past year, LTBP has recruited a number of administrators and facilitators to assist in carrying out activities at the riparian stations. Administrative assistants were recruited to manage the project accounts and tend to other matters, including: travel and accommodation bookings, importation and exportation of project equipment and other details. Our administrative assistants are very busy people undertaking thankless jobs. Happily, we have a top-notch line-up working for us: in Kigoma, Mr. Bahati (James) Barongo left the UNHCR repatriation effort to help us manage the LTBP station at Tanzanian Fisheries Research Institute-Kigoma (TAFIRI). In Bujumbura, Mr. Mamert Maboneza, who is very experienced owing to his previous service with our sister project Lake Tanganyika Research (LTR), has a double load, managing payments and other activities for both the Bujumbura and Uvira stations (DR Congo does not have a functional banking system for the moment, so all such transactions for Uvira are routed through the Bujumbura station). And in Mpulungu, Mr. Clement Mwelwa joined us from Lusaka last October after Mr. Martin Pearce left the project to run his own business. The riparian station administrators work together with the administrative staff in the Project Coordinator's office in Dar es Salaam, Ms. Maria Hiza, Mr. Ritesh Bhandari and Mr. Christopher Rweyendera to ensure a smooth execution of all LTBP activities.



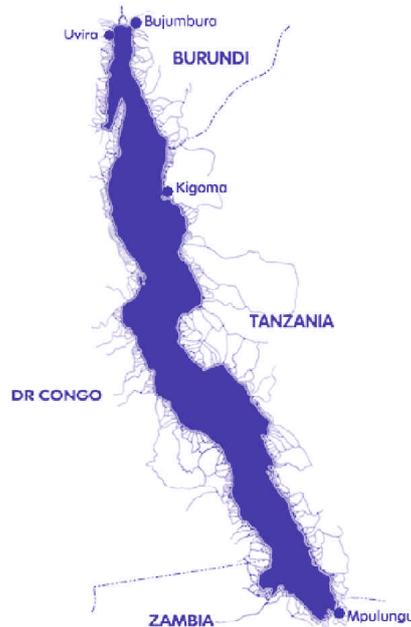
Mamert Maboneza



Richard Paley



Olivier Drieu



Pierre-Claver Nzimpora



Bahati Barongo



Clement Mwelwa

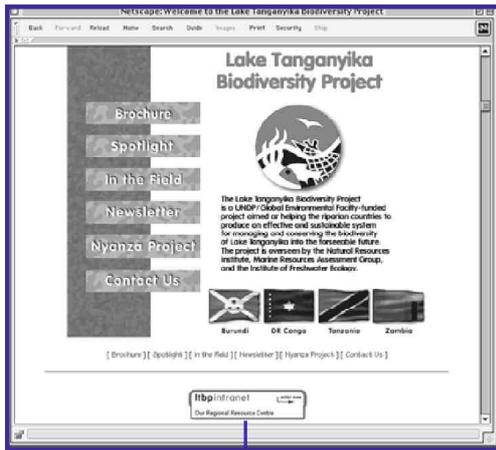
In addition to administrators, LTBP has also recruited facilitators/trainers to help develop and implement the special studies workplans and in so doing raise local capacity. Messrs. John Dorr (Fishing Practices Special Study), Olivier Drieu (Sedimentation Special Study) and Richard Paley (Biodiversity Special Study) arrived in Mpulungu in October 1997 and spent the following month touring the riparian stations to meet their national colleagues and discuss their special studies' workplans. Mr. Paley is based in Kigoma and Mr. Drieu is based in Mpulungu, though they spend much of their time travelling to the different stations to tend to activities. Dr. Dorr was based in Bujumbura, but has since left LTBP to coordinate an environmental project in the Philippines. We were sad to lose Dr. Dorr, however, before leaving he completed a detailed assessment and workplan for the Fishing Practices Special Study. LTBP is currently finalizing arrangements for his replacement as well as a facilitator for the Socio-Economic Special Study.

Additionally, LTBP has recruited a full-time translator, Mr. Pierre-Claver Nzimpora, to translate the wealth of documents the project generates from English to French or French to English as necessary. Mr. Nzimpora is based at the LTBP Bujumbura Station. Mr. Robert Kimanduka, also based at LTBP Bujumbura Station, works closely with the BIOS team to manage the Biodiversity Literature Database.

Your Regional Resource Center — Introducing LTBP's Intranet Website

by Jerod Clabaugh

As many of you know, LTBP has no single 'base' of operations, but rather many bases including: the Project Coordinator's office in Dar es Salaam, the Scientific Liaison Officer's Office in Bujumbura, the Kigoma and Mpulungu Stations, the National Coordinators' Offices in Bujumbura, Dar es Salaam, Kinshasa and Lusaka, plus the offices of Natural Resources Institute (NRI), Marine Resources Assessment Group (MRAG) and the Institute of Freshwater Ecology (IFE), and UNOPS and GEF headquarters in the USA. With so many different affiliates spread throughout the region and across the globe, it is very difficult to ensure that all project information is readily available at all places and to all participants.



«Click» on this banner to enter our private section

depth information and data on each Special Study or our Geographical Information System, keep in touch with the Strategic Action Program, download forms and other files crucial for project administration, find out the current location of consultants in the region or just peruse our expanding photo gallery of project events. Whether in the UK or Mpulungu, all project information is at your fingertips.

Jerod Clabaugh served as Technical Officer with LTBP for 16 months and continues to update the website and publish the newsletter.

Over the past two years, LTBP has been investigating solutions to tackle this problem. We chose Internet technology to develop a 'regional resource center', where all project information is gathered, archived, and made available to potential users. In January 1999, we unveiled our globally-accessible intranet website. And for those participants without direct access to the Internet, we are providing a complete portable copy of the website on CD-ROM, updated every 3 months.

Although this website is currently based in the UK at NRI, plans are already underway for its deployment to the region later this year. In the coming months, a regional participant will be trained to oversee the development and maintenance of the website into the future.

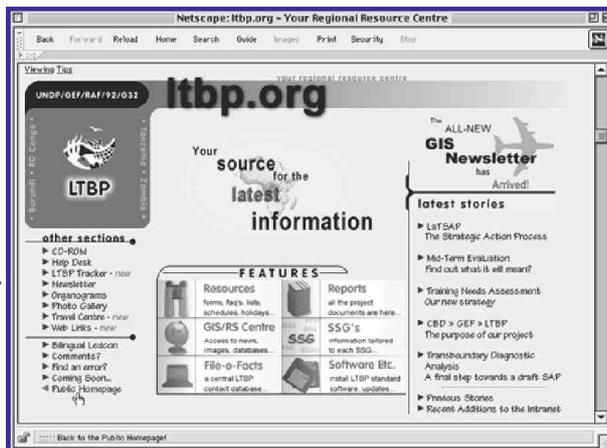
Our website is divided into two sections. The public section allows anyone in the world to learn more about Lake Tanganyika and LTBP's efforts to protect its biodiversity. Visitors accessing the public section can even, through pictures, visit our riparian field stations. In the private section, LTBP affiliates can find out the latest project news, read or print any project document (even this newsletter), view in-

How to Connect..

For those with access to the Internet, you can begin by going directly to our homepage at <http://www.ltbp.org>

The private section can be accessed by clicking on the logo (above left) at the bottom of the homepage. Access may be requested from lakeside@cni.cbinfo.com

For those lacking access to the Internet, you can request a CD-ROM subscription. Just email us at lakeside@cni.cbinfo.com for more information.



Our private section — information at your fingertips

BIOSS Workshop for Francophones

By Félix Nicayenzi

Following the example of the training workshop on special studies techniques and methods held in Kigoma from 22 September to 3 October 1997 for Lake Tanganyika researchers from anglophone countries, a similar workshop was held in Bujumbura for the benefit of francophone countries from 2 to 10 July 1998. Twenty one participants from the Democratic Republic of Congo and from Burundi took part in the workshop with the assistance of international experts.

Mr Jean-Berchmans Manirakiza, the LTBP National Coordinator, made the opening speech. After bidding welcome to all participants, he recalled the importance of Lake Tanganyika for the riparian population, the different threats affecting the lake's biodiversity and the need to protect it. He finished his speech by wishing plenty of success to the workshop.

The objectives of the workshop were among other things the analysis, discussion and standardisation of methods and protocols for the estimation and management of biodiversity used in the project in order to improve taxonomical knowledge and finalise protocols of sampling and surveying for the research program in Burundi and the Democratic Republic of Congo.



Students study the hippos, crocodiles, and birds at Rusizi National Park

An eight day intensive program was prepared and included some presentations/debates, theoretical and practical sessions of taxonomy of fishes and macro-invertebrates, sessions of initiation to the project database, field trips and analysis and processing of samples collected from the field. The program also inserted an excursion to Rusizi National Park. In order to facilitate practical activities on the field, in laboratories and on the computer, participants divided themselves into two groups taking turns around the trainers.

The different speakers addressed such themes as : “ What is biodiversity ? What is its importance ? How to measure it ?”, “Ichthyological diversity of the lake Tanganyika catchment” , “Ecology and evolution of cichlids frequenting shells”, etc.

Let us recall that special studies methods used by the project to evaluate and estimate biodiversity are the following : “manta”, profile of sub-lacustrine habitat, stationary fish census, rapid fish census, global fish census, census along mollusc transect and quads, gill net fishing, collecting macro-invertebrates with a bottom sampler or a net and crab trapping. Most of these activities are carried out through diving using SCUBA.

All these methods were scrutinised in order to improve them, and were practiced on the field during two days in Gitaza and Magara. Some samples of molluscs and of other macro-invertebrates were brought to the lab and studied, and then preserved with appropriate techniques. Calculation of biodiversity indexes was also introduced and applied to these samples. Participants also practised how to key in the obtained data into the computer.

After field and lab work, participants briefly presented the obtained results to make sure that the methods had been well practised and



Drs. Nshombo Muderhwa and J. Bosco Gashagaza make final preparations for an aquatic survey

to allow comparison of these techniques. Calculation of biodiversity indexes was well mastered. Taxonomical knowledge was improved.

The workshop was organised by Kelly West from LTBP and Eddie Allison from MRAG in the United Kingdom. The trainers who conducted the work were: Kelly West for molluscs, Eddie Allison for the calculation of biodiversity indexes and initiation to the Project database, Koen Martens from the Royal Belgian Institute of Natural Science for macro-invertebrates, Luc De Vos from Kenya National Museum, J. Bosco Gashagaza from Rwanda National University, Gaspard Ntakimazi from University of Burundi, and Nshombo Muderhwa, Director General of CRH Uvira in the Democratic Republic of Congo for fish taxonomy. Other participants from DRC at Hydrobiological Research Centre were: Mulimbwa N'sibula, Scientific Director, Bwebwa Diamani, Mukirania Muke Syaira, Bashonga Bishobiri, Amandala Shekani, Patrick Kukiye Buda, Muzumani Risasi, all of them researchers with the Centre. Burundi was represented by: Félix Nicayenzi, Wilondja Kamalebo, both LTBP researchers, Benoit Nzigidahera, adviser at INECN, Libère Ndayisenga, Ladislav Habonimana, respectively chief warden and tourist guide for Rusizi National Park and Bernard Sinunguka, researcher with the Department of Fisheries and Pisciculture, and Albéric Rugirabirori, technician from the University of Burundi.

The workshop closed with a dinner during which Koen Martens entertained us with his presentation on ‘Speciation in Ancient Lakes.’

Félix Nicayenzi wrote his university thesis on the cichlids fish of Lake Tanganyika. He worked for the Centre de Recherche Régionale en Hydrobiologie Appliquée before joining LTBP.

A Strategic Action Plan for Lake Tanganyika

by *Nicholas Hodgson*

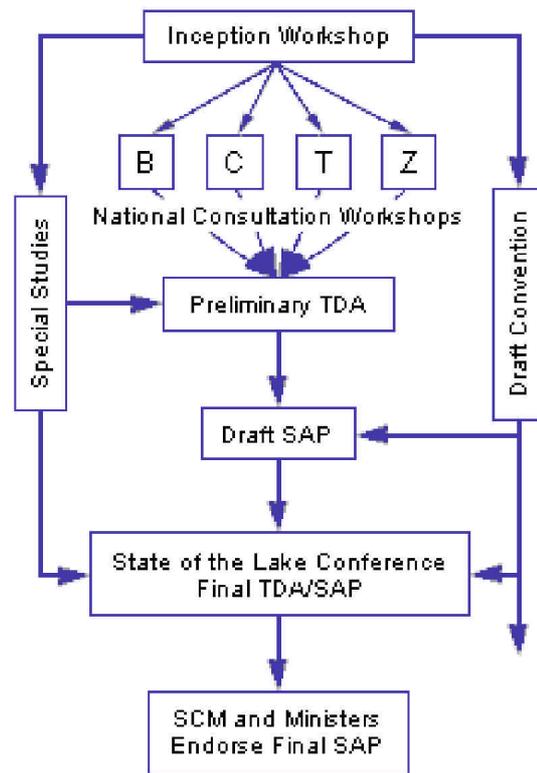
The RAF/G32/92 project document signed by Lake Tanganyika's four riparian nations describes the first immediate objective as: "...establish a regional long term management programme for pollution control, conservation and maintenance of biodiversity in Lake Tanganyika". The key mechanism for achieving this output was seen as the formulation of a Strategic Plan. The project document also envisaged establishing a permanent organisation, or Lake Management Body, to promote the cooperative management of the lake, effectively becoming responsible for supervising the implementation of the strategic plan.

This same approach has been adopted in many other international resource management programmes; lessons have been learned and concepts refined. The Strategic Action Plan - the SAP - is now central to the GEF approach to achieving consensus in the management of international waters. And it continues to evolve.

There is no definitive blueprint for a Strategic Action Plan, but underlying the SAP are two interlinked management requirements. These both relate to principles embodied in the Rio Convention. The Preventative Principle states that it is generally better to prevent damage than to cure it. While the Precautionary Principle states that "...lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimise such a threat."

The management implication is that there is a need to set priorities, based on best available information; and a need to respond to change as either the situation changes or the knowledge on how to manage it improves. A Strategic Action Plan is therefore not static, it becomes a tool and function of a Management Body responsible for adapting and implementing it as the situation changes.

Over the last year, the process of developing the Lake Tanganyika Strategic Action Plan has increasingly involved many of the stakeholders, planners, decision makers and scientists linked to the project in all four countries. But the process started three years ago with the inception workshop, where the four countries identified their priority management concerns. Following this, and informed by the baseline reviews, the priorities for the special studies were defined to answer specific management questions. In January 1998, the Project Steering Committee endorsed a process of national and regional consultation that would lead to a final SAP being endorsed within the project time frame. This process would be led by the Technical Advisory Committee with additional members brought in specifically for the SAP. In parallel with this, the steering committee approved the work programme for the development of a formal Convention that will provide the legal framework for the SAP. Since then the project has supported a series of national and regional meetings. The national meetings were led by the national working groups, with additional representation to include as wide a range of stakeholders as possible. The outcome of the national meetings was that all four countries developed a common analytical



framework, and that the national representatives, members of the restructured Technical Advisory Committee, were fully aware of their "Constituents" concerns.

The first major task of the Technical Advisory Committee has been to refine and expand on the priorities and management concerns identified at the inception workshop, using the formal mechanism of a Preliminary Transboundary Diagnostic Analysis - the TDA. This is simply a mechanism to establish a common framework of facts and an understanding of threats and opportunities, as a means of arriving at a consensus on the priorities for action that need to be included in the SAP.

The TDA workshop was held in Lusaka in November 1998 and the workshop report has now been distributed for comment.

The next stage in the process will be for the TAC to prepare a draft Strategic Action Plan. This will include both the results of the TDA and the conclusions from the first steps in preparing the draft Convention. Following this, the preliminary TDA will be revised to include implications of the final results of the special studies programmes, due to be completed later this year. And on the basis of the revised TDA a final SAP will be prepared for endorsement by the steering committee and additional ministerial representation. The SAP will then become the guiding path for the Lake Management Body, and its responsibility.

Nicholas Hodgson is coordinating the LTBP SAP process.

LTBP Participation in the Nyanza Project

by *Mukungilwa Kamalebo*

Nine African students and twelve American students participated in the first session of The Nyanza Project in Kigoma, Tanzania, from 1 June – 10 July 1998. The Nyanza Project is a scientific research and training course initiated by Dr. Andrew Cohen of the University of Arizona (USA). It is a part of the Research Experience for Undergraduates (REU) programs, the main objective of which is to interest and to actively involve participants in different types of scientific research. The Nyanza Project specialized in the following research subjects: geology, biology, and limnology of The African Great Lakes, and of Lake Tanganyika in particular.



Nyanza students work with freshly collected samples

The American National Science Foundation (NSF) sponsors the five-year project. While NSF/REU supported the American participants, The Lake Tanganyika Biodiversity Project (LTBP) sponsored the African participants and provided material contributions for the organization of the courses.

Tanzania Fisheries Research Institute (TAFIRI) hosted the courses. The project students and instructors also received scientific and technical collaboration from TAFIRI staff members.

The African students travelled many different paths to reach Kigoma. The Congolese delegation left Uvira, via Bujumbura, on the 28 May 1998 and arrived in Kigoma by small plane the same day. The Burundian delegation arrived the following day by small charter plane. The Tanzanian and Zambian delegates arrived by train on the 31 May 1998 along with the American students and the instructors. All the students were accommodated in « Railway Hotel ».

The training activities were two-fold i.e. theory and practical courses with exercises in the field and laboratory and individual research projects.

Theory and practical courses took place during the first three weeks of the session. One week of intensive classroom lecture and field and laboratory practical courses were devoted to each of the major theme topics: geology of East African lakes, tropical limnology and biology, biodiversity and the evolution of Lake Tanganyika.

Each student, under the supervision of a trainer and sometimes in collaboration with other students, completed an independent research project in a subject of his/her choice related to one of the branches of theory, (i.e. geology, limnology or biology of Lake Tanganyika). Research topics among the African students included diverse subjects such as: a comparison of fish populations at two different habitats, the effects of coastal upwelling in high relief and low relief zones, variations in the thermocline and its effect on nutrient levels in Kigoma basin, algal benthos of the littoral zone, diatom assemblages from surface sediments, the relationship between water parameters and fishing results, the effect of small streams on the hydrogeochemistry of the lake and studies of the settling rates of fish eggs. At the end of his/her work, each student presented, in plenary session, his achieved preliminary results.

In addition to their scientific activities, participants got the opportunity to visit Livingstone Museum in Ujiji and the road of slaves. They also had an excursion to Gombe Stream National Park.

Three Burundians participated in the course: Célestin Bigirimana, Arthur Nahayo, Térance Nahimana; along with three Congolese: Safari Borauzima (ISP Bukavu), Mukungilwa Kamalebo (CRH/UVIRA), Mavula Mbemba (CRH/UVIRA); two Tanzanians: Shariffa Bungala, Chobaliko Rubabwa and one Zambian: Phallen Milambo. Twelve American students also participated: Pete Macintyre, Karine Simon, Kirsten Bannister, Kristin France, Christie Hauptert, Beverly Green, Giana Gelsey, Ginger Edattukarran, Brandon League, Joel Hoffman, Sarah Pittiglio, Mark Woodworth.

The following trainers did their best to ensure the success of the Nyanza Project:

Andrew Cohen, University of Arizona, USA, Director of Nyanza Project; Chris Scholtz, geologist, University of Miami, Florida, USA; Ellinor Michel, biologist University of Amsterdam, Netherlands; Pierre –Denis Plisnier, limnologist, Tervuren Museum, Belgium, Gaspard Ntakimazi, biologist, University of Burundi, Nick Matthieu, R.E.U. Administrator and guest lecturers: Kelly West, biologist, scientific coordinator, LTBP; Simone Alin, biologist, USA.

The Nyanza Project training session, Kigoma 1998, ended as planned on the 10th of July 1998 and the African students followed different paths to their respective homes.

The Congolese team would like to take this opportunity to express its thanks to the Nyanza Project organisers, the trainers, LTBP and to all those who contributed to the success of Nyanza Project, Kigoma 1998.

Mukungilwa Kamalebo participated in the first year of the Nyanza Project. He is a researcher in the Biology Department of the Centre de Recherche en Hydrobiologie-Uvira in the Democratic Republic of Congo.

The Pollution Problem in Burundi

by *Gabriel Hakizimana*

Burundi is one of Lake Tanganyika's four riparian nations. It differs from its neighboring countries in that its capital city, Bujumbura, is located on the shores of Lake Tanganyika. Bujumbura is the most industrialized and most populated city in Burundi and along the entire coastline of Lake Tanganyika.

From more than a century, the city of Bujumbura underwent a considerable evolution, but it was during the 1960s that industrialisation started, and it has been expanding ever since. Bujumbura has about 250,000 inhabitants with about 70 industrial enterprises which influence the waters of Lake Tanganyika and its nearby rivers.

A census of pollution sources made by the National Institute for the Environment and Nature Conservation (Institut National pour l'Environnement et la Conservation de la Nature) in 1992 revealed the existence of many different types of industries in Bujumbura, including:

food processing, textiles, metallurgy, chemicals and pharmaceuticals, petrol warehouses and garages, soap manufacturers, slaughterhouses, paint refineries, printing houses, and so on.



Brarudi Brewery: one of over 70 industries in Bujumbura

Designers installed all these enterprises without thinking about waste pre-treatment systems. Consequently most of these industries discharge their waste into the lake or into rivers that flow into the lake.

There are also smaller towns, such as Rumonge and Nyanza-Lac, that directly discharge their domestic waste water into Lake Tanganyika. Domestic water discharge presents the danger of biological contamination and public health risk. Analyses conducted in Bujumbura Bay revealed the existence of different forms of bacteria especially coliforms and *Escherichia coli* which live very near the city's drinking water intake system.

Pesticides are another important risk factor along the Burundian portion of the Lake Tanganyika catchment. Much of the region

fringing the lake is agricultural land area where pesticides are often in use. This is especially problematic in the Rusizi plain and the Rumonge area where farmers use organochlorates in ricefields which constitute a dreadful pollution threat for underground waters and the Lake.



Bujumbura's water treatment plant

It is important to note that in the Bujumbura area, the lake is occasionally subjected to pollution, both accidental and intentional. With the growth of industrial activities, quantities of industrial waste, sometimes very toxic, are also increasing and we are witnessing cases of unauthorised dumping and even direct disposal in the lake. Recent events included the disposal of about 600 tons of out-of-date milk in the Rusizi River and a recent mass-mortality of fishes in Bujumbura Bay which according to our analyses was probably provoked by accidental disposal of a considerable quantity of caustic lye (NaOH) during the off-loading of boat cargo.

Burundi is taking many different measures to reduce the load of pollutants entering Lake Tanganyika. For example, the Government of Burundi has installed an industrial and domestic water treatment plant in Bujumbura. This facility, which employs mechanical and biological treatment, treats 38% of Bujumbura's wastewater before it enters the lake with a 95% reduction in Biochemical Oxygen Demand (BOD).

Furthermore in the framework of LTBP, the Pollution Special Study, engaged in Burundi since June 1998, carries out physico-chemical and phytoplankton analyses. They have already produced two quarterly reports on this subject. Their analyses concentrate on the water quality of Bujumbura Bay as well as the waters of Bujumbura City and its rivers. These and other pollution and water quality data were integrated into the Burundian National Strategic Action Programme reports and the Transboundary Diagnostic Analysis.

Gabriel Hakizimana is the LTBP Pollution Special Study Coordinator for Burundi.

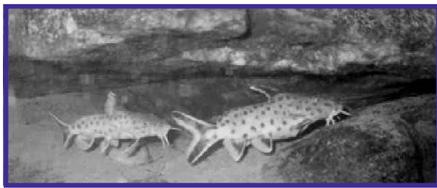
Reuben Shapola's Underwater Photo Gallery

by Kelly West



Mr. Reuben Shapola, from the Zambian Department of Fisheries (DoF) Mpulungu Station, was a participant in the first dive training course held in Kigoma in 1997 for the LTBP Biodiversity Special Study. In addition, Mr. Shapola is an amateur photography hobbyist. After being certified to dive and trained in underwater research methods, Mr. Shapola took an interest in underwater photography. He has refined his technique over the past year, and has selected some of his best images for us to show here and on the project website.

Mr. Shapola first became interested in both diving and underwater photography when some Japanese researchers visited Mpulungu Station in 1988. Over the years Mr. Shapola and other DoF staff have continued to collaborate with the Japanese research team. Though Mr. Shapola had previous experience diving, it was not until the LTBP underwater research methods training course that he tried his hand at underwater photography. The first roll of film that he shot included lots of pictures of only rocks or sand. "The fish



Synodontis sp. catfishes

move so fast!" Mr. Shapola lamented in describing some of the difficulties of underwater photography. In addition to all the complications of normal photography, Mr. Shapola notes that underwater photography is much more difficult than regular photography because the light underwater is more difficult to judge, and because the subjects, especially the fish, are not very helpful in that they never hold still and smile for the camera. As you can see from his photos, Mr. Shapola has found ways in which to overcome these difficulties.

Mr. Shapola attended Kasaka Fisheries Training Center in Kafue, Zambia before joining DoF Mpulungu Station in September 1986. In addition to diving surveys, Mr. Shapola also participates in the DoF gill net surveys in Zambia. We wish him much luck with his photography as he continues to practice and perfect his technique.



a bivalve mollusc

More photos can be viewed at

<http://www.ltbp.org/priv/GALLERY.HTM>

Kelly West is the Scientific Liaison Officer for LTBP.



Neolamprologus sexifacatus patrolling through a school of *N. brichardi*



Ophthalmotilapia ventralis patrolling territory



A troop of *Lamprologus callipterus* on the prow



Sand-dwelling cichlid nest



The Zambian dive team out for a snorkel



This rocky outcrop is home to at least 7-10 different spp. of cichlids



Ophthalmotilapia ventralis in nest



A Zambian diver collecting samples



Catherine O'Reilly measuring primary productivity



Julidochromis sp.



Rocky/sandy habitat - 3m

The Isotope Hydrology Of Selected Lake Tanganyika Watersheds

by Hudson Nkotagu

Background:

The isotope hydrology of selected Lake Tanganyika watershed areas is a component of the LTBP Sedimentation Special Study. Drs. Patterson and Nkotagu, along with other team members, selected two watersheds during a visit to the study area in September 1997. Both an impacted and unimpacted watershed were selected for comparative hydrological evaluation of the land use effects and their implications to the Lake's biodiversity.

The isotope techniques provide complimentary information to those of the classical methods. Information such as: sources of water, nutrients and the hydraulic interconnection between surface and groundwater can be obtained through the study of isotopes. In addition, the pollutant pathways into the lake and the quantification of stream flow into both base flow and surface runoff can be easily and more accurately achieved by use of environmental isotopes.

This work involves mainly water sampling from rainfall, stream flows, groundwater and the Lake. Furthermore, sediment sampling is also conducted in order to determine the current sedimentation rates.

Water sampling:

Water samples are collected from both the Mitumba and Ngonya streams flowing through the unimpacted and impacted watersheds respectively. A total of 160 duplicate water samples have so far been collected. Samples from both the high and low stream flows are targeted in order to observe the effects of both lithology and land use on the stream flows' chemical character as well as in the delineation of the major pollutant pathways. The same sampling points on the streams and the lake are maintained for proper monitoring of the chemical character of the water with season. Samples are likewise collected from rainfall.

Sediment sampling:

Sampling also includes sediment load from both the Ngonya and Mitumba streams.

Preliminary assessment shows, as expected, that Mitumba stream flowing across the unimpacted watershed area in the Gombe National Park carries lower sediment load than the Ngonya stream located in the heavily impacted watershed. The actual sediment load of the two streams is yet to be determined in the laboratory for proper evaluation of the recent sedimentation rates.

Stream flow measurements:

Stream flow measurements are recorded mainly for high flows. Both Mitumba and Ngonya streams are measured. Flow for the Ngonya stream varies from 0.093 to 0.733 M³/sec at gauge heights of 0.14 to 0.733 m respectively. The Mitumba stream flow is observed to vary from 0.031 to 0.190 M³/sec at gauge heights of 0.06 to 0.13m respectively. Because of the micro climate effect and/or shifting of the stream flow control factors resulting in increased channel width and reduced stream

flow velocity, stream flow measurements do not always correspond directly with the gauge height. Stream flow measurements for the shifting Ngonya stream were accomplished by use of surveying techniques. It is interesting to note that the data collected following this procedure and those obtained directly on the staff gauge, plot equally well on the rating curve for the stream.

Water samples analysis:

During fieldwork, analyses of water samples are limited to: the determinations of pH, NO₃, dissolved oxygen, electrical conductivity, temperature, Fe, Chloride, Phosphorous and alkalinity. However, laboratory work commences with the filtration of all the samples at the Kigoma LTBP wet laboratory and detailed chemical analyses for all major ions and other parameters are performed at the Tanzania Bureau of Standards (TBS) in Dar es Salaam.



Dr. Nkotagu and villagers collect water from the new collection chamber at Mwamgongo, Tanzania

Field equipment installation:

Two manual rain gauges were installed in the open air, one close to each of the Mitumba and Ngonya stream gauging stations. Due to the roughness of the Ngonya stream, a metallic gauze was installed in order to protect the gauge plate from being knocked down by rolling boulders and cobbles brought about during flash floods.

Interesting news:

Interesting news is that one of the seepage sampling points identified during this work has been developed into a water supply source for the Mwamgongo village. After our explanations to the village leaders on how to solve their acute problems of a clean and safe drinking water supply, a collection chamber was constructed. Collective efforts by all the villagers resulted in this wonderful potentially long-term solution.

Dr. Hudson Nkotagu is the Sedimentation Special Study Coordinator for Tanzania.

LTBP Renovations of Riparian Stations

During the past year, LTBP has worked hard to establish a presence in each of Lake Tanganyika's four riparian nations. In addition to our National Coordinator's offices in Bujumbura, Dar es Salaam, Kinshasa and Lusaka, and the Project Coordinator's office in Dar es Salaam, LTBP has established a presence at the lakeshore in each of these countries, with lakeside research stations in Bujumbura, Kigoma, Mpulungu, and Uvira.

In Bujumbura, the Burundian Ministry of Agriculture granted LTBP generous office space in the Department of Water, Fisheries and Aquaculture. After a coat of paint all around, we moved into the former offices of the Regional Research Center in Applied Hydrobiology (CRRHA). Our facilities include: wet and dry laboratories, a museum with aquaria, a library with computer



LTBP Bujumbura Station

facilities and office space. We are grateful for the resources, notably a vast library of literature, that we inherited from the CRRHA project. LTBP also capitalizes on the excellent laboratory facilities of other institutions in Bujumbura to carry out its studies. For example, the physico-chemical component of the pollution studies is carried out at the laboratory of the National Institute for the Environment and Conservation of Nature (INECN) and components of the sedimentation studies are conducted at the Department of Geology and Mines (DGGM), the National Geographic Institute (IGEBU) and the University of Burundi.

In Tanzania, LTBP is based at The Tanzanian Fisheries Research Institute (TAFIRI) compound in Kigoma. LTBP renovated an old fish-shaped storage building/canteen to provide offices for the facilitator, administrative assistant, visiting researchers and communal computer facilities. In addition, LTBP upgraded the



LTBP Kigoma Station (TAFIRI)

TAFIRI wet and dry laboratories and renovated the R/V Echo. Though some analyses are conducted in Dar es Salaam and Arusha, all the LTBP special studies conducting research in Tanzania rely on the TAFIRI Kigoma facilities.



The R/V Silver Shoal (DoF - Zambia)

The Zambian Department of Fisheries (DoF) granted LTBP office facilities at their compound in Mpulungu. LTBP has dedicated office space for the administrative assistant and facilitator and has use of communal DoF facilities, including, laboratories, the library, and storage facilities. At DoF Mpulungu station, LTBP has upgraded the wet and dry lab facilities, renovated the R/V Silver Shoal and contributed computers to the library. All the LTBP special studies conducting research in Zambia rely on these DoF Mpulungu Station facilities.

In the Democratic Republic of Congo, LTBP activities are concentrated at the Hydrobiological Research Center (CRH) in Uvira. The two-story center, with its biological and limnological laboratories, museum and darkroom, was constructed by the Belgians in the 1940s and at that time was surely the most



LTBP Uvira Station (CRH)

impressive scientific center on the lake. In addition to the Belgians, other international scientists including the Japanese, Americans, and French have relied on this center over the years. LTBP is currently renovating the CRH building to put it back in business as a functional laboratory. This work includes complete refitting of electricity and plumbing, masonry, woodworking and a fresh coat of paint all around.

We hope that you will make an effort to visit the LTBP riparian stations when you are in the area or learn more about each station by visiting our website.

Calendar of Progress and Upcoming Events

29 Jun-3 Jul 1998	Zambia held its National Sectoral Problem Review workshop in preparation of the SAP.	23-27 Nov 1998	Transboundary Diagnostic Analysis held in Lusaka, Zambia. Technical specialists from Tanganyika's four riparian nations met in Lusaka to prioritize the threats to Lake Tanganyika's biodiversity.
2-10 Jul 1998	Francophone Biodiversity Workshop held in Bujumbura: 'Atelier ESBIO: Evaluation, monitoring, gestion et exploitation de la Biodiversité'	16 Nov 1998	Project Personnel from LTBP and the Lake Tanganyika Research (LTR) projects met to discuss a joint monitoring program to be executed at the riparian station.
13-14 Jul 1998	Interviews held at Marine Resources Assessment Group (MRAG) and Natural Resources Institute (NRI) for field-based facilitators to assist with execution of special studies.	16 Dec 1998	Project personnel visited the Centre de Recherche en Hydrobiologie (CRH) for the first time since July 1998 owing to insecurities in the region. Scientific activities and renovation of CRH resume.
27-31 Jul 1998	Tanzania held its National Sectoral Problem Review workshop in preparation for the SAP.	25-29 Jan 1999	Training and Communications Liaison Officers from Tanganyika's four riparian nations met in Bujumbura for a workshop.
12-13 Aug 1998	Delegations from Burundi, DR Congo, Tanzania and Zambia gathered in Arusha, Tanzania for Steering Committee and Technical Advisory Committee Meetings. Agenda items included: review of project progress at all levels, presentation of the IW:Learn distance-based learning initiative, clarification of the roles of National Working Groups and National Steering Committees, discussion of the Training Needs Assessment Report, overview of the Strategic Action Planning Process and preparation for Transboundary Diagnostic Analysis.	4-5 Mar 1999	Delegates from Tanganyika's four riparian countries attend the closing conference for the Lake Malawi GEF project.
31 Aug-4 Sept 1998	Zambia held its National Environmental Priorities and Strategies Review workshop in preparation for the SAP.	15 Apr 1999	Project Management Meeting in UK to discuss the recommendations of the mid-term evaluation.
7-11 Sept 1998	Burundi held its National Sectoral Problem Review workshop in preparation for the SAP.	May 1999	Steering Committee Meeting and Tripartite Review in Bujumbura, Burundi.
2 Oct-6 Nov 1998	Facilitators arrived in post and, with the SLO, toured the Mpulungu, Kigoma and Bujumbura stations to assess resources and determine priorities as they made forward workplans for their special studies.		
12-16 Oct 1998	Tanzania held its National Environmental Priorities and Strategies Review in preparation for the SAP.		
20-24 Oct 1998	RD Congo held a workshop in Arusha, Tanzania to deal with both the National Sectoral Problem Review and the National Environmental Priorities and Strategies Review in preparation of the SAP.		
1-29 Nov 1998	LTBP underwent mid-term evaluation. Msrs. G. Cougny and N. Ipsen, contracted by UNOPS to carry out an evaluation of LTBP on behalf of UNDP and GEF, visited Dar es Salaam, Bujumbura, Kigoma, Mpulungu and Lusaka to meet with National Coordinators, members of National Working Groups, the Project Coordination Unit, members of national institutions executing work on behalf of the project and other project personnel.		
2-6 Nov 1998	Burundi held its National Environmental Priorities and Strategies Review workshop in preparation for the SAP.		