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IMPACT OF SOIL EROSION IN BURUNDI AND WESTERN TANZANIA ON THE LARVAL CHIRONOMID FAUNA OF RIVER DELTAS IN LAKE TANGANYIKA, EAST AFRICA

by

Hilde EGGERMONT
2000

Pollution Control and Other Measures to Protect Biodiversity in Lake Tanganyika (RAF/92/G32)
Lutte contre la pollution et autres mesures visant à protéger la biodiversité du Lac Tanganyika (RAF/92/G32)

Le Projet sur la diversité biologique du lac Tanganyika a été formulé pour aider les quatre Etats riverains (Burundi, Congo, Tanzanie et Zambie) à élaborer un système efficace et durable pour gérer et conserver la diversité biologique du lac Tanganyika dans un avenir prévisible. Il est financé par le GEF (Fonds pour l'environnement mondial) par le biais du Programme des Nations Unies pour le développement (PNUD)"	The Lake Tanganyika Biodiversity Project has been formulated to help the four riparian states (Burundi, Congo, Tanzania and Zambia) produce an effective and sustainable system for managing and conserving the biodiversity of Lake Tanganyika into the foreseeable future. It is funded by the Global Environmental Facility through the United Nations Development Programme.

Burundi: Institut National pour Environnement et Conservation de la Nature

D R Congo: Ministrie Environnement et Conservation de la Nature

Tanzania: Vice President's Office, Division of Environment

Zambia: Environmental Council of Zambia

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Impact of soil erosion in Burundi and western Tanzania on the larval chironomid fauna of river deltas in Lake Tanganyika, East Africa

[De invloed van bodemerosie in Burundi en westelijk Tanzanië op de benthische biodiversiteit van Lake Tanganyika, Oost-Afrika]

by Hilde EGGERMONT

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English Summary

Soil erosion as a result of deforestation and agriculture constitutes a major threat to the unique biological diversity of Lake Tanganyika (East Africa). In the framework of the United Nations Development Program's Lake Tanganyika Biodiversity Project, this study investigated the impact of soil erosion and excessive sedimentation on the chironomid fauna of Lake Tanganyika by comparing subfossil chironomid species assemblages from river deltas adjacent to three relatively undisturbed catchment areas (Gombe, Lubulungu, and Kabesi) with those from deltas adjacent to five highly disturbed catchment areas (Mwamgongo, Gatorongoro, Nyamuseni, Karonge/Kirasa and Luiche) in Burundi and Tanzania. A total of 38 samples were analysed; one sample originating not from a delta but from great depth on Kalemie Ridge in the middle of the lake was used to evaluate the importance of pre-burial long-distance transport of subfossil remains on the spatial distribution of the various taxa; this long-distance transport proved to be relatively limited.

The chironomid fauna of Lake Tanganyika has never been the subject of comprehensive ecological study, and is poorly known taxonomically. This study yielded a total of 4244 fossil chironomid specimens of which 89.5% could be identified to the level of species, species type, or genus. A total of 80 chironomid taxa were distinguished, among which 7 Tanypodinae, 21 Orthocladiinae, and 52 Chironominae. To promote taxonomic consistency in future research, differential diagnoses illustrated with black and white photographs are provided for all taxa.

The three most common taxa *Microchironomus* type 1, Tanytarsini type 1-2 a 'spur', and Tanytarsini type 3 together make up only 1/3 of the total fauna; thus, there were no truly dominant species. The highest species diversity was found in the relatively undisturbed Lubulungu delta, and the lowest diversity in the highly disturbed Luiche delta, but otherwise no clear relationship was found between the degree of disturbance of a delta and the species richness of its chironomid fauna.

Multivariate and univariate statistical methods were used to investigate relationships between faunal composition and several environmental variables such as water depth, distance from the shore, catchment area, and sediment texture and organic-matter content; the degree of disturbance of the catchment area was treated as a categorical variable. Multivariate analyses (TWINSPAN and CCA) distinguished 5 groups of samples which largely coincided with one or more deltas: Luiche, Kabesi, Lubulungu-Gombe, Mwamgongo, and the combined Burundian deltas Nyamuseni and Karonge/Kirasa (Figure 1). Around 30% of the total variation in faunal composition was accounted for by the environmental variables catchment area, water depth, distance from the shore, and sedimentary organic-matter content. Also here

no clear-cut difference between the chironomid faunas from disturbed and undisturbed deltas could be found, however within each size class of catchment area disturbance appears to result in similar shifts in faunal composition which possibly reflect an expansion of littoral-type benthic habitats.

Linear regression analyses showed that 29 out of the 43 non-rare taxa (total count ≥ 7 specimens) are significantly to very highly significantly related to one or more of the selected environmental variables. This allowed sorting of these 43 taxa into 5 faunal groups, whereby each delta is characterised by one or more of these groups. Significance tests revealed that abundances of only 6 of these 43 chironomid taxa (14%) differred significantly between disturbed and undisturbed deltas, with *Microchironomus* type 1 being an indicator species for disturbed deltas, and *Dicrotendipes kibriicola*, *Cladotanytarsus* group A sp.2, Tanytarsini type 1-2 a, Tanytarsini 1-2 a 'spur', and *Procladius* spp. indicators for undisturbed deltas.

The results of this study indicate that soil erosion so far does not have a dominant impact on the diversity and species composition of chironomid faunas in Lake Tanganyika. The fairly high specificity of the fauna in each river delta emphasizes the importance of a conservational strategy that covers the largest possible length of Lake Tanganyika shoreline. The results of this study can be directly applied to paleolimnological reconstruction of the evolution of benthic habitats in a disturbed river delta in relation to human activities in the adjacent catchment.

Figure 1. CCA ordination of larval chironomid faunal composition in 38 sites on river deltas in Lake Tanganyika adjacent to disturbed (closed symbols) and relatively undisturbed (open symbols) drainage basins of four size classes: very small (circles: disturbed Mwangongo versus undisturbed Gombe), small (diamonds: disturbed Nyamuseni versus undisturbed Lubulungu), large (triangles: disturbed Karonge/Kirasa versus undisturbed Kabesi), and very large (squares: only the disturbed Luiche delta).