

Report on the freshwater insect (Ephemeroptera, Plecoptera, Trichoptera) survey of the Akagera National Park Freshwater Summer School

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Akagera National Park represents a wet tropical savanna landscape the comprises multiple freshwater habitats. These are mainly swamps and lakes, most of which are hydrologically linked to the namegiving Akagera River, one of the upper tributaries of the Nile. Additionally, there are numerous temporary pools and puddles that represent freshwater habitats that are potentially inhabited by freshwater insects.

During the field school these different habitats were sampled by kick-sampling for larvae and nymphs, sweep netting for adults, and where possible light trapping for adults. Target taxa were mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Trichoptera).

We sampled the following water bodies for aquatic insect larvae: Lakes Beringero, Hago, Ihemba, Mihindi, Rwanyakazinga, the Akagera River at the northern border of the park, Papyrus swamps with clear water and slight flow on the Kageyo Peninsula, as well as pool on the Mubari-Migongo escarpment. The return varied at different sites. This was largely dependent on the access to benthic invertebrate habitat. Most samples could only be taken from shore mud or shore vegetation because access to deeper waters was limited by the activity of hippopotamus. Access to the boat on Lake Mihindi allowed us to also sample shoreline substrates from the lakeside. These included deadwood, rocks, and the roots of floating water hyacinth islands. The observed taxa did not vary noticeably from those collected from the lakes shoreline below the cafe and campsite. Within the underwater vegetation most specimens returned were of non-target groups (aquatic Hemiptera, Acari, Diptera, aquatic Coleoptera, Odonata). In numerous sites we also collected mayfly nymphs. Trichoptera larvae (presumably family Leptoceridae) were only found on the rocky shore fixtures of Lake Shakani. No Plecoptera larvae were found. Based on the return we will now DNA barcode the mayfly, dragonfly and damselfly nymphs to facilitate future juvenile/adult associations and thereby perhaps facilitate the development of species-level identification keys for these taxa in eastern Africa.



Figure 1. Larval sampling from the boat on Lake Mihindi (left). Larval sampling in the Papyrus swamp habitat (right).

Adult sampling. Sweep netting for EPT proved unsuccessful. This may have many reasons, but limited access from the water side to the shore vegetation is certainly one of several reasons. Success was better at the light traps. Active and passive light trapping was conducted at Lake Shakani, Lake Ihemba, Lake Rwanyakizinga, Hippo Beach at Lake Mihindi, and on the Akagera River. In total, seven adult caddisfly specimens of five to six taxa were collected (Table 1). The number of specimens was very low. Mayfly adults were collected at all sites, except at Hippo Beach. However, with less than ten specimens per site, the number of individuals was again very low. A highlight was an adult female stonefly caught on the shore of the Akagera River. All adult specimens will now be subjected to further integrative taxonomic treatment comprising DNA and morphological work prior to final species-level identification for the males. Females will likely be identified to genus level only. Identified specimens will be returned to CoEB for the Odonata, Ephemeroptera, and Trichoptera. Individual specimens of Trichoptera will remain at SGN for further study of the Afrotropical caddisfly fauna.



Figure 2. Sweep netting on the shore of Lake Ihemba.

Table 1. Collected caddisflies during the survey.

Locality	Date	Family	Species	Sex	N specimens
Akagera river	01-Nov-2023	Hydropsychidae	<i>Cheumatopsyche</i> sp. 1	female	2
Akagera river	01-Nov-2023	Hydropsychidae	<i>Cheumatopsyche</i> sp. 1	male	1
Akagera river	01-Nov-2023	Hydropsychidae	<i>Macrostemum</i> sp.	female	1
Akagera river	01-Nov-2023	Leptoceridae	<i>Leptocerus</i> sp.	female	1
Lake Ihema	28-Okt-2023	Hydropsychidae	<i>Cheumatopsyche</i> sp. 1	female	1
Lake Shakani	27-Okt-2023	Leptoceridae	<i>Athripsodes</i> sp.	female	1



Figure 3. Light trapping. Setup on Akagera River (left). Light trapping on side of truck (centre). Light trap at Lake Mihindi camp site (right).

Overall, our sampling returned far fewer specimens than originally anticipated. The reasons for this could be manifold:

- One observation was that most water bodies were turbid and oxygen levels of the standing water bodies were very low (<50% O₂ saturation). Even on the flowing Akagera River we only measured 58% O₂ saturation. Since all three EPT taxa generally have highest diversity in unperturbed, well-oxygenated freshwaters, the low return could reflect low diversity of those species more tolerant to lower O₂ conditions. This fits with the observation that the families and genera observed fit well those known to have greater tolerances toward perturbation or marginal habitats (e.g. Caenidae, Ephemerellidae, Leptoceridae). We would, however, have expected greater numbers of individuals from a few tolerant species to characterize these communities.
- Another important factor could be seasonality. Coming off the end of the dry season many species may still be in their juvenile stages far off from shore in preferable microhabitats. As mentioned access to these habitats was limited and we may thus our survey certainly underrepresented the diversity and abundance of EPT larvae. Adaptations to seasonality can vary with some species aestivating as adults over the dry period and laying eggs early in the wet season. It takes some weeks to months before the next generation of adults can emerge. In D.R. Congo EPT have been surveyed for numerous years at Lwiro. There we observe greatest abundances of adults during the transition times from dry to rainy season and from rainy to dry season (Mwangi, personal observation). It also seems that Odonata abundances were on the low end during the summer school period (Dijkstra, personal observation).
- Another factor may be the influx of pollutants. The Akagera is hydrologically linked to all the wetlands and lakes on the eastern and northern sides of the park. Flowing from Lake Rweru through pastoral and agricultural landscapes the Akagera likely brings with it high levels of sediment. High levels of eutrophication of the sampling areas (e.g. influx of organic materials from large mammals along the shorelines of the lakes) may also pose a problem for the target species. However, in this case we would have expected greater numbers of specimens from a few tolerant species.

In summary, we find that the EPT fauna recorded was below our expectations. However, a more intense temporal and spatial survey, specifically sampling larger stretches of shore habitats is necessary prior to drawing conclusions.