Recent Efforts in Biological Control of Water Hyacinth in the Kagera River Headwaters of Rwanda

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Abstract

As part of regional water hyacinth management activities in the Lake Victoria Basin that also involve Kenya, Tanzania, Uganda and several international partners, Rwanda is currently implementing efforts to rear and release the two *Neochetina* weevil species as biological control agents through coordination of training activities and training visits made to Uganda and Tanzania. Weevils for release in Rwanda have come from stocks maintained in Uganda.

The implementation of the biological control program within the Kagera River system of Rwanda is expected to further support the long-term control of water hyacinth in the Lake Victoria Basin by reducing water hyacinth biomass in source waters. Funding and technical support for the implementation of the biological control program for water hyacinth in Rwanda are being provided by Clean Lakes, Inc. through a two-year cooperative agreement with the United States Agency for International Development Greater Horn of Africa Initiative through the Regional Lake Victoria Water Hyacinth Management Program.

APPROXIMATELY 13 years ago water hyacinth was officially recognised as having invaded the world's second largest lake, East Africa's Lake Victoria. During the ensuing years various management activities have been implemented by Kenya, Tanzania and Uganda with support from several international partners and donor organisations. Recently, these countries and Rwanda have begun to coordinate management efforts through regional organisations such as East African Cooperation (EAC), the Lake Victoria Fisheries Organization, the Lake Victoria Environment Management Program, or through bilateral memoranda of understanding. Biological control efforts using the weevils *Neochetina eichhorniae* and *N. bruchi* began in late 1995 through release efforts initiated by Uganda that continue to date. Rwanda is currently implementing water hyacinth control through rearing and release efforts assisted by Clean Lakes, Inc. (CLI), under cooperative agreement funding from the United States Agency for International Development (USAID), and through coordination of training activities and visits carried out in Uganda and Tanzania. Weevil stocks maintained in Uganda are the source of weevils imported into Rwanda.

The Lake Victoria Basin water hyacinth infestation extends to its uppermost point within the Kagera River system to the headwaters of Mukungwa River tributary, located approximately 50 km northwest of Kigali, Rwanda (F. Orach Meza, pers. comm.). The Mukungwa River is joined by the Nyaborongo River, keeping the latter's name, until it merges with the

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Burundi's Ruvubu River system near Lake Rweru, along the Burundi border, to form the Akagera River, also known as the Kagera River (see Figure 1). The entire Mukungwa/Nyabarongo/Kagera river system to Lake Victoria is infested with water hyacinth, a length of over 500 km. Water hyacinth ultimately enters Lake Victoria in the form of mats torn away from the shoreline or as individual plants. There is at least one set of major waterfalls along the Rwanda/Burundi border at Rusoma, Rwanda, and a large swamp/lake complex along the Rwanda/Tanzania border of the Akagera River where water hyacinth becomes damaged or is caught in the swamp matrix, thus potentially reducing amounts travelling downstream. Downstream of this large swamp/lake system, which forms a large part of the Akagera National Park, the Akagera River changes direction to an easterly course, becomes shared by Tanzania and Uganda, and experiences a series of elevational drops near Kikagati, Uganda, where water hyacinth again becomes damaged by turbulent waters.

Below Kikagati at a point approximately 160 km from Lake Victoria, the river flattens and passes primarily through Tanzania where water hyacinth flourishes along river banks, growing toward the river centre to a width of about 2 m from the shoreline. Water currents and velocity prevent water hyacinth from growing much beyond that with the exception in some bends, inlets or sloughs, or during periods of drought or flood. Considering that all rivers have two banks, these 160 km of river therefore produce 320 km of linear shoreline growth potential for the weed to a width of approximately 2m, or a total of about 64 ha. It has been visually estimated by CLI staff that within 1 km of Lake Victoria the daily rate of weed flowing down the Kagera River ranges between 0.2 and more than 1.5 ha/day (average 0.75 ha/day or 300 ha/year), depending on seasonal river flow. Others have estimated weed flow rates at 3.5 ha/week or 0.5 ha/day (Twongo and Balirwa 1995). If a growth rate model of 1% per day were assumed, then these 64 ha growing along the shoreline would generate about 0.64 ha of new weed growth/day. This is equivalent, on average, to the estimated daily inflows documented by CLI staff in 1997 (unpublished data) and by Twongo and Balirwa (1995).

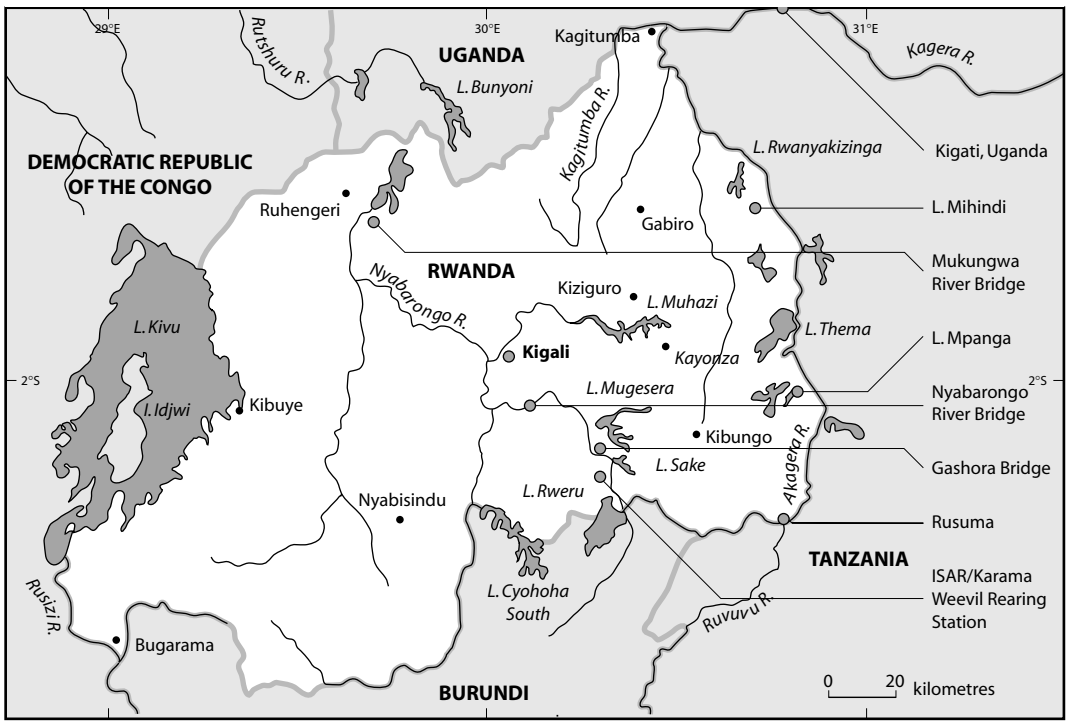

Figure 1. Rivers and lakes of Burundi and adjacent areas of the Lake Victoria Basin

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The Rwandan Biological Control Effort—a Summary

It was recognised that, in order to bring the water hyacinth under management within the entire Lake Victoria Basin, a cooperative effort should be encouraged between the countries concerned. Recommendations were made in various regional and EAC fora to include Rwanda and Burundi in efforts to manage water hyacinth in the lake basin. In 1997, the governments of Rwanda and Uganda signed a memorandum of understanding on common agriculture issues to cooperate on, among other things, water hyacinth management. Both governments committed their countries to full collaboration in management of the water hyacinth problem.

During a Uganda Agricultural Policy Committee meeting in July 1999, the Uganda National Agriculture Research Organization (NARO) sought support for Rwandans to be trained for implementing biological control of water hyacinth in the upper Kagera River watershed.

In August 1999, EAC adopted a regional strategy document on the control of water hyacinth and other invasive weeds in East Africa. This document covered the issue of water hyacinth control in the upper Kagera River.

In September 1999, CLI staff visited Rwanda to hold discussions with the Director General, Institut des Science Agronomique du Rwanda (ISAR), to explore interest in training and release programs for biological control of water hyacinth in the upper Akagera River watershed. While there, CLI staff visited the Nyabarongo River, a tributary of the Kagera River that flows south of Kigali, and reviewed the weed infestation.

During November 1999, the Secretariat of the EAC, in close collaboration with the United Nations Economic Commission for Africa, Kigali Sub Regional office, held a workshop in Entebbe on water hyacinth in the Lake Victoria Basin. One of the recommendations of the workshop was that a program for the biological control of water hyacinth should be implemented in the upper Kagera River.

Through a USAID cooperative agreement, CLI facilitated the training of Rwandan and Burundian government officials in November 1999. The training was led by Dr James Ogwang, head of biological control programs at NARO's Namulonge Agriculture and Animal Production Research Institute (NAARI) and by staff of the Uganda Ministry of Agriculture, Animal Industries and Fisheries/Water Hyacinth Unit (MAAIF/WHU).

In May 2000, MAAIF/WHU and CLI staff visited Rwanda, in cooperation with ISAR officials, to identify locations suitable for establishing the initial weevil rearing centre. Karama Animal Husbandry and Fisheries Unit, one of the ISAR branch locations in Rwanda, was selected because of its relative closeness to the Nyabarongo/Akagera River system. This unit is located in the southern part of the country, approximately 70 km southeast of Kigali in the Commune of Gashora on the shores of Lake Kilimbi.

In July 2000, MAAIF/WHU, CLI and ISAR officials erected two weevil rearing tanks at ISAR/Karama. The tanks were filled with water and water hyacinth.

In mid August 2000, the Rwanda Ministry of Agriculture, Livestock and Forestry issued an authorisation allowing the Director General, ISAR, to import water hyacinth weevils.

During 19–22 September 2000, ISAR/Karama weevil rearing facility and CLI staff travelled to the weevil rearing sites at Kyakairabwa (Bukoba) and Kyaka (Kagera River), Tanzania, to review and further strengthen weevil-rearing techniques and experience through observation and discussions with weevil-rearing technicians. On their return to Kampala, they proceeded to the village sometimes known as Goma (near Kasensero) to a point approximately 1 km upstream from the Kagera River outlet on Lake Victoria to observe water hyacinth growth. Weevil damage was noted on plants. The weevils present might have come from releases carried out by the Goma weevil rearing site, or have migrated upriver from Lake Victoria after releases carried out in the Bukoba, Tanzania area, or from upriver releases at Kyaka (quarterly releases since June 1998) under the support of the Lake Victoria Environment Management Project, or at Mulongo, Tanzania through support from the International Fund for Agriculture Development under the Kagera Agriculture and Environmental Management Program (KAEMP) (quarterly releases since 1999). The ISAR/CLI team understood that KAEMP had also made two weevil releases on the Tanzanian side of the Akagera River, opposite Rusoma, Rwanda, though no dates were given and details remain sketchy.

In September 2000, the Deputy Director – Research of the Ugandan NARO, issued a letter granting approval for Rwanda to export weevils from Uganda and gave permission for NAARI to collect and prepare weevils for transit to Rwanda.

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On 25 September, weevils were collected in cooperation with NARO from the NAARI weevil rearing tanks under the direction of the head of biological control programs and assisted by NAARI, ISAR, and CLI staff. The numbers of weevils collected for transport were as shown in Table 1.

In order to help monitor the efficacy of weevil releases, satellite images were scheduled for acquisition in late September or early October 2000, depending on cloud cover. IKONOS 1-metre PAN and 4-metre multispectral band data were to be collected in collaboration the United States Geological Survey–EROS Data Center. One image each will be acquired for the small lakes, Lake Mpanga and Lake Mahindi, in the Akagera River area of Akagera National Park (eastern Rwanda) at the upstream and downstream ends of the swamp/lake complex, respectively. While influences such as flooding, drought and pathogens may also lead to declines in water hyacinth, it is expected that these images will provide a baseline sample for tracking water hyacinth cover and distribution before and after weevil release. On-the-ground observations will be made along other sections of the river.

On 27 September 2000, ISAR and CLI staff travelled by air from Entebbe, Uganda to Kigali, Rwanda, with the consignment of *Neochetina* spp. Upon arrival in Kigali, they were met and transported to the ISAR Karama weevil rearing facility in order to inoculate the weevils into water hyacinth in previously established tanks. Approximately 800 weevils were placed in the water hyacinth plants of the two tanks. The two weevil species were deliberately mixed when placing them in the tanks. The Karama weevil rearing site is within 10 km of the Gashora Bridge on the Nyabarongo River, which is expected to become one of several weevil release sites within Rwanda.

Table 1. Numbers of water hyacinth weevils collected in Uganda in September 2000 for release in Rwanda

	Chevroned water hyacinth weevil (*Neochetina bruchi*)	Water hyacinth weevil (*Neochetina eichhorniae*)
Females	117	330
Males	127	280
Subtotal	244	610
Total	854	

On 28 September, approximately 25 weevils of each species were released in a small depression, Lake Kiruhura, in the Nyabarongo River floodplain, approximately 2 km east of the Nyabarongo River Bridge, 20 km south of Kigali. This seasonal lake, just over a hectare in area, lies approximately 200 m south of the Nyabarongo riverbank. It was about 60% covered with water hyacinth of estimated average height 30–40 cm. About 40% of the plants were in flower. As a result of drought in much of Rwanda at the time, rivers, pools, and depressions were experiencing very low water levels. It was expected, however, that the rainy season would commence shortly over the entire country, as rains had at release time been reported in the upper Mukungwa/Nyabarongo rivers of northern Rwanda.

Conclusion

Studies and evaluations of the effectiveness of the biological control program will continue, and updates will be provided as data become available. The next report on the campaign is scheduled for release in January 2001.

Reference

Twongo, T. and Balirwa, J.S. 1995. The water hyacinth problem and the biological control option in the highland lake region of the Upper Nile basin—Uganda's experience. Paper presented at the Nile 2000 conference: Comprehensive Water Resources Development of the Nile Basin: Taking Off. 13–17 February 1995, Arusha, Tanzania.

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