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Managing *Aquatic Plants on a Massive Scale*

Jane Dauffenbach

A Lake Victoria case study

Lake Victoria is the second largest freshwater lake in the world. It covers nearly 27,000 square miles. Bordered by Kenya, Tanzania, and Uganda, the lake serves as a valuable resource to the region providing food, potable water, hydroelectric power, and transportation. It is less than 260 feet at its deepest point.



For nearly ten years a growing water hyacinth (*Eichhornia crassipes*) infestation has wreaked havoc on the neighboring countries. Massive islands have formed that blow around from one region of the lake to another, like big green icebergs. When one of these masses settles into a port or bay, it paralyzes local fishing and transportation. There are areas where the weed islands came ashore seven years ago and still remain. Rotting fishing boats remain stranded on the beach where they were last docked. In these areas, half-grown children have never seen the open water nor realize that the lake's shoreline is there.

Although no one is sure exactly when the water hyacinth first entered the lake, it most likely traveled down the Kagera River that empties into Lake Victoria. Satellite photos taken of Lake Victoria in 1996 showed that hyacinths covered nearly one percent of the immense lake. This figure is now estimated as high as three percent.

The Kenyan coastline and Port of Kisumu have been particularly hard hit by this menacing weed. The huge mats have even prevented large boats from

leaving the harbor.

So why the explosive vegetation growth? The lake suffers from point and nonpoint sources of pollution including raw and under-treated sewage, agricultural runoff, industrial effluent, and a host of other man-made stresses resulting from the developing areas in the watershed. The opportunistic water hyacinth has flourished under these conditions.

Water hyacinth is a free-floating water plant that is native to South America. It can vary in size from a few inches tall to over three feet. The plant has blue-green leaves, thick stalks, and a showy purple or lavender flower. It thrives in tropical regions and in waters that are high in nutrients.

Reproduction is primarily vegetative, with the mother plant sending out a stalk that grows a daughter plant. The daughter plant matures and sends out another daughter plant, and so on. It is common to find several generations among one stand of hyacinths, as the plants often remain entangled in a large mass. Hyacinths can also reproduce through seed, but the seeds must germinate in very shallow, muddy waters. A seed dropped in relatively deep water is unlikely to ever grow. Rarer still is the possibility of the hyacinth to regenerate from a plant fragment.

Water hyacinth mats trap a large ship at the Port of Kisumu in Lake Victoria.



The Solution

Aquarius Systems was awarded a World Bank Tender to chop 3,700 acres of water hyacinth in a 12-month period. The project was financed by a grant from the Global Environmental Facility through the International Bank for Reconstruction & Development, and a Credit from the International Development Association. We worked under the direction of the Lake Victoria Environmental Management Project.

We proposed using three Swamp Devil Aquatic Vegetation Cutters to perform the work. The Swamp Devil is a powerful machine fitted with two circular cutting blades on the bow that also serve to propel and steer the vessel. It can trench channels nearly three feet deep and eliminate brush and trees up to four inches in diameter. By using a special double blade system, the machine could shred the water hyacinth into small pieces, thus fulfilling the contract requirements.

The Interim

Between the time of the award and contract signature, we manufactured the equipment required to do the job and made other preparations. During this time several trips to Kenya were made for site visits and plenary meetings. Some groups questioned the intent to leave the chopped material in the water to decompose, as was specified in the tender. In response we voluntarily offered to substitute a weed harvester and shore conveyor for one of the Swamp Devils in order to demonstrate the effectiveness of harvesting the spoil once it was chopped. In August 1999 the first of three shipments arrived in Kenya's Mombassa Port, and was subsequently

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trucked to Kisumu, a city of one million people located on Lake Victoria. Kisumu is the third-largest city in Kenya, after Mombassa and Nairobi, and is the base of operations for this project.

Between the time of the contract award and the time the chopping work started, an unprecedented phenomenon occurred—the beds of sater hyacinth had become colonized by secondary growth consisting of 23 plant species. Hippo grass and papyrus were the predominant plants.

In our surveys we estimated that 30 percent of the plants visible were hyacinth, and 70 percent was other vegetation. These huge floating islands blow in and out of the bays with the daily tradewinds at rates of three to four knots, and are impressive to see. Bushes and trees have formed on some islands, and the weeds are more than 10 feet high on others.

There is a valid concern that the islands will become permanently lodged in shallow water, turn into sediment traps, and eventually destroy the natural shoreline and Ports. If the islands are allowed to block any outlets, artificial flooding will occur, severely impacting the neighboring villages.

Harvesting

In October the chopping work commenced in Kisumu and included areas adjacent to Dunga Beach and Hippo Point. These areas were cleared, and were followed by a successful chopping and shredding operation at Homa Bay in November. This time period was used to train the 20 Kenyan employees in the use of the unusual machinery.

This secondary weed growth made executing the job more difficult as well, but it was handled by the Swamp Devils almost as readily as chopping the hyacinth itself. By working two shifts seven days a week, the 12-month contract was completed in only five months. That the work was finished in



Swamp Devil at work.

half the allotted time was due in no small part to skills of the Kenyan operators, all of whom were trained to a high level of proficiency.

The chopping and removal program is a useful and productive technique in the lake manager's toolbox. The mechanical method of weed management allows the user selective control; the equipment works only where it is directed to work. The immediate benefits from the work were providing fishing boats and ferries access to open water, and reclaiming the original shoreline. Longer-term benefits from the eradication process include reduced vegetation growth and, when harvesting, some nutrient removal.

The Lake Victoria Environmental Management Project is hoping to experiment with developing a by-product for the chopped plants that are removed from the lake. We suggest that the simplest and most cost-effective solution in this case will be to compost the weeds for soil conditioner. There is a co-operative for disadvantaged women called KICK located in Kisumu that is using harvested vegetation to make decorative papers and crafts, baskets, and casual style furniture that resembles wicker in texture and design.

The Weevils

Weevils were introduced about three years ago as a biological control agent to manage the hyacinth growth. The species being used are *Neochetina Eichhorniae* and *Neochetina Bruchi*, which are commonly used together to combat water hyacinth.

The goal was to have five weevils per hyacinth plant. During our non-scientific and random sampling, we counted from one to eight weevils per plant, averaging about three per plant.

Since 1998 we have not observed healthy, robust water hyacinth in Kenya. We suggest two possible reasons for this: algal growth in the water is competing for the available nutrients and the weevils have stressed the plants. But the weevils have not eradicated the hyacinth infestation by any

means.

Some groups have tried to polarize the hyacinth control efforts as a battle between: Machine vs. Bug. However, these control measures are two separate and distinct methods, each with its own set of benefits. Mechanical control offers immediate eradication and provides the relief required for transportation and use of the ports. The weevils offer a potential for long-term control by stressing existing plants and keeping new growth in check. Both methods are useful and necessary, and they work hand in hand.

What Happened

Nature played a helpful role in the disposal of the chopped vegetation. At the end of each day the trade winds reversed and carried away most of the material not collected by the harvester, dispersing it over a large area. While touring the bay at different times we observed scattered bits of slightly submerged decaying vegetation. The fragments created no navigational hazard and were barely noticeable. In a short time there was no evidence of the fragments.

We have not yet compiled the final results of our decomposition studies, but it appears that there was not a significant nutrient release from the decaying vegetation. Perhaps this is to be expected from the relatively unhealthy state of the water hyacinth. We also observed no regeneration of the hyacinth fragments.



A medium-sized harvester cleans up the floating debris remaing from the chjopping work.

A few people are now intrigued by why the other plant species colonized the water hyacinth mats. Some have a theory that the weevil-stressed hyacinths provided the perfect substrate for this extraordinary secondary growth. On the other hand it seems reasonable to expect that this could have happened on top of healthy hyacinths as well.

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Summary

One important consideration in the management of Lake Victoria is to understand that it took many years for the lake to get into the poor shape it is in, and it's going to take time to reclaim it. The water hyacinth infestation is a devastating symptom of the serious water quality problems that plague the lake.

Many efforts are underway to address the management issues facing the lake. The countries surrounding the waters are developing common standards, policies, and practices to adopt for proper conservation of the lake and watershed. Our project is a small but useful component in this effort.

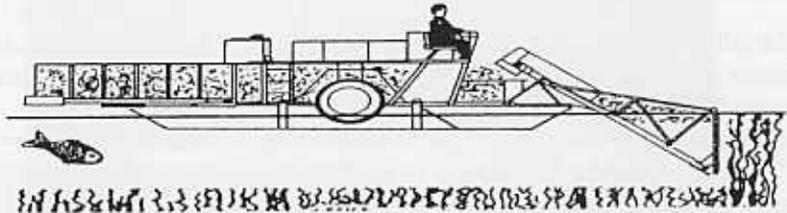
Without the hyacinth chopping program in the Port of Kisumu this past winter the floating islands would have continued to inhibit navigation and fishing activities. Our program opened up the Port for ships and made commercial fishing viable once again. To learn more about this project, please visit the website on it at: <<http://www.water-hyacinth.com>>.



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