AQUATIC WEEDS HOTSPOTS IN THE LAKE VICTORIA BASIN - UGANDA AND ON LAKE KYOGA: IMPLICATIONS FOR THEIR MANAGEMENT

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Young fishermen trapped in a mobile water hyacinth mat

INTRODUCTION

Proliferation of invasive aquatic weeds has developed into a major ecological and socio economic issue for many regions of the world. As a consequence, inference on where to target control and other management efforts is critical in the management of aquatic weeds (Ibáñez et al., 2009). Notwithstanding, aquatic systems in Uganda in general and in the basins of Lakes Victoria and Kyoga in particular, have fallen victims to aquatic weeds invasion and subsequent infestation. If these aquatic weeds infestations are to be minimized and their impacts mitigated, management decisions ought to be based on up-to-date data and information in relation to location of infestation hotspots. Aquatic systems in the basins of the two production systems are important sources of livelihoods especially from fish production and trade yet they are prone to infestation by aquatic weeds. Thus, the invasion and subsequent infestation of aquatic ecosystems by aquatic weeds pose a major conservation threat to various aquatic resources (Catford et al., 2011; Kayanja, 2002).

This paper examines the extent to which aquatic weeds have infested aquatic ecosystems in the basins of Lakes Victoria and Kyoga. The information is expected to guide management of major aquatic weeds through rational allocation of the scarce resources by targeting hotspots.

MATERIALS AND METHODS

Field data collection to quantify cover abundance of major aquatic weeds was undertaken on Lake Victoria and some of her satellite lakes (Nakivali, Mburo, Kacheera, Kijanebabola and Nabugabo), in addition to Lake Kyoga. The objective was to determine and map hotspots in order to guide management interventions. Surveys were undertaken on a motorized canoe in the littoral (shallow inshore) zones where aquatic weeds thrive.

To determine cover abundance of submerged aquatic weeds from the shore out to the open water, a locally fabricated underwater plant harvester (rake) attached to a nylon rope (Plate 1) was cast and retrieved at various locations along predetermined transects of 50 metres apart until no submerged macrophytes were retrieved. The transects were perpendicular to the shoreline.

Plate 1:
Underwater plant harvesting rake (A); and a rake with retrieved submerged plants (B)

A similar approach, though with no rake, was used for other weeds that were not of submerged growth form e.g. water hyacinth. A line parallel to the shoreline was established between two points that were marked using a GPS (Garmin Extrex - Taiwan) to get the coordinates. The distance between the two points was the length of the weed bed, while the width was visually estimated. This exercise was repeated along every stretch that had aquatic weeds. The area cover (m^2) of the weed bed was therefore a product of the length and the width of the sampled area i.e.

A = L x W, where A = area (m^2), L = length (m) and W = width (m).

Actual cover abundance (ha) was derived by dividing the area (m^2) by 10,000m^2 since 1 ha is equivalent to 10,000m^2.

RESULTS:

Major aquatic weeds of ecological and socio-economic importance in the Lake Victoria Basin and on Lake Kyoga were Water Hyacinth (Eichhornia crassipes) and Brittle Water Nymph (Najas horrida) (Plate 2 A & B). Others included Curly Waterweed (Lagarosiphon spp.) in Fielding Bay on Lake Victoria, and Water Thyme (Hydrilla verticillata) (Plate 2 C & D) on Lake Kyoga.

Plate 2. Major aquatic weeds in Lakes Victoria and Kyoga: A) Water hyacinth along a lake shore; B) *Najas horrida;* C) *Lagarosiphon sp;* D) *Hydrilla verticillata*

On Lake Victoria, major hotspot bays for water hyacinth (Figure 1A) were Bunjako (358ha), Fielding (48ha), Murchison (3ha), and MacDonald (1.5ha) in addition to Ssesse Islands (24ha). Minor lakes in the Lake Victoria Basin were relatively free of major aquatic weeds.

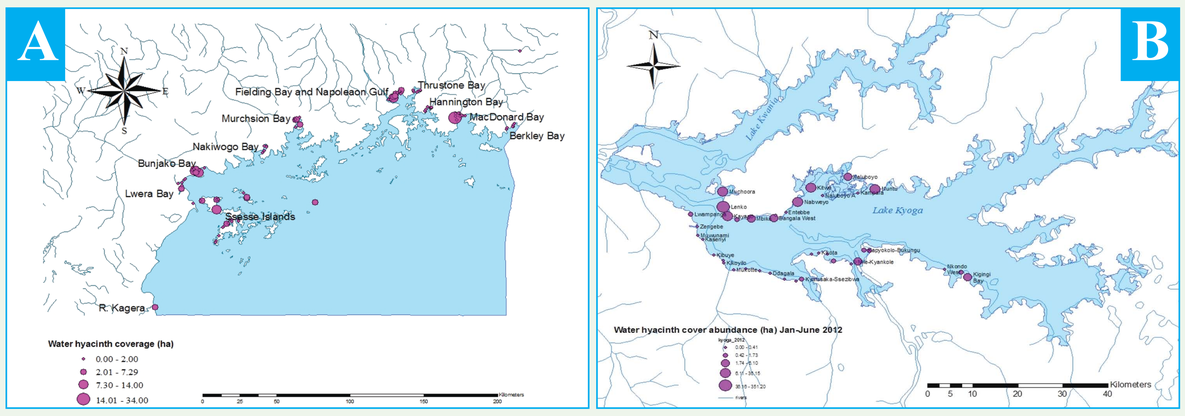

Figure 1: Hotspots for water hyacinth on A) Lake Victoria and B) Lake Kyoga

While water hyacinth infestation was mainly in the northern zones of Lake Victoria, infestation on Lake Kyoga was of wider occurrence but the infestation magnitude reduced in the west east direction i.e. dense infestations were in the western zone, with the eastern zone being free of major aquatic weeds. Thus, major hotspots for water hyacinth on Lake Kyoga (Figure 1B) were Lenko (194ha), Kayago (36ha), Muntu (28ha), Muchora (25ha), Kitwe (23ha) and Nabweyo (17ha).

The Najas horrida was the second most important aquatic weed on the two lake systems. On Lake Victoria, major hotspots (Figure 2a) were MacDonald (26ha), Hannington (12ha) and Nakiwogo (4ha). On Lake Kyoga, hotspots for N. horrida (Figure 2b) were around Lenko (343ha), Kayago (130ha), Muchora (51ha), Kitwe (32ha), Mbiko (18ha) and Nabweyo (17ha). Other than water hyacinth and N. horrida, other aquatic weeds of importance were Lagarosiphon sp that was in Fielding Bay (48ha) of Lake Victoria, and Hydrilla verticillata at Kitwe (8 ha) on Lake Kyoga.

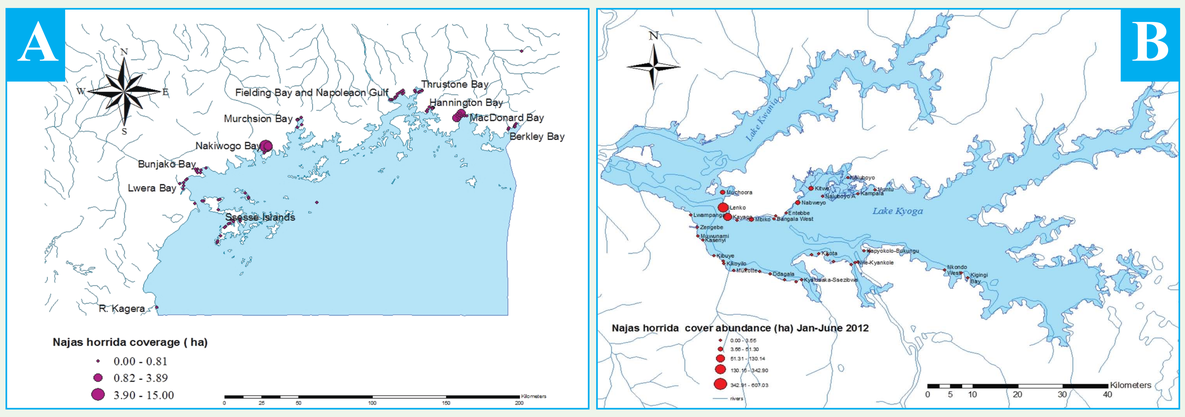

Figure 2: Hotspots for Najas horrida on A) Lake Victoria and B) Lake Kyoga

DISCUSSION

Due to overwhelming negative environmental and socio-economic impacts, most invasive aquatic weeds have been regarded as pests because they negatively affect ecosystem properties, processes, and community structure (Levine et al. 2003; Lodge et al. 2006). The overall impact of aquatic invasive weeds is defined as the product of three terms i.e. the size of the range occupied by the weeds (i.e. its spatial extent), the average cover abundance in a given range, and per unit/capita impact. Therefore, management efforts are mostly aimed at controlling or where possible, eradicating aquatic weeds.

Littoral zones of both production systems were prone to aquatic weeds infestation due to shelter from winds and waves, absence of major water currents, ample ambient macro-nutrient levels, and muddy lake bottoms. Submerged aquatic macrophytes (e.g. *Lagarosiphon sp, Hydrilla verticillata and Najas horrida*) were associated with shallow water depth of ≤ 3m deep, and sechhi depths (water clarity) of ≥ 0.5 m. High water turbidity (or low water clarity) in relation to total water depth was characteristic of the Koki lakes (Nakivali, Mburo, Kacheera and Kijanebalola), a factor that likely accounted for absence of submerged aquatic macrophytes and weeds due to light limitation in those lakes.

While water hyacinth infestation was widespread on Lake Victoria, hotspot zones to be targeted were therefore the bays of Bunjako, Fielding, Murchison, and MacDonald, in addition to Ssesse Islands. On Lake Kyoga, water hyacinth hotspots to be targeted were Lenko, Kayago, Muntu, Muchora, Kitwe and Nabweyo. Although N. horrida was not a major aquatic weed on Lake Victoria, major targets zones were MacDonald, Hannington and Nakiwogo bays. On Lake Kyoga, however, *N. horrida* had a wider occurrence, with target hotspots being Lenko, Kayago, Muchora, Kitwe, Mbiko and Nabweyo. Other than water hyacinth and *N. horrida*, the target hotspot for *Lagarosiphon sp* was Fielding Bay of Lake Victoria, while that for *H. verticillata* was at Kitwe on Lake Kyoga. Minor lakes in the Lake Victoria basin were free of major aquatic weeds. Allocation of resources to manage the major aquatic weeds should be guided by this information that has to be updated on a regular basis due to the dynamism of proliferation and subsequent infestation.

CONCLUSIONS

1. Water hyacinth and *N. horrida* were the two most important water weeds on Lakes Victoria and Kyoga. However, due to its mobility under the influence of winds and water currents, water hyacinth was the most problematic weed on both systems.

2. Satellite lakes of Lake Victoria were free of major aquatic weeds.

3. Though in the same family of Hydrocharitaceae (Frog's bit or tape grass), *Lagarosiphon sp* was only found on Lake Victoria, while *H. verticillata* was in isolated and small amounts on Lake Kyoga.

4. In order to successfully manage these aquatic weeds, rational allocation of resources ought to be done only when particular zones have been identified and weed biomass quantified.

RECOMMENDATIONS

1. Resources for managing major aquatic weeds (water hyacinth and N. *horrida*) in the basins of Lakes Victoria and Kyoga ought to target the identified hotspots.

2. Monitoring on a regular basis (e.g. quarterly) ought to be undertaken in order to continuously update information on aquatic weeds infestation status in order to guide management efforts.

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REFERENCES

Catford Jane A, Peter A Vesk, Matt White and Brendan A Wintle, 2001. Predicting hotspots of plant invasion. Rural Industries Research and Development Corporation (RIRDC). Publication No. 11/016, ISBN 978-74254-203-4 & ISSN 1440-6845, Pages 1-26 (www.rirdc.gov.au.)

Ibáñez, Inés, Silander Jr, JohN. A, Allen, Jenica M, Treanor, Sarah A., Wilson, Adam, 2009. Identifying hotspots for plant invasions and forecasting focal points of further spread. Journal of Applied Ecology 46(6): 1219-1228.

Kayanja, F.I.B., 2001. Experiences with managing water hyacinth infestation in Uganda. Pp 6-17.

Levine, J.M., M. Vila, C.M. D'Antonio, J.S. Dukes, K. Grigulis, and S. Lavorel., 2003. Mechanisms underlying the impacts of exotic plant invasions. Proceedings of the Royal Society of London Series B-Biological Sciences 270:775–781.

Lodge D.M., Williams S, MacIsaac H.J., Hayes K.R., Leung B, Reichard S., Mack R.N., Moyle P.B., Smith M., Andow D.A., Carlton J.T., McMichael A., 2006 . Biological invasions: recommendations for U.S. policy and management. Ecological Applications 16(6):2035-54.