Aquatic Weeds

A NEW APPROACH FOR THE SELECTIVE CONTROL OF AQUATIC WEEDS

J.S. CLAYTON

New Zealand Electricity Department, Hamilton

Summary

A new approach for selective aquatic weed control is described. It is based on the early recognition of new exotic weed infestations, the selective removal of the shoot and root systems by diver operated suction hoses, and a filtration technique for collecting and separating weeds from water and sediment.

INTRODUCTION

The history of lagarosiphon (*Lagarosiphon major*) and the problems it has caused have been well documented for New Zealand fresh waters (Chapman 1970; Hughes 1976). Although attempts have been made to control and to eradicate this plant, it has continued to spread into new catchments.

A new approach is required to preserve the few remaining lakes which contain only native species. This paper proposes an effective eradication procedure for new infestations of exotic water weeds.

MANAGEMENT STRATEGY

There are three principal requirements for efficient removal of specific weeds.

1. *Early recognition.* It would appear that what in the past has often been identified as an early exotic intrusion into a water body has frequently been present for a considerable period of time.

Studies on lagarosiphon development (Clayton unpublished) show that considerable lateral growth takes place before the predominately vertical growth develops. Generally it is not until substantial vertical growth has taken place that the existence of an exotic species is noticed.

The time required to reach this stage of development is highly variable and depends on the availability of nutrients in the water and sediments. However, once this stage is reached any attempt at eradication may be too late because of fragmentation and dispersion of viable vegetative shoot fragments. Rooted growing shoots less than 10 cm may fragment due to pathogenic lesions below the shoot apex (Clayton unpublished). The shoot apex can then be dispersed by water currents, while lateral shoots develop on the remaining plant due to the loss of apical dominance.

Better early detection can be made by replacing surface observation with underwater examinations by Scuba divers trained to recognise exotic species.

Proc. 30th N.Z. Weed and Pest Control Conf.

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It is recommended that a sustained diver vigilance be maintained upon all vulnerable water bodies. This would involve the close scrutiny of the most probable sites for introduction. The studies on presently infected lakes have confirmed that most introductory points for exotic plants correspond with boat access sites. Even though the development of exotics may be greater in less exposed and more enriched backwaters, it is imperative that recognition take place while still within the immediate vicinity of introduction.

Examination by divers should be made twice a year preferably in March/April following the Christmas vacation when transport of exotic plants is most probable, and again in September/October before the start of the growing season.

This vigilance policy has been adopted recently for a number of the hydroelectric lakes administered by the NZED and it is hoped to extend it to all of their remaining lakes. Responsibility for all vulnerable lakes should be suitably delegated to enable an efficient early detection method to operate. It is also necessary to consider the potential inconvenience from any introduced species since some may be acceptable. The criteria by which potential aquatic weed problems may be recognised have been discussed by Mitchell (1974).

2. *Selective Removal.* Selective removal of undesirable species by hand is possible only when there is a small amount of material to be plucked. For rooted submerged plants there is considerable difficulty in removing and retaining all of the viable shoot material. The process of uprooting creates considerable turbidity which generally limits the success of such an operation.

The eradication procedure discussed here is based on the principle of suction which creates a unidirectional water movement that reduces turbidity and loss of disrupted plant material.

Four different designs of venturi pumping systems and one suction pumping system have been tested. Air lifts using compressed air are not appropriate due to their greater depth requirement for efficient operation. A choice exists between having the venturi pump on the surface of the water (such as on a boat), or on the shoreline, or operated by the diver within the water. The first two alternatives require suction hose extensions from the venturi down to the diver. This is also necessary when using a suction pumping system. The third alternative requires the diver to manipulate the venturi pump, discharge line and the pressure hose. There are advantages and disadvantages with each alternative (Table 1).

Present investigations include the most suitable diameter of suction and discharge lines to be used, the operable head of discharge relative to pumping efficiency, maximum lengths of suction and discharge lines relative to frictional losses, maximum carrying capacities, suction efficiency with respect to plant removal time and costs.

3. *Weed Collection.* It is essential that all of the plant material uprooted and dislodged is safely retained. Since the pumping operations generally pass in the order of 1.0 m³ min. of water mixed with plant material and sediments, it is impractical to store the large volume

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discharged. It is also impractical to lay a long discharge line into any natural land basin or into a different catchment.

TABLE 1: Weed removal alternatives showing the advantages and disadvantages experienced.

<i>Removal Method</i>	<i>Advantages</i>	<i>Disadvantages</i>
Hand removal	Accessibility	Fragmentation Turbidity Limited coverage
Air lift	—	Depth requirements
Surface venturi	Manoeuvrability	Frictional losses
Diver operated venturi	Suction	Impaired manoeuvrability
Suction pump	Manoeuvrability	Blockages

This led to the design of a filtering system where the plant material can be separated from the water and finer sediments. The filter containers are 1.0 x 1.5 m in size and stand 1.5 m high. They are open at the top and bottom and have an angle iron frame with 8 cm steel mesh sides lined with 8 mesh wire netting. The fine netting allows water and finer sediments through and retains all vegetative material of viable size including the coarser sediments. The containers are designed so that the discharge passes into the top and filtration takes place through the sides. The containers can be placed on a flat base such as a boat deck or car trailer. Once filled the containers can be lifted off and re-used while the contents that remain can be disposed of safely.

An additional safety feature has been incorporated using a long net made of white-bait netting. This has a weighted base, long surface floats and is placed around the filtration area in case of accidental loss of plant material back into the water body.

DISCUSSION

Early identification is possible if regular underwater investigations are made, as has been demonstrated for at least one of the lakes administered by NZED. Unfortunately in this instance the weed removal method discussed in this paper was not sufficiently advanced for an immediate application. A hand removal attempt failed and vegetative fragmentation and dissemination rapidly advanced within six months of identification to a stage where it had become impractical to eradicate (Clayton unpublished).

The uprooting capacity of the pumping systems is most effective. The complete plant and root systems can be removed with little danger from loss or inadequate removal of viable material. Generally it is only necessary to excavate the rooting system within the sediment to a depth of 10-20 cm to be assured of adequate plant removal, however this varies with the species, its stage of development, and the type of sediment in which it has established. Successful trials have been

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made on at least four rooted submerged exotic species that are common in New Zealand fresh waters.

The collecting system is remarkably efficient provided that the rooting substrate of the plant to be removed is amenable to filtration. If the substrate is of a coarse inorganic or partially decomposed organic material, it may block the filtration system.

The efficiency of the weed removal and collection technique is inversely proportional to the degree of plant development. Herbicides may be necessary for an initial reduction in the density of weed to be removed, however if so it is probable that fragmentation and dissemination will have taken place and reduced the chances of successful eradication.

CONCLUSIONS

It is imperative that a regular and sustained vigilance be adopted on the probable points of entry of exotic weeds into any vulnerable water bodies to allow the early detection necessary for successful plant removal by suction. A filtering system enables collection and disposal of the vegetation. It has proved possible to selectively remove and collect lagarosiphon and other undesirable exotics provided that early identification is made and development minimal.

ACKNOWLEDGEMENTS

Many people have been involved in the designing, building and testing of the venturi pumping systems. Appreciation is especially given to C. Malcolm and L. King (NZED) and to Dr B. Coffey (MAF).

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