Waterhyacinth Control On The Lower Fitzroy River

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ABSTRACT

In 1970 a river barrage was constructed at Rockhampton, 61 km from the mouth of the Fitzroy River in Queensland, Australia. The barrage was designed to bar tidal flow and inpound 63,600 megaliters of freshwater for domestic, industrial, and agricultural use. By 1973 this water storage was completely covered with waterhyacinth (*Eichhornia crassipes* (Mart.) Solms.), colonized from numerous infested lagoons and swamps in the river's flood-plain. A wet season flood allowed opening of the barrage gates, and the bulk of waterhyacinth on the water storage was swept out to sea. In this paper, the floating weed problem in the area is examined, and the equipment and techniques employed in the control program are outlined.

INTRODUCTION

The Fitzroy River basin lies astride the Tropic of Capricorn, and drains into the Pacific Ocean. Draining an area of 143,000 km², this is the second largest river system in Australia. Within the basin are very many freshwater storages, including three major dams. In its lower reaches the Fitzroy River meanders over an extensive flood-plain (Figure 1). The river and its tributaries have changed course many times, creating numerous lagoons and a complex drainage pattern.

Waterhyacinth has infested the lagoons and swamps of the lower flood-plain since about 1900, while salvinia (*Salvinia molesta* D.S.Mitchell) was first observed in lagoons in 1965. During the summer wet season floating weeds are flushed from the lagoons into other lagoons and swamps, into creeks and the Fitzroy River, and eventually out to sea.

In 1970 a barrage was erected at Rockhampton, 61 km from the mouth of the river. The barrage bars the tidal flow which had previously carried saltwater approximately 50 km further upstream. The barrage created a freshwater reservoir of 63,600 megaliters, which is 1% of the mean annual discharge of the river. The water is available for domestic, industrial, and agricultural use.

Since the barrage freed the storage area from tidal and salt influences, it created an ideal habitat for floating aquatic plants; infested lagoons and swamps drain into the water storage. Colonisation by waterhyacinth was observed within a few months of completion of the barrage. The infestation spread to an estimated 630 ha by 1972, and by late 1973 the river was covered with waterhyacinth for 50 km above the barrage and was colonised for several km more. The period 1970 to 1973 was abnormally dry, and there was little flushing of lagoons and swamps into the river. Chemical and mechanical control measures were attempted. Chemical means alone proved successful, although the spray equipment used was not well suited to aquatic weed control.

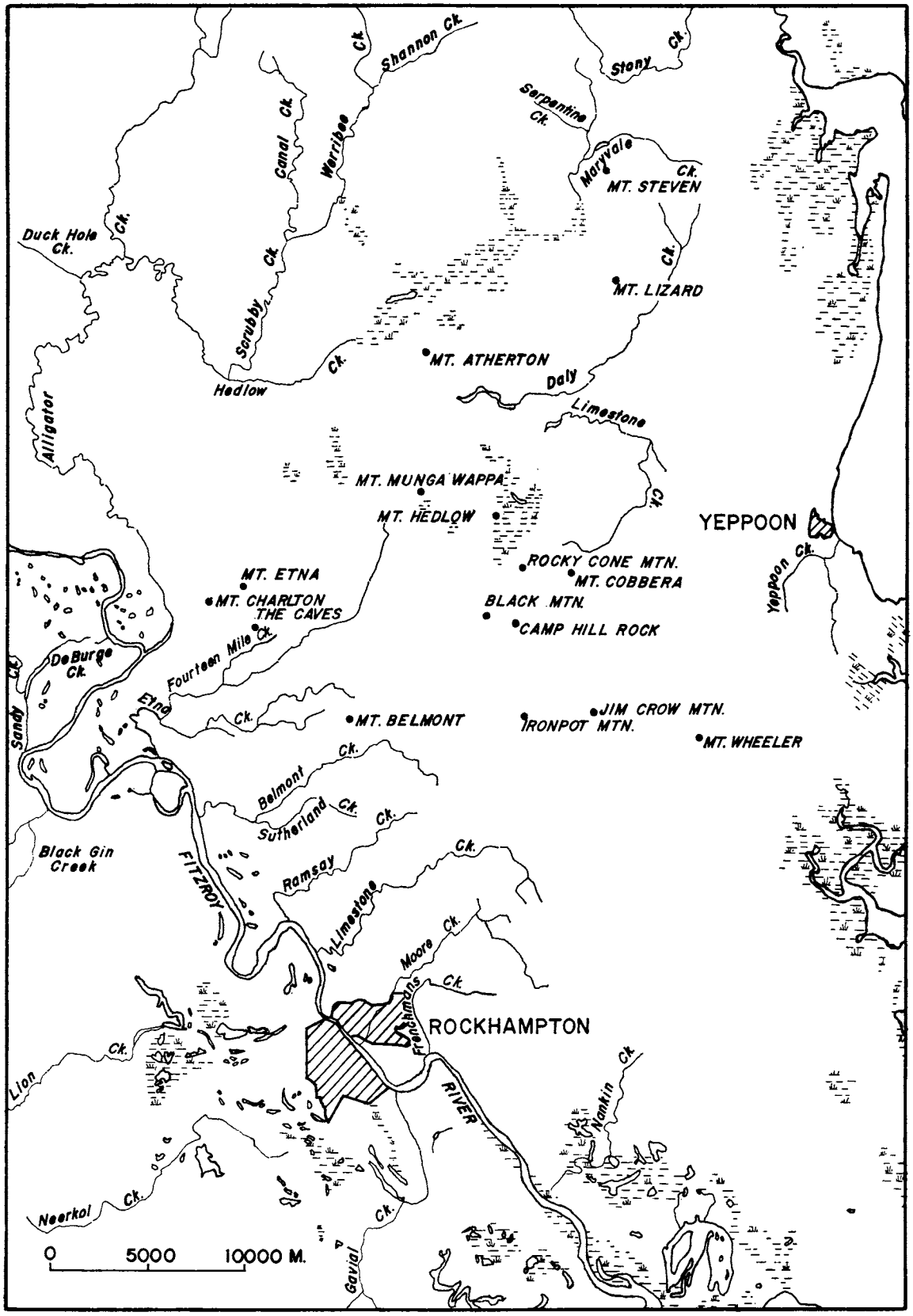

Figure 1 - Lower Reaches of the Fitzroy River.

Figure 1. The flood plain of the lower reaches of the Fitzroy River showing the numerous lagoons and swamps which drain into the river.

Early in 1974 flooding allowed opening of the barrage gates, and most of the waterhyacinth on the river was flushed downstream and out to sea. This reprieve allowed the opportunity to institute a control program with promise of success. Rockhampton City Council appointed staff and acquired equipment specifically to combat the menace of waterhyacinth in the city water supply. The Queensland Government undertook to subsidise costs and provide technical assistance, and the Australian Government later provided further financial assistance.

THE CONTROL PROBLEM

At present waterhyacinth constitutes the main floating aquatic weed problem on the barrage storage area. The problem can be considered in two parts: (1) the river and creeks below the barrage and those lagoons and swamps which drain into the river below the barrage. Control in this part is of no immediate priority; (2) the river and creeks above the barrage and those lagoons and swamps which drain (or could drain) into the river above the barrage. The infestation in this part necessitates vigorous control measures to protect the water storage.

A highly complex drainage pattern connects the swamps, lagoons and the river. Direction of flow in the drainage channels depends on where local flash flooding occurs, and on the height of river flow. During the wet season waterhyacinth may be flushed into the river from any of hundreds of sources. It is difficult therefore to determine priority areas for control.

The barrage raised the mean river level by over 1.0 m; nearly 1,000 ha of previously tree-studded river flats are now inundated; here dense timber, logs and shallow water make access difficult. As tree species less tolerant of inundation die and fall, access will become even more difficult. Waterhyacinth in these and other backwater areas is not flushed out during floods, and forms dense mats difficult to penetrate.

Lagoons which drain into the river above the barrage have an estimated total area of 850 ha and are located on many private land-holdings. A few are infested with salvinia, but the remainder are covered with waterhyacinth. An even larger area of swamps and marshes is involved, where seedling regrowth is a particular menace. Seedlings are also a problem in the shallow inundated areas of the river, influenced by rise and fall in the water storage level.

It is now becoming clear that salvinia may become a problem as waterhyacinth is brought under control. Salvinia survives the chemical applied to control waterhyacinth, and when waterhyacinth has been killed, a residue of salvinia often remains.

CONTROL METHODS

A study of aquatic weed literature was undertaken to evaluate mechanical, chemical, and biological methods of control, and to consider possible utilisation of waterhyacinth. Many suggestions were offered by local organisations and individuals. Chemical treatment of the impounded water to precipitate phosphates was proposed, along the lines of tests conducted in Florida (2). Warnings were given against the problems associated with chemical control; it was proposed that waterhyacinth be retained in the storage area for harvesting as cattle fodder in times of drought (1). Commonwealth Scientific and Industrial Research Organisation's Division of Entomology released the beetle *Neochetina eichhorniae* (Warner) experimentally in 1975-76 summer. Chemical spray methods appeared to offer the most developed and applicable technology, and were considered the most practical on which to base the immediate control program.

In the water storage area the herbicide used is 6,7-dihydrodipyrido(1,2-*a*:2′,1′-*c*)pyrazinediium ion (diquat) at the rate of 2.8 to 5.5 liters per ha with up to 5.5 liters of a non-ionic wetting agent. In other areas (2,4-dichlorophenoxy)acetic acid (2,4-D) 50% amine is applied at the rate of 11 liters per ha with varying amounts of non-ionic or ionic wetting agent. For an effective kill, it has been found vital to wet the plants thoroughly; this is accomplished by varying the volume of water and wetting agent. Diquat or 2,4-D is applied in a range of 2,200 to 13,200 liters per ha of water, the volume depending on the size of the waterhyacinth plants, and the volume required to wet them thoroughly. It has also been observed that when the water and the weather are warm, wetting and an effective kill can be achieved by applying as little as 1.4 liters per ha wetting agent with either diquat or 2,4-D.

Salvinia infestations are sprayed with 1,1′-dimethyl-4,4′-bipyridinium ion (paraquat) at the rate of 5.5 liters with 5.5 liters of a non-ionic wetting agent in 2,200 liters water per ha. Where salvinia is known to be present in the waterhyacinth infestation, a mixture of diquat (2.75 liters), paraquat (2.75 liters), and non-ionic wetting agent (5.5 liters) is applied in 2,200 to 13,200 liters water per ha.

SPRAY EQUIPMENT

The differing chemical mixtures and the range of application volumes necessitate versatile application equipment. The equipment is shown schematically in Figure 2.

The high pressure self-priming single stage centrifugal pump is direct coupled to a 3.4-kW petrol motor. Water, chemical, and wetting agent are drawn separately into

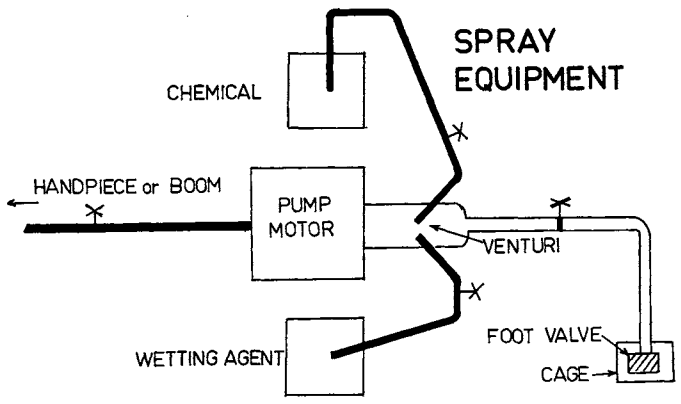

Figure 2. Chemical and wetting agent are injected into the pump intake and mixed with water in the pump. (schematic illustration)

the pump, where they are mixed satisfactorily. The delivery capacity of the pump with attachments is about 90 liters per minute.

Water is drawn directly from the river or lagoon. This source has proved fully satisfactory, even with diquat which is rapidly adsorbed by colloids. The metal valve and stem type of foot valve is robust, and unaffected by being removed regularly from the water. The foot valve is enclosed in a metal mesh case covered with fine galvanised gauze. This filters slime and other foreign matter from the intake. Chemical and wetting agent are drawn from their original drums. Metering taps regulate the flow of each into the pump.

The delivery hose is 18 mm braided nylon. A 2-m length is sufficient when spraying from a boat; maximum spray range with the short hose is 18 m. Longer delivery hoses are needed for some jobs, and spray range is reduced to about 9 m with a 90-m hose. The hand-piece is fitted with an on-off tap. A nozzle that produces a clean jet is made from a 9-mm internally machined steel tube. A very useful hand-piece which is available commercially, contains a four-setting dial controlled spray selector. The selection ranges from a broad fan for close coverage to a clean jet for long range spraying.

A double boom with a combined width of 18 m may be fitted to a boat or a four-wheel-drive vehicle (Figure 3), and is capable of spraying large areas rapidly. The swath

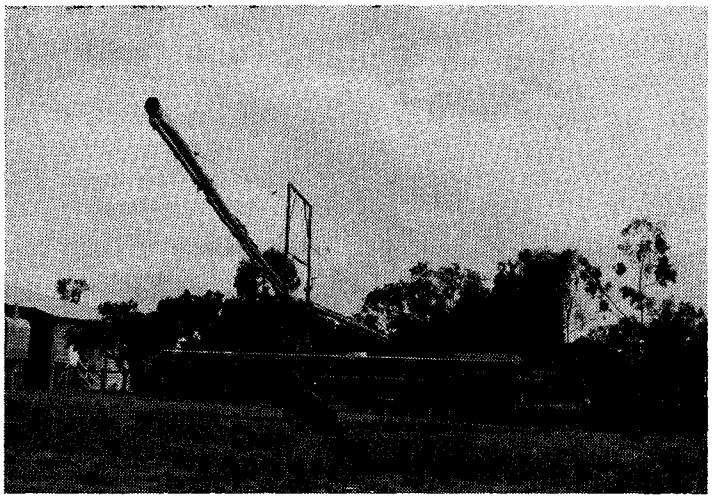

Figure 3. The double boom allows rapid spraying of salvinia, which is easily penetrated by boat.

may be varied, as nozzles are arranged on the booms in banks, each controlled by a tap. This equipment is useful for spraying salvinia, which is more easily penetrated by a boat than is waterhyacinth.

There is usually little value in employing regular spraying patterns when using a hand wand; irregularities in the size of the plants and interference by trees make it difficult. Whatever system the operator employs, it is essential that all plants be wetted thoroughly with minimum runoff and waste of chemical. Up to 2 ha an hr can be covered with uninterrupted spraying using a hand wand. However, this rate of spraying is normally greatly reduced by travelling time, manoeuvring the boat, access difficulties, mechanical problems and preparing and maintaining the equipment.

ACCESS

For an effective waterhyacinth control program it is vital to spray the weed wherever it grows. Gaining access to floating weeds in all localities necessitates a variety of techniques.

Flat bottomed aluminium boats of 3.0 to 3.6 m have proved ideal for spray operations where the boat can float on clear water. These boats draw only 125 mm when fully loaded with spray equipment, 23-liter drums of chemical and wetting agent, fuel, a driver, and a spray operator. An 18.7-kW outboard motor with forward and reverse gears allows rapid transport and easy boat control while spraying is in progress.

The cutting boat (Figures 4 and 5) is able to penetrate dense rafts of waterhyacinth of any height. The high power requirement is best provided by an outboard motor

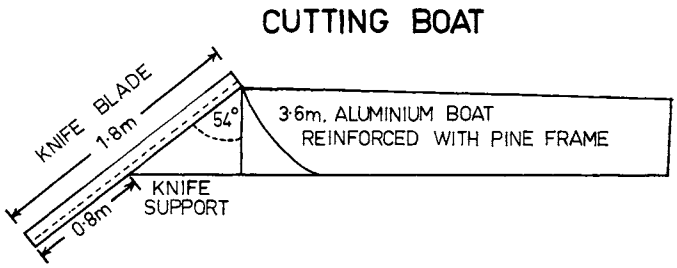

Figure 4. The bow section of the cutting boat.

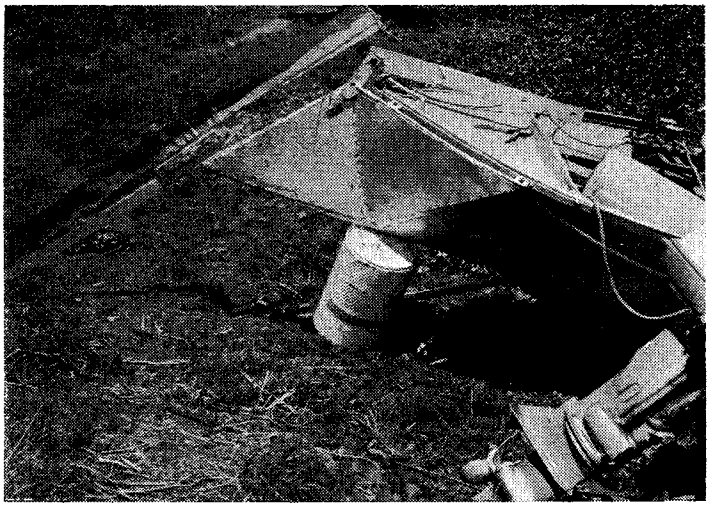

Figure 5. Side elevation of the cutting boat.

of at least 48.5 kW fitted with a work propeller. High power becomes most important in old plants (especially in lagoons) whose root systems are particularly heavy. The cutting effect is achieved by a 1.8-m angled knife blade fitted to a false bow. The blade is stainless steel and is kept very sharp. Momentum of the boat forces the blade to lift the waterhyacinth and shear it, allowing progress. The false bow is designed to prevent the boat from rising on top of the waterhyacinth; it also supports

the angled knife blade. The cutting boat requires about 900 mm of water to operate when fully loaded.

The 3.6-m vee bottomed cutting boat now in use cannot realise the full potential of the innovation: (1) a specially designed boat, probably wedge shaped, would be more suitable, (2) waterhyacinth fouls the propeller, reducing efficiency. This could be prevented by protecting the propeller in a grated tunnel built into the hull, (3) waterhyacinth forces the water intake apparatus out of the water, making it impossible to spray while travelling. This could be overcome by incorporating the intake into the hull.

In spite of these short-comings the cutting boat has been responsible for a great acceleration in the waterhyacinth control program. Before its development rafts could be killed only by progressive spraying from the edges. Only when the sprayed edge died and sank could the new edge be attacked.

Rafts of waterhyacinth in water too shallow or too obstructed for the cutting boat to operate are best sprayed from walk planks. Two 150 by 25 mm softwood boards 6 m long are spaced 5 cm apart and fixed together with wooden spreaders to form a walk plank. These are placed end to end on top of the waterhyacinth. A 64-kg spray operator with a long delivery hose can be supported safely if the plants are small but matted. Larger matted plants will support a larger operator. The walk planks are transported on top of a four-wheel-drive vehicle.

The pump unit is mounted on a boat trailer (Figure 6), which is backed into the water far enough for water intake. To permit levelling the pump is set on a pivoted turntable.

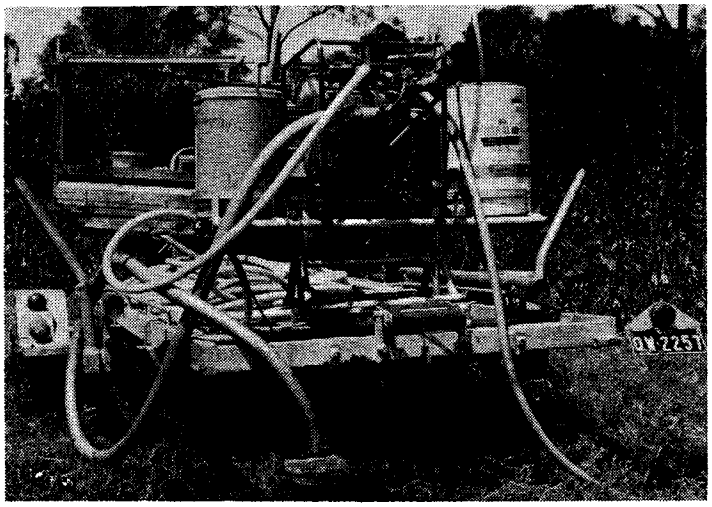

Figure 6. The pumping equipment may be mounted on a trailer or in a boat, or may be transported manually.

Wading is necessary in inaccessible areas where it is not possible to deliver large equipment. The spray equipment is transported manually by two operators. If the operators are reluctant to wade, the inaccessible areas serve as sources of reinfestation.

Following a wet season, scattered waterhyacinth plants dot the banks of the river and creeks and accumulate in backwaters. Uncontrolled, these plants would soon develop into large infestations. Large scale spraying is not warranted; the banks are patrolled by boat or on foot, and where possible plants are removed by hand. Larger infestations and seedling growth are spot sprayed using double-action stirrup pumps with a spray range of 9 m. Chemical and wetting agent are carried in small containers and when needed are mixed in a bucket.

PRESENT SITUATION

The river has been virtually cleared of waterhyacinth, but the banks are patrolled regularly to control fresh outbreaks. About 200 ha of infestation remain in the tree-studied inundated backwater area at the mouth of Ramsay Creek. The front edge of this infestation is about 200 m from the river channel, and this buffer area is being increased gradually. It is considered that with patrolling, this area is unlikely to reinfest the river, and priority is now being given to the 850 ha of lagoons.

Wet season flushing of lagoons and swamps will certainly reinfest the barrage storage; control of waterhyacinth and slavinia in these numerous source areas requires full co-operation between the landholders, Rockhampton City Council and neighbouring local authorities. An extension program is to be initiated to promote an understanding of the problem and to encourage the necessary co-operation.

In the first 2 years of the waterhyacinth control program (1974-75) the total cost approached $A120,000. Most of the work has been carried out by 3 operators, but at times the team has been enlarged to as many as 10. It is clear that for success, the program must be pursued relentlessly, and cleared areas must be patrolled constantly. Because of the rapid growth of waterhyacinth, any flagging of effort will result in rapid reinfestation of the barrage water storage area.

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