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Effects of Mechanical Cutting on Submersed Vegetation in A Louisiana Lake

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ABSTRACT

Evaluation of a mechanical weed cutter yielded data which can be used to determine effectiveness and approximate costs of cutting submersed vegetation in a Louisiana Lake. Cost data utilizing these comparatively inexpensive machines ($34.27/ha) appear reasonable if no other control technique could be used. Visual observations on Lake Bistineau indicated regrowth from vegetation cut in May 1975 was at the water surface in August 1975. This corresponds to regrowth data collected on Black Bayou Lake. It can be concluded that only temporary control can be expected from mechanical cutting. One of the dangers presented by mechanical cutting of egeria was demonstrated on Lake Bistineau by the large amounts of severed plant stems found drifting throughout the lake. Data collected on Black Bayou indicates these stems can survive to produce new plants in non-infested waters. Biomass data collected is inconclusive because of an absence of egeria throughout Black Bayou Lake in June 1976. Data collected in 1975 indicated no shift in plant species composition occurred after cutting.

INTRODUCTION

Louisiana has 3.18 million hectares of freshwater wetlands (4). There are 0.62 million hectares in lakes and reservoirs over 262 hectares in size. Long growing seasons and shallow water depths are conducive to lush growths ot aquatic vegetation in most of Louisiana's waters.

Many of the favorite fishing areas and boat lanes become choked with dense growths of aquatic plants, a condition usually at its worst during periods of peak use. Aquatic plants decrease phytoplankton which increases the clarity of water allowing greater plant growth (3). Heavy aquatic plant infestations tend to decrease spawning areas available for use by desirable fish species. Cover provided by dense aquatic weed growth tends to favor survival of forage fish normally consumed by predator fish. This tends to overbalance the predator-prey reationship necessary for a healthy fish population (1).

Interest in aquatic weeds has led to development of numerous control techniques including preventative, biological, chemical, and mechanical methods. Preventative control in Louisiana has been a weak point for many years.

The combination of many factors has increased pressures directed toward use of mechanical methods for submersed aquatic weed control. Mechanical control devices were used with only limited success for many years in attempts to control waterhyacinth growth (5). In recent years several machines and devices have been proposed for cutting or harvesting submersed vegetation. In October 1963, the City of Winter Park, Florida purchased from the Aquatic Control Corporation, an amphibious, self-propelled harvester and an amphibious self-propelled barge for a total price of $22,000.00. The removal cost of submersed aquatic vegatation using these machines was computed to be $12.70 per 908 kg (2). Equipment of this nature has been manufactured and sold throughout the United States. In 1974, the Louisiana Department of Wildlife and Fisheries purchased two mechanical cutting machines from Carver Aquatics Incorporated, Minden, Louisiana, for testing and evaluation of their effects on submersed aquatic vegetation. These two machines were purchased for $12,772.72.

If the mechanical cutting devices proved effective and feasible, they could possibly become a useful management tool. However, literature indicates most work has been directed toward cutting and removing waterhyacinths. Only limited research has been conducted on the effect of cutting submersed plants.

A project was initiated in April 1974 that had four main objectives: Evaluation of the operational cost of the cutting machines per ha; collection and evaluation of aquatic plant biomass samples prior to and following cutting; measurement of stem regrowth of aquatic plants following cutting, and the determination of survivability of cut plant stems placed in enclosures.

METHODS AND MATERIALS

The project was originally designed to evaluate mechanical cutting to control submersed aquatic vegetation, primarily Egeria (*Egeria densa Plach.*) in Lake Bistineau, Louisiana. The lake was built in 1938 and provides much of the water-borne recreational needs of the Shreveport-Bossier City, Minden metropolitan areas. Many of the favorite fishing areas and boat lanes become choked with egeria, Fanwort (*Cabomba caroliniana* Gray), Coontail (*Ceratophyllum demursum* L.) and Watermilfoil (*Myriophyllum sp.*) during late spring and summer months. Success of water flunctuation programs have varied from fair to good but have brought demand to attempt other methods of control.

The cost/ha analysis portion of this project was conducted on Lake Bistineau as planned. The project parts requiring biomass data, analysis of regrowth from rooted plants and analysis of cuttings taken from rooted plants was moved to a secondary location due to high probability of a water level fluctuation program which would have adversely affected the sample plots on Lake Bistineau.

Black Bayou Lake in northeast Louisiana near Monroe was chosen to complete the project requirements. This 820 ha lake has an average depth of 1.8 m and is connected to nearby Bayou DeSiard. Drainage area of the lake is primarily fertile bottomland used mostly for cultivating cotton. The lake also supports a dense growth of egeria.

The mechanical cutting machine consisted of a pontoon type barge with an expanded aluminum deck (Figure 1). The unit weighs 635.6 kg and is 6.1 m long and 1.8 m wide. It is powered by a highly maneuverable air propulsion unit. It is equipped with two vertical and one horizontal cutting bars with extensions allowing the barge to cut a 3.6 m wide swath. The manufacturer of the barge states the barge has the capability of cutting to a maximum depth of 1.2 m.

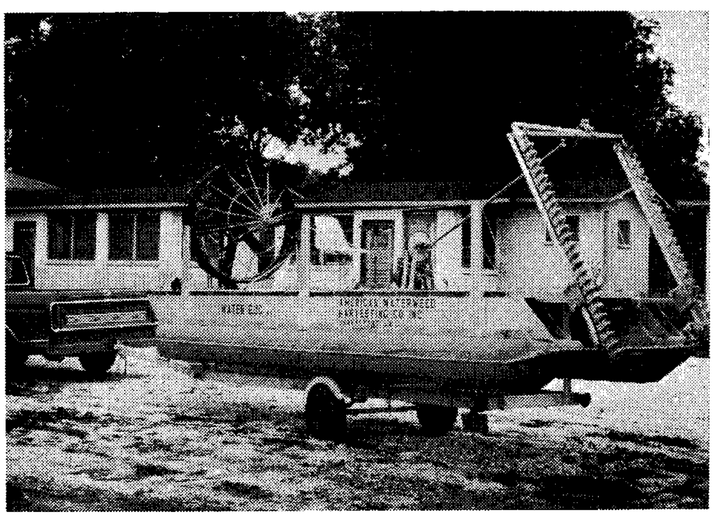

Figure 1. Mechanical weed cutter used in trials in Louisiana.

The two mechanical cutting machines began cutting submersed vegetation on May 26, 1975 near State Park Number One on Lake Bistineau. This area like most of Lake Bistineau has a tremendous amount of cypress and tupelo trees growing in the zone with the submersed vegetation. A detailed daily operational log was kept for every day of operation for each cutting machine. The log included all expenses (oil, gas, grease, repairs, etc.), maintenance time, actual cutting time and time lost due to breakdown. Each breakdown was described giving complete details of aspects such as time lost, cost of repair, probable cause of breakdown and part or parts affected. The log also contained number of hectares cut. The information could then be used to compute operational costs. Operation was started on May 26, and ended August 1975.

As previously noted the remaining parts of the project were moved to Black Bayou Lake due to an impending water level fluctuation program on Lake Bistineau. In June 1975, four permanent transect lines were established in a 1.5 ha egeria infested area on Black Bayou Lake with a uniform depth of 2.1 m. High water levels, low water temperatures, and high turbidity levels hindered work in the area until July 22, 1975. Each transect line was sampled for vegetation at 15.25 m intervals. Six biomass samples were taken on each transect line.

A 1.83 m by 6.7 m triple pontoon barge powered by either an outboard motor or an air propulsion unit was used as a vehicle for transporting the sampling device. Vegetative samples were taken using a 61 cm by 61 cm sheet metal quadrat possessing cutting edges along its bottom. The unit was designed to be hoisted above water level by a boom attached to the barge. A nylon net sack was placed over the top of the quadrat to retain vegetation inside the quadrat. A quick release device allowed the sampling unit to free fall through the water severing all vegetation in its path. A SCUBA diver inserted a cutter bar in a slot near the quadrat bottom to cut the vegetative stems at the top of the hydrosol.

The unit containing vegetation was then brought upon deck and all vegetation inside was removed and placed into labled plastic bags for transporting to a field laboratory. At the field laboratory the samples were washed, sorted by species, spun in a centrifuge at 850 rpm for 2 min. to remove excess water and weighed.

After presampling was completed, three of the line transects were mechanically cut with the cutter bar extended to its maximum depth of 1.2 m. The remaining transect line was designated as a control plot.

The transect lines were again sampled using the previously-described technique on September 24, 1975. This date was selected for post-sampling as it was near the end of the growing season for the Northeast Louisiana area. Biomass samples were also collected in June 1976 to determine vegetation changes one year after mechanical cuttings.

Immediately following the mechanical cutting, permanent stakes were established on each of the three cut transect lines. A permanent marker was affixed to the stake at the same level as the top of the surrounding cut egeria stems. Each stake was connected by heavy twine to enable a technician using SCUBA to move easily to each of these sampling stations. Using a white ruler with heavy black increment markings, regrowth in cm above each stake marker was determined. Regrowth from each rooted plant began at some node beneath the cut of the stem which corresponded with the marker on the stake. However, regrowth was not measured until it surpassed the height of the marker on the stake. Regrowth from the rooted egeria was measured one wk., three wks., five wks., and nine wks., after cutting.

Stem survival data was determined by randomly placing one hundred, 45.7 cm apical cuttings of egeria collected after mechanical cutting of the transect lines in each of five 3.05 m by 3.05 m enclosures. Sample enclosures were established on

Bayou DeSiard in a 61 cm average depth shoreline area free of vegetation and were surrounded by poultry netting with approximately 1.3 cm openings. If a plant produced adventitious roots it was considered capable of survival. Each plot was evaluated weekly for ten wks. after introduction of cuttings. Each plant fragment was carefully examined for lateral shoots or adventitious roots and recorded. If adventitious roots were noted, the plant was removed from the sample plot. This part of the project was discontinued on the last sample date of September 24, 1975.

RESULTS AND DISCUSSION

Analysis of cost data for operation of mechanical cutting machines on Lake Bistineau was obtained over eighty-six operating days (Table 1). Operating and maintenance expenses for this time period was $1,081.04. Labor costs were $1,540.64. Annual depreciation (20%) on the machines was $2,284.22. This computed to approximately $34.27 per ha cut. This figure seems very reasonable when compared to other methods of control. It is also below that reported for harvesting of aquatic plants (2 and 3). Labor costs of $2.24 per hour are extremely low and had considerable effect on supressing this figure. Total cut area was 154.16 ha or a daily average of 1.8 ha, which was below the manufacturer's claim of .82 ha/hr. Down time during this project period of 688 hours was 237.5 hours or 34.5 per cent of project time cost.

TABLE 1. OPERATION OF MECHANICAL CUTTING MACHINES—1975.

I	Capitol Investment for Carver Aquatics Equipment	
	Two "Water Bug" Aquatic Vegetation Cutters $12,772.72	
	Annual depreciation (20 percent/year)	$2,554.54
II	Labor 688 hours @ $2.24/hour	1,540.64
III	Mechanical cutters operating and maintenance expense	1,081.04
IV	Contingencies (10 percent)	108.00
V	Three month operating cost	$5,284.22
VI	Total ha cut	154.16 ha
	Cost per ha cut	$34.27/ha
	Total machine operating days	86 days
	Total machine downtime in days	29.7 days
	Percent of downtime	34.5 percent

Vegetation cut on Lake Bistineau in May 1975 was again near the water surface in late August 1975. This would indicate control over submersed rooted vegetation, primarily egeria and fanwort was temporary. There were numerous complaints concerning drifting mats of severed vegetation blocking access to normally non-infested areas and boat roads 10 km down the lake. The severed stems were observed to drift and float for a week or more. This led to many requests to move the machines from one area of the lake to other areas where complaints were received; however, the lake was worked systematically from the north end and west bank, south to the dam and then up the east bank to the north end to complete one circuit of the lake.

On Black Bayou Lake, visual observation revealed a heavy infestation of egeria throughout the sampling site. The four line transects chosen were sampled for biomass (Table 2). Data collected indicated an average biomass of 1474.0 gr/m² on transect A; transect B averaged 1137.6 gr/m²; transect C averaged 1711.7 gr/m²; and transect D averaged 1036.5 gr/m². Transect D was the control plot. This represented 92.53% egeria with coontail and traces of Bladderwort (*Utricularia sp.*) comprising the remaining 7.4% of plant material. After mechanical cutting lines A, B, and C, no biomass samples were attempted as large amounts of severed stems were drifting throughout the area. SCUBA observations immediately following cutting revealed actual cutting depth was not 1.2 m as expected but only .5 m beneath the water surface. The mechanical cutter bar tended to push the dense growths down and forward thereby reducing the depth of the cut on the plant stem. Results of the biomass samples taken two months later, near the end of the growing season are shown in Table 3. Transect A averaged 834.3 gr/m²; transect B averaged 795.0 gr/m²; transect C averaged 1387.9 gr/m²; and transect D averaged 1263.7 gr/m². This biomass was 92.25% egeria. This figure corresponds closely with the July percentage figure indicating no appreciable change in species composition. Comparison of weights in July and September indicates a plant biomass decrease of 42.89% in transect A, 30.15% decrease in transect B, and 12.79% decrease in transect C (Tables 2 and 3). The average percent decrease in plant biomass two months after cutting was 28.61%. The control plot demonstrated a 34.3% increase in biomass over the same two month period.

TABLE 2. COMPARISON OF WET WEIGHTS FOR TRANSECTS SAMPLED BEFORE CUTTING ON JULY 22, & 23, 1975.

Transect[1]	Weight (gr/m²) Egeria	Coontail	Bladderwort	Total
A	1331.2	135.2	7.6	1474.0
B	1080.6	57.0	0.0	1137.6
C	1591.4	115.1	5.2	1711.7
D (Control)	934.1	80.6	1.8	1036.5

[1] Each transect had 6 biomass sampling points which were averaged in this table. Area of sample was 61 cm x 61 cm.

TABLE 3. COMPARISON OF WET WEIGHTS FOR TRANSECTS SAMPLED ON SEPTEMBER 24, 1975.

Transect[1]	Weight (gr/m²) Egeria	Coontail	Bladderwort	Total
A	728.5	101.2	4.6	834.3
B	768.1	20.8	6.1	795.0
C	1301.3	75.4	11.2	1387.9
D (Control)	1150.6	60.9	52.2	1263.7

[1] Each transect had 6 biomass sampling points which were averaged in this table. Area of sample was 61 cm x 61 cm.

Biomass samples taken during June 1976 were not considered significant due to the absence of vegetation throughout Black Bayou Lake. It is possible that extremely high water levels and heavy runoffs from the surrounding cottonfields increased turbidity levels in the lake to a point where egeria could no longer flourish. Also heavy herbicide in surrounding cottonfields could have affected the plant life in the lake. Regardless of phenomena present, 1976 samples were not valid for use in evaluation of biomass.

Regrowth from the rooted plants was measured at intervals until the end of the 1975 growing season. The results of these measurements indicate regrowth began immediately after cutting and continued until September 24, 1975, at time of last evaluation (Figure 2). Average length of regrowth during the two months sampling period from the seven stations on Transect A was 29.0 cm. Transect B averaged 29.5 cm and transect line C had 30.5 cm average regrowth from the rooted egeria. This would correspond to the observations made on Lake Bistineau regarding regrowth of egeria to water surface in 2 to 2 1/2 months.

Evaluation of survival of cuttings of egeria collected from Black Bayou Lake were made for 10 weeks following their introduction into the sample plots. From the five hundred 45.7 cm cuttings used in this study, 365 new plants were produced. These data indicate that serious problems with new aquatic weed infestations could occur in noninfested portions of a water body by the movement of cut plant fragments.

The peak production of roots was three weeks after cutting (Figure 3). Root production from the original cuttings continued through the sixth week of sampling. Observations at this time revealed severe fragmentation of the original cuttings. New plants were being produced from these fragments at termination of the sampling period. It is evident from the data collected that additional new plants would have been produced if the original cuttings had not been removed from the enclosures as they produced adventitious roots.

Large scale mechanical cutting of submersed vegetation in a timbered reservoir on a large scale does not appear to be feasible. The limited period of control gained by cutting vegetation is offset by the comparatively slow rate of machine operation. Mechanical difficulties due to using the cutting machines in timber rapidly increase with continued operation.

Figure 2. Average stem regrowth of 7 measurements taken along each of 3 line transects.

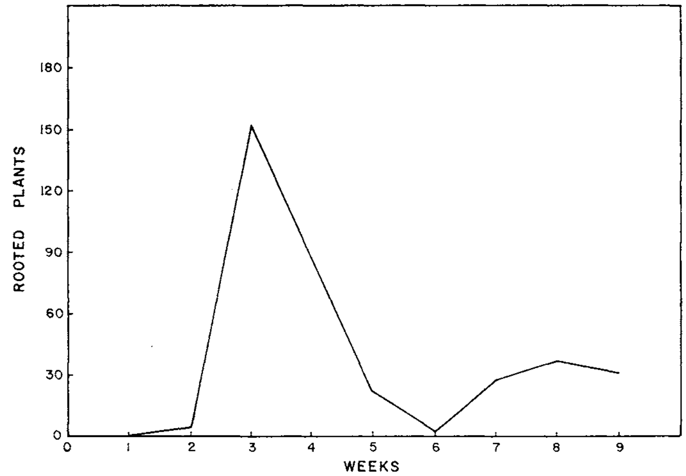

Figure 3. Number of plants produced from 100 egeria cuttings placed in each of 5 enclosures.

Use of the mechanical cutting machines to open or maintain boat roads through rooted, submersed vegetation could be of some benefit. However, the area to be cut would have to be extremely large for cost per hectare figures to be economically feasible. This economic factor would appear to severely restrict areas in Louisiana seeking this type of control. The possibilities for infesting new areas with plant fragments must also be evaluated closely.

Although these criteria may prohibit mechanical cutting in most areas, those that remain may indeed benefit from its use. There are areas where herbicide useage may be restricted by environmental considerations or by prohibitive costs. In a canal or waterway with relatively uniform demensions and submersed vegetation problems the mechanical cutting machines used in this project may provide acceptable temporary control for comparatively low cost.

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