15 The Progression of Hydrilla Management in the Kissimmee Chain of Lakes

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Abstract

The Kissimmee chain of lakes system in Osceola and Polk counties comprise the headwaters of the Kissimmee River and receive waters draining from much of the southern Orlando/ Orange County metroplex, as well as Osceola County cities of Kissimmee and St. Cloud. Therefore, the system of man-made canals connecting natural lakes functions as a essential element for regional flood protection and water management in the region, while providing vast areas for sport fishing, recreational boating, and wildlife habitat. By the late 1980s, hydrilla (*Hydrilla verticillata* (L.f.) Royle) had overtaken most of the Kissimmee chain of lakes system and effectively shut down navigation, seriously impeded water flows, especially during storm events, and overwhelmed critical aquatic wildlife habitat. The only source of funds for aquatic plant management in waters of the state is the Florida Department of Environmental Protection's, aquatic plant control trust fund. Until 1996, legislative allocations to this fund were insufficient to effectively battle hydrilla's expansion in this system and the state as a whole. Since 1996, added funding has supported hydrilla treatments on a scale never before performed in the nation. South Florida Water Management District (SFWMD) aquatic plant managers were unsure whether treatment of this size were possible, but approximately $5 million treatments were made in both 1997 and 1998, by combining helicopter and boat applications, with many hours of concerted effort by SFWMD employees and contractors.

Introduction

The Kissimmee Chain of lakes, noted for its wide variety of wildlife and productive fisheries, consists of 21 natural lakes connected by 15 navigable, man-made flood control canals. This ecosystem, which represents 83 000 surface acres of public waterways and wetlands, is located south of Orlando and is the headwaters of the Kissimmee River.

Central Florida's warm climate and large waterbodies provide a near-tropical haven for invasive exotic vegetation, including water hyacinth (*Eichhornia crassipes* (Mart.) Solms), water lettuce (*Pistia stratiotes* L.), and hydrilla (*Hydrilla verticillata* (L.f.) Royle). Annual vegetation management in the Kissimmee chain includes the chemical, mechanical, and biological control of 15 000 ac of exotic and native plants. This program is primarily funded by the Florida Department of Environmental Protection (FDEP) and is contracted through the South Florida Water Management District (SFWMD). The overabundant growth produced under these environmental conditions, coupled with insufficient funding, has prompted vegetation managers to prioritize work projects to maximize cost-effectiveness. Simply put, managers must make their best judgments on what gets done using the available money. On the Kissimmee chain, vegetation management is a team effort; decisions are made by an interagency working group which has members from federal, state, and local agencies as well as representatives from the general public.

Priority Ranking

Flood Control. With 1.75 million residents in the central Florida area, prevention of flooding is the primary objective.

Navigation. The second priority is to maintain navigation in the federal navigation channels created by the connection of this chain of lakes to the Kissimmee River and Lake Okeechobee.

Fishery enhancement and wildlife protection. The Kissimmee chain provides beneficial habitat for one of the best largemouth bass fisheries in the country. In addition, these lakes are a birdwatcher's paradise with many native and endangered species. Vegetation treatments are used to open fishing access, increase native plant diversity, and provide beneficial habitat for endangered species like the bald eagle, the Everglades snail kite, and the whooping crane.

Aesthetic improvements. Vegetation managers receive hundreds of requests for the control of nuisance vegetation in and around lakefront properties or private canals. Although FDEP funding is usually not available for this type of work, some relief may be provided to residents as a by-product from the operations performed ac-

cording to the above listed priorities.

Since 1982, hydrilla has been a major problem in several of these lakes. Boat channels and fishing holes have been opened in dense hydrilla stands using mechanical harvesters and contact herbicides, but managers have turned to the aquatic herbicide fluridone (Sonar™) for large scale control projects. Fluridone has been used in these lakes in increasing amounts since 1986, with 115 000 ac of hydrilla treated at a cost of $15 million.

Fluridone inhibits carotenoid pigment synthesis and results in the photodegradation of chlorophyll, chlorosis in the leaves and stems, and the slow death of the plant. Hydrilla is particularly susceptible to this herbicide and is often controlled with fluridone concentrations between 5-8 parts per billion (ppb), a rate much lower than that needed to control many other plants. During the 11 years since the registration of fluridone, it has been possible to modify and improve application techniques to maximize the amount of hydrilla controlled for each acre that is actually treated. Factors including available funding, water movement or dilution, plant species present, bottom sediment type, and infestation size will modify the application strategies for effective hydrilla management using fluridone in different waterbodies. This article describes some of the practices utilized to achieve the most cost-effective hydrilla management in the headwater lakes of the of the Kissimmee River.

Methods of Treatment

Whole lake treatment plus triploid grass carp

Of the 21 lakes in the chain, Fish Lake (210 ac) is unique because it is a nearly closed system with a single outflow, which contains a grass carp barrier. In 1983, 20 ac of hydrilla were treated under an experimental use permit with 2 lbs active ingredient per acre of fluridone and a chelated copper herbicide. This treatment was effective for 4 years; after that time, 70% of the lake was covered with hydrilla. In 1988, 33 ac of hydrilla were treated with 2 lbs active ingredient per acre of fluridone. That treatment was followed by the stocking of 640 triploid grass carp. The combination of herbicide and grass carp maintained sufficient control for four more years. By 1992, hydrilla had re-grown from tubers and was expanding due to a decline in the grass carp population. In 1993, 20 ac of hydrilla were treated with the same rate of fluridone and an additional 650 grass carp were stocked. The 1997 FDEP annual survey revealed that less than one acre of hydrilla was present in the lake. This level of control is proof that the integration of herbicide and biocontrol agents can reduce herbicide applications to once in at least five years and continues to reduce the annual average cost for herbicides and fish with each passing year.

Whole lake, split treatments

When sufficient funding is available, treatment of an entire waterbody with fluridone is the most effective method of controlling extensive hydrilla infestations. Lake Jackson, a 1500 ac lake in the Three Lakes Wildlife Management Area, is noted for its tremendous fishery and wildlife value. At times, hydrilla has covered nearly 50% of its surface. Because of its high turnover rate of water, single applications of fluridone did not provide sufficient herbicide contact time to be effective.

However, hydrilla has been controlled in the entire lake by applying fluridone at a rate of 2 lbs active ingredient per acre to 250 ac of the lake, if the total application is split evenly over a 4 week period. Such a treatment can cost $150 000 and has reduced hydrilla coverage for more than a year. Long term control of hydrilla can be achieved if funding allows annual treatments of the entire lake for four or five consecutive years. Because hydrilla propagules remain viable in the hydrosoil for that period of time, annual treatments to control germinating plants in the spring and to prevent reproduction in the fall would eventually diminish the propagule supply in the sediments.

Similar results were achieved in Lake Hatchineha (6660 ac) in 1997. A total of 990 ac was treated over a 6 week period at a rate of 2 lbs active ingredient per acre. By utilizing the FasTEST sampling method developed by the SePRO Corporation, managers were able to monitor fluridone concentrations in the water and make adjustments to the treatment schedules to compensate for unexpected water movement or dilution. Hydrilla acreage was reduced from 5100 to 1150 ac in a single year. However, continued treatments of this scope are needed to extend these results beyond a single year.

Partial lake treatments adapted to water movement

A whole lake treatment of Lake Kissimmee (34 960 ac) could cost as much as $4.5 million. In 1997, one of the largest hydrilla treatments in the Kissimmee chain was conducted on Lake Kissimmee as a partial lake treatment; more than 3100 ac of hydrilla were treated at a cost of $2 million. In situations like this, treatments must be conducted to provide the maximum impact on hydrilla populations.

Each year, treatments are made to the areas of the lake with the greatest hydrilla infestations and these locations vary from year to year. Prior to 1994, these treatments were divided over a 4 week period. However, applications were halted in some years, e.g., 1987, prior to completion due to large discharges of water into the Kissimmee River. This caused a significant reduction in the herbicide contact time in the treatment areas.

In 1994, rather than making applications in 25 ac blocks over a 4 week period, ap-

plications were made over seven weeks and the herbicide was applied in strips around the shoreline of each bay that was treated. Using this strategy, hydrilla was controlled in the bays by a method which approximated a whole lake treatment. It also allowed applications to continue when water discharges into the Kissimmee River were greater than could have previously been tolerated. FasTEST monitoring was also utilized during these treatments to monitor fluridone concentrations in the treatment areas and the adjacent open water areas.

This treatment strategy has proved to be successful in most areas of Lake Kissimmee and has provided 12-18 months of control from each treatment. However, the northwestern portion of the lake at the mouth of the canal from Lake Hatchineha (C-37) has been problematic for several years. For reasons that have yet to be determined, fluridone applications in this area disperse rapidly. This dispersion appears to be independent from any other water movement in or through the lake; this phenomenon was established during dye movement tests conducted by the University of Florida in 1996. In order to be effective, treatments must be repeated at least twice a year in this area.

Lake Cypress is a 4100 ac lake which has inflow canals from Lake Tohopekaliga (C-35) and Lake Gentry (C-34). In addition, there is a major outflow to Lake Hatchineha (C-36). It was determined that treatment of the whole lake was likely to be unsuccessful due to the rapid turnover of water in the southern half of the lake. Therefore, fluridone applications were made to the northern half of the lake and treatment of the southern half was restricted to applications of contact herbicides to maintain boat access from the public boat ramp to the connecting canals. In reality, low flows during the treatment period enabled some fluridone to disperse into and remain in the southern end of the lake long enough to have a moderate impact on the hydrilla. Again, herbicide levels were monitored with FasTEST.

Over the past several years, improvements in the efficiency of partial lake treatments and the existence of sufficient funds have enabled efforts to decrease hydrilla infestations in Lakes Kissimmee and Cypress. Once a level of control is established, however, sequential treatments must occur every year to maintain proper control. Similar treatment regimes have also proven effective in East Lake Tohopekaliga (12 540 ac) and Lake Marian (5700 ac).

Partial lake treatments to enhance fishery habitat

Like Lake Kissimmee, Lake Tohopekaliga (18 000 ac) is large enough to be considered for whole lake treatments in years of sufficient funding, despite hydrilla infestations which have covered 45% of the lake. In 1987 and 1988, water levels were lowered to facilitate the mechanical removal of organic sediments from the littoral zone in an effort to restore sport fish spawning habitat. After the lake was refilled, these cleared areas were rapidly colonized by dense stands of hydrilla. This type of

site has become a primary target for hydrilla control in an attempt to continue the habitat restoration and to provide access to anglers.

In 1993, 50 ac in a restored area were treated with 2 lbs active ingredient per acre of fluridone, applied over an 8 week period in 7000 foot long strips along the shoreline. In this site, which was subjected to noticeable water movement parallel to the shore, these treatments were estimated to have exposed the hydrilla to a 15 ppb concentration of fluridone for more than 8 weeks. This treatment selectively controlled hydrilla in 300 ac for more than a year and caused minimal impacts to native plants, a very important consideration in habitat restoration.

As a consequence of this treatment, shoreline strip treatments over 6 to 8 weeks have been adopted as the primary fluridone treatment technique for most of the applications in the Kissimmee chain of lakes. This 50 ac site has been used as a test to determine the long term effects of successive treatments on native vegetation. Fluridone was applied at the same rate and with the same technique over the next 4 years

Vegetation monitoring by the Kissimmee Fishery office of the Florida Game and Freshwater Fish Commission (GFC) has revealed that native plants, especially eelgrass (*Vallisneria americana* Michx.), have expanded in this area and the fishery has greatly increased. In addition, anglers are reporting excellent catches of fish in an area which had no access to fishing prior to the fluridone treatments.

In 1996 and 1997, a similar drawdown and habitat restoration project was undertaken on Lake Kissimmee. Although the monitoring and follow-up vegetation treatments have not been completed, GFC biologists are optimistic that even greater positive impacts will result from this massive project.

Conclusions

Based on our industry's growing experience and collaborative research, strategies for applying fluridone are continually improving to achieve control of the maximum amount of hydrilla with the often limited funds available. In the Kissimmee chain of lakes, there has been a successful integration of chemical, mechanical, and biological control methods over the past 15 years. We have the technology and the tools to effectively manage this menace to our aquatic ecosystems; however, the ability to implement that technology is often hampered by the lack of funds. Efficient management of hydrilla in small lakes or priority areas of large lakes does work, and vegetation managers responsible for these public waterways will continue to cooperate in research projects addressing the hurdles which arise along the way. Increasing the success of treatments in the northwestern area of Lake Kissimmee is one of our immediate goals. However, the future of these fragile ecosystems and the progress we have achieved is threatened if our legislative leaders do

not secure a sufficient, dedicated funding source.