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ABSTRACT

ECOSYSTEM MANAGEMENT AT HOUGHTON LAKE, MICHIGAN WITH EMPHASIS ON WILD RICE (*Zizania aquatica*) ECOLOGY

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Houghton Lake has traditionally been an important stopover site for migrating waterfowl. Since 1973 numbers of waterfowl using Houghton Lake have declined dramatically. Changes in the lake ecosystem, particularly the disappearance of wild rice (*Zizania aquatica*), were suspected to have accounted for declines. Macrophyte and macroinvertebrate communities were sampled in 1995-96 in 5 distinct weedbeds that supported wild rice, to determine species composition and density. Additionally, water quality, boating impacts on macrophytes, lake level management and wild rice restoration were investigated. Macrophyte and macroinvertebrate communities experienced drastic declines in diversity and abundance in all weedbeds compared to baseline data. Macrophyte density indices were not significantly different from those within experimental exclosures. Lake levels were not significantly different for three periods before, during and after declines of wild rice. Declines of wild rice, other macrophytes and macroinvertebrate numbers can be attributed to increased turbidity, mechanical damage and expansion of exotic macrophytes.

MANAGEMENT RECOMMENDATIONS

1. Reestablish wild rice within its former range at Houghton Lake.

The seeding efforts of 1996-97 should be continued for 3 additional years or until self-sustaining stands of wild rice have become established in Middle Grounds, Muddy Bay and North Bay weedbeds. The reestablishment of a viable wild rice seed bank is critical to reestablishment. Ustipak (1995) reported that seeding natural wild rice stands which have produced seed for years is generally a waste of resources because of the large quantity of rice seed that accumulates over the years in the lake bed. Wild rice seed can remain dormant for many years, possibly indefinitely, in the anaerobic conditions of the lake bottom (Aiken *et al.* 1988, Ustipak 1995). It became apparent while sorting benthic invertebrate samples from areas of Houghton Lake where wild rice was once abundant that the seed bank had been seriously depleted. Few samples contained more than 15 viable wild rice seeds. Therefore, if seeding fails to produce viable plants the following growing season, a seed bank will be in place to take advantage of favorable growing conditions in the future.

The cost of continuing wild rice seeding at Houghton Lake is minimal, both monetarily and from the standpoint of effort. Two-hundred fifty kg of wild rice seed was purchased from the Great Lakes Indian Fish and Wildlife Commission in 1997 at a cost of $750. A 50% cost sharing agreement between the Commission and MDNR exists, reducing the final cost to $375. Assuming that prices of seed remain stable, the cost to continue seeding for 3 additional years is $1125. Three approximately 0.5 hectare areas can easily be seeded by 2 or 3 workers in less than 8 hours.

The buoys used to exclude boaters from specific areas of each weedbed in the course of this study should be used again to exclude boaters from wild rice reestablishment areas. Buoys were used in this capacity in 1997 in Muddy Bay, but were not used in North Bay and Middle Grounds weedbed. Due to their location, the buoys in these areas served to attract curious boaters more than exclude them. The use of buoys in areas far from shore should only be necessary if human disturbance becomes a problem in reestablished stands of wild rice.

2. The expansion of exotic macrophytes, particularly EWM, must be controlled.

Without some form of control over the increasing dominance of EWM at Houghton Lake, the recovery of wild rice and other native macrophytes important to waterfowl cannot occur. Curly leaf pondweed does not yet appear to be expanding its range at Houghton Lake, but its spread should be monitored. Control of EWM has been achieved in many Michigan lakes utilizing aquatic herbicides; specifically, fluridone (widely known by its trade name, Sonar) and 2,4-D (Aquakleen). These herbicides have been shown to selectively control EWM with little effect on native macrophytes at specific application rates (Pullman 1993). However, the use of aquatic herbicides to control aquatic macrophytes is controversial, given the potential uncertainties concerning the biological fate of the active ingredients. Biological control methods for EWM, although few, appear to be promising. Sheldon (1997) suggests that *Euhrychiopsis lecontei*, an aquatic weevil native to North America, may act as a biological control for EWM. After open water releases of weevils in three Vermont lakes, weevil populations became established and had a negative impact on EWM (Sheldon 1997). Sheldon (1997) indicates

that in the presence of *E. lecontei*, EWM never regained its former abundance in the experimental lakes. Mechanical control of aquatic macrophytes utilizing aquatic weed harvesters is practiced on many Michigan Lakes, but is not recommended for the control of EWM on lakes in which the goal is to restore native macrophyte populations (Pullman 1993). The use of weed harvesters can spread EWM by producing large numbers of fragments that can develop into viable plants.

The use of fluridone or 2,4-D in Houghton Lake will likely provide the most efficient and cost effective control of EWM. Aquatic herbicides, if applied diligently by conscientious licensed aquatic herbicide applicators over 2-3 years, will effectively control the spread of exotics and allow native macrophytes to recolonize large areas of Middle Grounds and South Shore weedbeds dominated by EWM.

3. Manage Houghton Lake at the legal level of 346.89 m.

In recent years the Roscommon County Board of Commissioners, who are responsible for lake level management at Houghton Lake and throughout Roscommon County, have managed summer lake levels far above the legal level, in direct violation of the law. The purpose of regulating the lake above legal level was to increase recreational opportunities for the boating public. The decline of wild rice occurred around the same time that Roscommon County began to increase summer lake levels. This does not imply that increased water levels were directly responsible for the decline, however, high water levels may have contributed to the decline in some way. Due to the extreme depths at which wild rice grows at Houghton Lake, any long term increase in water depth through the growing season will hinder wild rice reestablishment. In 1996, the Roscommon

County Board of Commissioners reached an agreement with MDNR to regulate lake levels 6 in. (15.24 cm) above the legal level.

Although this agreement has shown that Roscommon County is willing to work with MDNR to manage the lake, the fact remains that in order to effectively reestablish wild rice, the lake must be managed at the legal level, and ideally, should be regulated at the winter level throughout the year. This will not only benefit wild rice, but will benefit the rest of the macrophyte community by increasing light penetration to lower growing species.

4. Study further aspects of the Houghton Lake ecosystem.

Few lakes have been studied as extensively as Houghton Lake. MDNR completed seven technical reports based on original research conducted at Houghton Lake in the early 1970's, representing perhaps the greatest single source of baseline data on Houghton Lake. Further study at Houghton Lake should utilize this excellent resource to investigate the following:

a. Waterfowl Feeding Ecology: The tremendous changes in macrophyte and invertebrate community structure at Houghton Lake has undoubtedly affected waterfowl feeding habits and distribution patterns since 1973. Future research should focus on these aspects and utilize the excellent baseline data compiled by Evenson *et al.* (1973).

b. Fisheries Ecology: Until recently, Houghton Lake was considered to have one of the premiere panfish fisheries in Michigan. Although netting surveys conducted in 1993 by MDNR, Fisheries Division indicate that a healthy population of panfish still exists in the lake, longtime fishers of Houghton Lake report that sizes and numbers of fish, particularly blue gills, have declined. MDNR 1993 netting surveys indicate that the numbers of large blue gills has remained relatively stable, but numbers of small blue gills have declined since the last survey (D. Smith, MDNR, Fisheries Div. pers. communication). Future research at Houghton Lake should investigate panfish feeding ecology and if declines in total benthic invertebrate numbers has implications regarding recruitment and growth. Additionally, research should focus on how changes in macrophyte community structure affect fish communities.

c. Limnological Analysis: Pecor *et al.* (1973) collected a vast amount of baseline data regarding the limnological conditions present at Houghton Lake. Research should try to repeat the original study as closely as possible to determine what changes have occurred over the years and what implications changes may have for the Houghton Lake ecosystem.

d. Watershed Management: A watershed management plan based upon limnological conditions at Houghton Lake and a detailed analysis of land use, the contribution of nutrients from streams flowing into the lake, human population trends, etc. should be written for Houghton Lake (see MDNR publication "Protecting Inland Lakes: A Watershed Management Guidebook, Warbach *et al.* 1990). Although a research project of this scope would take several workers to complete, it would insure that the Houghton Lake ecosystem will be managed responsibly in years to come.