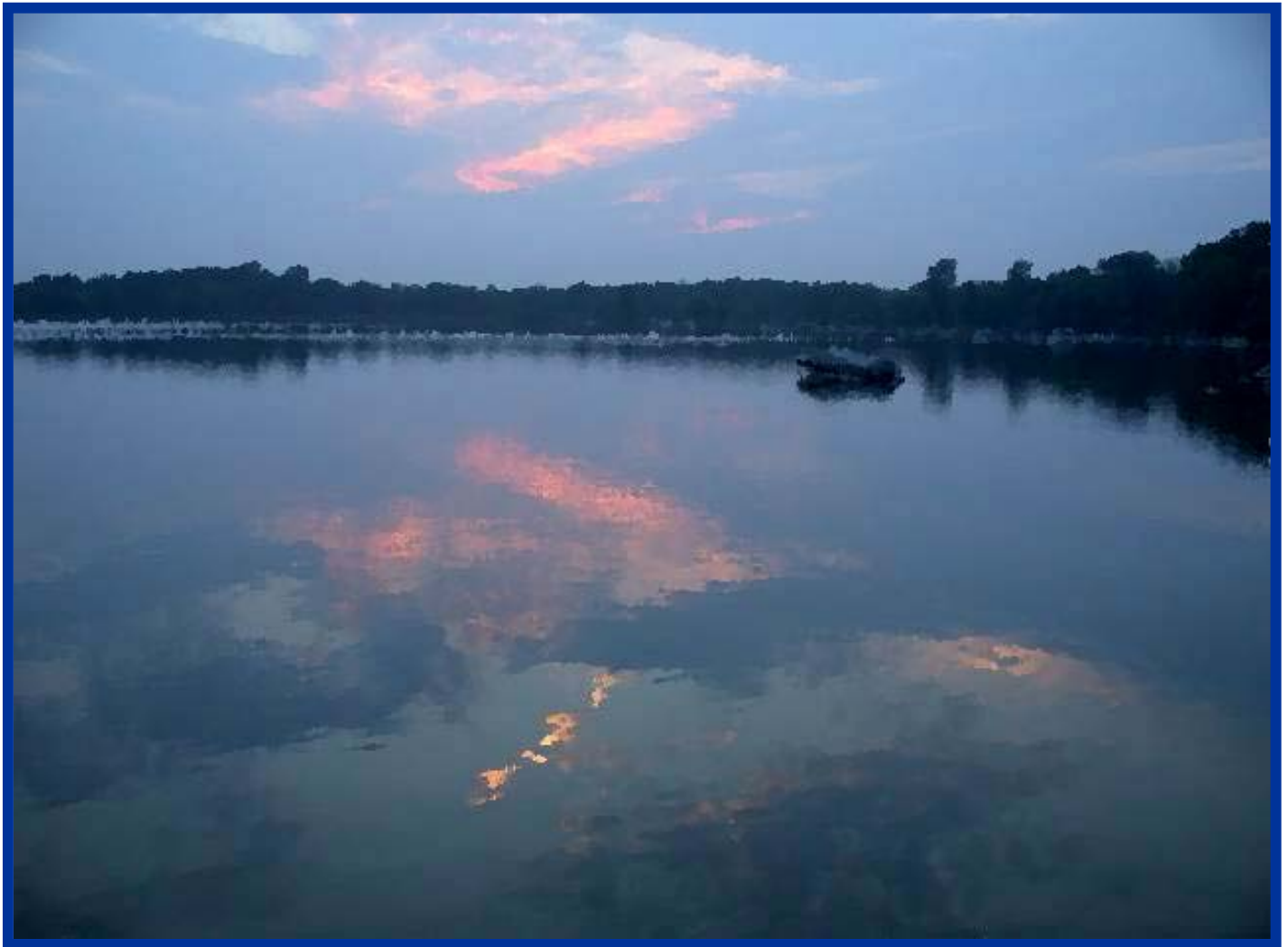


Joslin Lake

2009 Critical Fishery Habitat Assessment Report

WASHTENAW COUNTY, MICHIGAN



Prepared for:
Washtenaw County Department of Public Works & Joslin Lake Improvement Project

by:
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A LakeScan™ Analysis
18 March 2010

TABLE OF CONTENTS

1.0 INTRODUCTION	PAGE 1
2.0 PURPOSE AND METHODS.....	PAGES 1 - 2
3.0 THE IMPORTANCE OF FISH SPAWNING AND NURSERY HABITAT.....	PAGES 2 -3
4.0 GENERAL DESCRIPTION OF THE JOSLIN LAKE FISHERY	PAGES 3 - 4
5.0 CRITICAL FISH HABITAT ASSESSMENT	PAGES 4 - 5
6.0 FISHERY MANAGEMENT RECOMMENDATIONS.....	PAGES 5 – 7
7.0 LITERATURE CITED	PAGE 7
APPENDIX 1 CRITICAL FISH HABITAT MAP	
APPENDIX 2 PICTORIAL KEY TO FISH OF JOSLIN LAKE	

PREFACE

This update report is the result of decades of effort to create a reader accessible report that still contains enough information that it might be useful for a broad group of readers with a wide range of understanding and experience with lake ecology and lake management. On one level, the charts that are presented herein may be all that a reader may want to review. The relative height of a bar is indicative of how conditions are trending in a lake. Narrative is provided to summarize how the author interprets the data and how that interpretation may influence management prescriptives. Obviously, there are many parts of the report that will not change very much from year to year. For example, the overall lake management goal of the lake management program may not change until the goal is believed to have been achieved. There are notes at the bottom of each section to indicate the last time that section was modified or edited. Explanatory information (boiler plates) has been placed in text boxes so that they are available to the reader but don't just create "bulk" in the narrative. How should the report be read? That's up to the reader and their level of experience. Some may only wish to look at the charts and read the summary at the beginning of the report. Others may wish to consider the updated narratives. First time readers are encouraged to read the entire report.

The methods used to collect data and analyze those data are part of the LakeScan system. LakeScan emerged in 1991 and has seen continual development since that time. The current system contains a variety of analytical tools that are expressly designed to be used to guide lake management program decisions. Wherever possible, metrics or indices have been culled from the established and accepted peer reviewed scientific literature. In some cases, the algorithms have been modified to meet the demands of lake data analysis. Some metrics, such as the nursery habitat index, are based on established ecological inferences and data and have been adapted to meet a specific need. This required that certain assumptions had to be adopted by the developers of LakeScan. The reader is cautioned that these indices have not been subjected to peer review; however, they are so useful, that they are offered anyway.

Update reports are "living documents". Time and resources restrict how much effort is can be dedicated to each report each year. Each year, efforts are made to make the report "more complete", but we are confident that the reader will not find a more useful, sensible, or meaningful report format. Input and comments are always welcome and appreciated.

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ABSTRACT

Joslin Lake is located Washtenaw County, Michigan's Lower Peninsula. The Washtenaw County Division of Public Works as part of the Joslin Lake Improvement Project contracted with Aquest Corporation and Superior Environmental & Aquatic Services LLC (SEAS) used LakeScan™ methods to conduct assessments of aquatic vegetation and critical fishery habitat. The purpose of the fishery habitat assessment is to evaluate the quality and location of critical fish spawning and nursery habitat within Joslin Lake and potential changes that may result from the current aquatic vegetation management program. Observations of three critical habitat types including 1) Spawning Habitat (Active and Non Active); 2) Nursery Habitat; 3) Refuge Habitat (primarily Submerged Woody Structure); and starry stonewort impacts are discussed.

Available spawning habitat for bass and sunfish species is very abundant in Joslin Lake. The north and east littoral areas within the lake provide considerable areas of mixed sand and gravel substrate that is preferred spawning habitat of bottom nesting sunfish and bass. Spawning areas were located in littoral areas one to six feet deep. These areas were often sparsely vegetated or devoid of standing vegetation. This habitat would also serve as spawning habitat for small native species such as log perch (*Percina caprodes*) and possibly johnny darters (*Etheostoma nigrum*). Redear sunfish, bluegill sunfish, rock bass and pumpkinseed sunfish were observed spawning. Active spawning habitat was found in 22% of BOS

There is no shortage of nursery habitat in Joslin Lake. Prime nursery habitat consisting of structurally complex and well vegetated nursery habitats at depths from one to six feet was abundant, being found in 35% of biological observations sites (BOS). Fish species including yellow perch, largemouth bass, various sunfish, bullhead and minnow species were observed using littoral nursery areas, one to three feet deep, along the east shore.

Submerged woody structure was not detected in the lake. The large wetland complex that borders the lake to the east and south shoreline prevents establishment of woody vegetation for recruitment into the lake. In addition, the north and east shores have undergone a considerable amount of residential development which reduces the potential for contributions of new woody debris from the trees along the shoreline. Lack of submerged woody structure may be a contributing factor to the below average growth rate of largemouth bass and low numbers of yellow perch found in Joslin Lake.

Starry stonewort has become well established in Joslin Lake and was found in 35% of the BOS. It was very dense near the public access site along the south shore. Negative impacts to nursery habitat and isolated spawning areas along the east shore are expected to occur as the invasive charophyte continues to expand in coverage and density.

The first year of the critical fishery habitat survey was conducted prior to the implementation of intensive nuisance aquatic vegetation management activities and provided very valuable information with regard to habitat type and utilization by fish of Joslin Lake. In 2010, we will begin to determine the response of the fish community to aquatic vegetation management as we now have established a baseline for habitat location, quality and utilization.

1.0 INTRODUCTION

Joslin Lake is located Washtenaw County, Michigan's Lower Peninsula. The Washtenaw County Division of Public Works as part of the Joslin Lake Improvement Project contracted with Aquest Corporation and Superior Environmental & Aquatic Services LLC (SEAS) to conduct assessments of aquatic vegetation and critical fishery habitat. The information included in this report pertains to critical fishery habitat assessment conducted by SEAS in 2009.



Figure 1. Joslin Lake, Washtenaw County, Michigan (T1S., R3E., Sec. 3 and 4).

2.0 PURPOSE AND METHODS

Purpose

The purpose of the fishery habitat assessment is to evaluate the quality and location of critical fish spawning and nursery habitat within Joslin Lake and potential changes that may result from the current aquatic vegetation management program. The fishery of Joslin Lake is considered to be an important natural and recreational resource, and therefore, requires careful and sound fishery management. To assemble the necessary information for fishery management recommendations, SEAS aquatic biologist conducted assessments of historical data, angler interviews and field inspection and remote evaluation (maps) of critical fishery habitat. Field inspection of critical habitats was conducted from the boat during the time of the late spring / early summer aquatic vegetation assessment.

Methodology

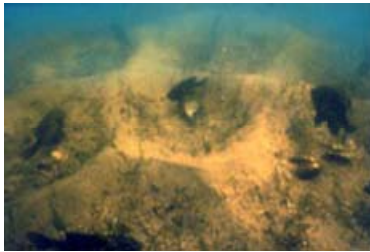
Assessment of critical spawning and nursery habitat was conducted using field observation, MDNR Lake Maps (showing bottom type) and research on the life history strategies of fish known to inhabit the lake. Critical fish habitat parameters assessed include 1) spawning substrate type; 2) depth; 3) relative abundance and use of spawning habitat and 4) shoreline development. Nursery habitat parameters included 1) observed use, 2) connections to lake; 3) vegetation type and 4) shoreline development. In determining critical spawning and nursery habitat we assess both individual and combined value of the habitat parameters. If a threatened or endangered species is present, its habitat will be automatically deemed critical. Because the assessment occurs over the span of one day during the spawning season, the survey can only be considered a snapshot of the actual utilization on the day of the observation. However, repeat observation across years can indicate real trends of habitat use and the potential for habitat to serve critical functions of fish can be inferred within the limits of methods used to assess habitat. Variation in location of critical fishery habitat areas from year to year may occur and may be the result of natural changes or may reflect an increase in investigator accuracy in detailing observations. Since the areas are visual estimates they are assumed to be accurate as to the degree that can be determined by visual observation.

Working field maps are created using the LakeScan™ method. Observations are recorded at predetermined Bio Observation Sites (BOS) and are recorded on maps or in spread sheet format. In many cases, these sites are also geo-referenced to UTM's. These records are used for a broad range of analyses and to represent the location of key species or habitats. The Bio-Observation Sites (BOS) are depicted on Critical Fishery Habitat Maps (Appendix 1). Tiers 1 and 2 are used to delineate shoreline areas that are dominated by emergent or wetland vegetation. By convention, the near shore BOS are considered collectively as part of Tier 3 and can support submersed vegetation. Often, the Tier 3 BOS are very shallow, sandy, and plant-free because of wind, ice, and wave action. However, Tier 3 BOS may also play a role as a deposition zone juxtaposed to wetland outflows (diffuse shoreline) or influent streams. Tier 3 zones are strongly influenced by shoreline conditions and development. The tier 4 zone is characterized by deeper water and is generally more plant productive than the near-shore Tier 3 BOS. Plants in this zone are not as subject to wind and wave disturbance. The Tier 2 zone is often located just beyond boat docks. The Tier 5 observation sites are in deeper water and are generally associated with the "drop-off" zone in a lake and are commonly characterized by steep slopes. Some lakes have submerged islands, located off shore, and beyond typical Tier 5 zones. These are classified as Tier 6

3.0 THE IMPORTANCE OF FISH SPAWNING AND NURSERY HABITAT

There are many factors that affect recreational fisheries including, angling pressure, other recreational uses, climate, competition, primary productivity, water quality, invasive plant species and resource management decisions. Quality and quantity of spawning, nursery and refuge habitat are three fundamental components of fish life history and can determine the survival, composition and condition of a fish population in a given environment. In simple terms, naturally sustaining fish populations cannot occur without a place to spawn. In addition, if spawning success is good but mortality of fry is high (due to lack of nursery habitat) then the number of adults added to the existing population by that year class will be reduced. In some fish species, mortality within the first 100 days of life can be as high as 99%. The high mortality of the early life stage is typically referred to as the bottleneck in population potential. In lakes under management for nuisance aquatic vegetation, recreation or aesthetics it is important to know where these critical habitats are and what the possible effects of management activities may be upon them.

SPAWNING HABITAT



Spawning habitat consists of the physical structure selected by adult fish for egg deposition and fertilization. Fish utilize sand, gravel, snail shells, woody debris, hollow submerged timber, cobble, aquatic vegetation, submerged tree roots, and rock reefs as spawning substrate. Some fish species build nests and others simply broadcast eggs into the water column. The majority of fish species in temperate inland lakes orient to or select some form of physical substrate to spawn upon.

NURSERY HABITAT



Nursery habitat, consists of shallow littoral areas rich in aquatic plant life. Mouths of tributaries, lake fringe wetlands, coves, bays, marshes and even canals can serve as nursery areas. The highest quality nursery habitat provides the optimum temperature, shelter and food necessary inhibit predation and to sustain high rates of growth that occur during the first year of life.

REFUGE HABITAT



Surveys in conducted by the Wisconsin Department of Natural Resources indicate that the presence of woody habitat is an important habitat variable providing forage and refuge for many fish species. Our observations also conclude that both largemouth and smallmouth bass preferentially orient spawning beds toward woody cover when the bottom substrate is also acceptable for construction of spawning beds.

GENERAL DESCRIPTION OF THE JOSLIN LAKE FISHERY

Fishery Surveys

Michigan Department of Natural Resources and Environment Fisheries Division (MNRE) periodically conducts intensive fishery surveys of Joslin Lake. The most recent fishery survey was conducted by the MDNRE in May 2003. This section contains highlights taken directly from the MDNRE fisheries resources report titled Michigan Department of Natural Resources, Status of the Fishery Resource Report No. 2005-11.

A total of 17 fish species and 6 turtle species were collected or observed during this survey with 2,614 fish and 59 turtles handled (See Appendix 2 for pictures of fish species). Panfish such as redear sunfish, bluegill, pumpkinseed sunfish, hybrid sunfish, rock bass, and black crappie dominated the survey making up over 90% of the total catch both by number and weight. Large gamefish such as largemouth bass and northern pike were about 2% of the total catch by number and weight. Brown, black and yellow bullhead were fairly numerous totaling over 5% of the catch while rough fish species such as bowfin and longnose gar were scarce at less than 1% of the total catch. Other fish caught in small numbers included golden shiner, lake chubsucker, warmouth and yellow perch. Turtle species observed included numerous musk, painted and snapping turtles along with a few spiny softshell and common map turtles. One Blanding's turtle, a special concern species, was caught as well.

Redear sunfish and bluegill were by far the most abundant fish species caught during this survey (55% and 28% of the total catch by number, respectively). The redear sunfish averaged an impressive 9.9 inches in length with about 63% (899 of 1,437) exceeding the 10-inch master angler minimum size requirement. Over 99% of these sunfish collected during this survey exceeded the minimum size acceptable to anglers of 6 inches. Bluegill averaged 6.6 inches with 89% exceeding the minimum acceptable size of 6 inches and 163 of the 719 caught over 7 inches in length. Growth rates for the redear sunfish were good with a mean growth index 0.7 inches over the state average. Bluegill growth was below average with a mean growth index 0.8 inches below the state average. A wide range of age

groups were present for both species indicating consistent reproductive success and multi-year survival is occurring in Joslin Lake.

Fish Stocking

From 1995 - 1998 the MDNR has transplanted 42,792 redear sunfish in Joslin Lake or approximately 8,558 per year. The stocking rate averaged across all four years was 45 redear sunfish per acre. The stocking program was successful in establishing an additional game fish species in Joslin Lake.

Recreational Fishing Experience Update

Joslin Lake supports a quality sport fishery with larger than average to trophy sized panfish. Local anglers hold the fishery in high regard. Largemouth bass are numerous but the majority of the population is below the state minimum legal size limit. Bullhead catfish and northern pike also provide good angling opportunities. Recent communication with anglers and lake residents indicate that the fishery appears to be improving in terms of quality and ease of catch as a result of aquatic plant management activities. The recent MDNRE survey data results indicate that this perception is probably correlated to average size of gamefish species inhabiting the lake. Since 2000, a total of twelve State of Michigan Master Angler Awards for fish species of exceptional size has been registered by anglers that fished Joslin Lake and were all redear sunfish. All trophy sized panfish were caught during spring spawn.

4.0 CRITICAL FISH SPAWNING AND NURSERY HABITAT ASSESSMENT

Approximately one-third of the shoreline of the 187-acre lake is characterized as marshy and undeveloped, with emergent wetland vegetation that includes lily pads, cattails, and bulrushes. The remaining shoreline is developed with mainly permanent homes although some summer cottages do exist. This developed shoreline (primarily the north and east sides of the lake) is mostly lawns with a fair number of trees and a few rock seawalls. A DNR public access site and gravel boat launch is located on the south side of the lake off of Joslin Lake Road to the east. Joslin is a very shallow lake with depths averaging 5 to 8 feet. About two-thirds of the lake is shallower than 5 feet with one deeper area reaching the 20 foot maximum depth. The lake's bottom is composed mainly of sand, marl, pulpy peat and fibrous peat. It is mostly sand along the north and east sides of the lake with submerged aquatic vegetation sparse or absent.

2009 Critical Fishery Habitat Survey

Observations of three critical habitat types including 1) Spawning Habitat (Active and Non Active); 2) Nursery Habitat; 3) Refuge Habitat (primarily Submerged Woody Structure); and 4) Starry Stonewort) are discussed. Data is reported as a percentage of BOS's containing a specific habitat type. Because of the need to provide greater sensitivity to the potential changes in active spawning activity, a BOS containing active spawning is wholly categorized and counted as active spawning habitat even though non active habitat may have been present.

Spawning Habitat

Available spawning habitat for bass and sunfish species is very abundant in Joslin Lake. The north and east littoral areas within the lake provide considerable areas of mixed sand and gravel substrate that is preferred spawning habitat of bottom nesting sunfish and bass. Spawning areas were located in littoral areas one to six feet deep. These areas were often sparsely vegetated or devoid of standing vegetation. This habitat would also serve as spawning habitat for small native species such as log perch (*Percina caprodes*) and possibly johnny darters (*Etheostoma nigrum*). Redear sunfish, bluegill sunfish, rock bass and pumpkinseed sunfish were observed spawning. Active spawning habitat was found in 22% of BOS (Figure 2). In every lake we have surveyed for active spawning habitat, we have found that nesting areas are traditional and revisited every spawning season. This indicates that these traditional spawning areas

are very important to the fish community. It typically takes three years to confirm traditional spawning areas.

Nursery Habitat

There is no shortage of nursery habitat in Joslin Lake. Prime nursery habitat consisting of structurally complex and well vegetated nursery habitats at depths from one to six feet was abundant, being found in 35% of BOS (Figure 2). The highest quality nursery areas were found at BOS's 3- 6, and 30 - 54 (Appendix 1). Fish species including

yellow perch, largemouth bass, various sunfish, bullhead and minnow species were observed using littoral nursery areas, one to three feet deep, along the east shore. Evidence of juvenile sunfish using extensive offshore areas of submergent aquatic vegetation was also observed. Nursery areas may also serve as spawning habitat for many phytophilic (plant loving) spawners that are found in the lake including lake chubsucker, golden shiner and black, brown and yellow bullheads, yellow perch and northern pike.

Woody Habitat

Submerged woody structure was not detected in the lake. The large wetland complex that borders the lake to the east and south shoreline prevents establishment of woody vegetation for recruitment into the lake. In addition, the north and east shores have undergone a considerable amount of residential development which reduces the potential for contributions of new woody debris from the trees along the shoreline.

StarryStonewort

This invasive charaphyte has become well established in Joslin Lake and was found in 35% of the BOS (Figure 2). It was very dense near the public access site along the south shore (Appendix 1). Negative impacts to nursery habitat and isolated spawning areas along the east shore are expected.

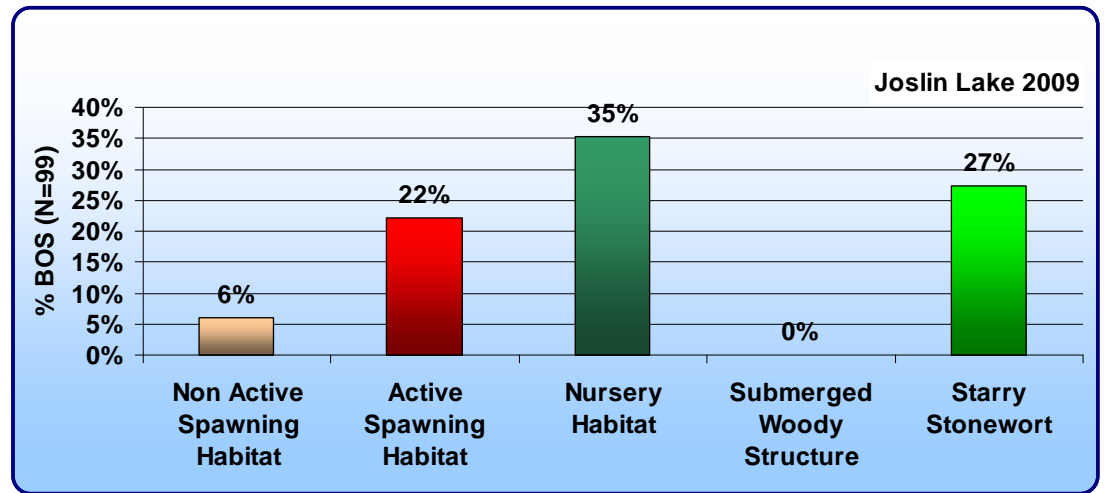


Figure 2. Percentage of BOS containing critical fishery habitat types observed during the 12 June 2009 Critical Fishery Habitat Survey.

5.0 FISHERY MANAGEMENT RECOMMENDATIONS

The fishery of Joslin Lake has experienced fishery management activities primarily in the form of planting fish resulting in the establishment of a trophy panfish fishery. It appears that the recreational fishery is important to the residents of Joslin Lake. SEAS has suggested a fishery management program consisting of strategies that will continue to support and possible enhance the present at minimal costs. The goals strategies and objectives provided do not have to be conducted in order of occurrence and they can be completed as fiscal resources or time permits. These management suggestions are submitted for consideration for the Joslin Lake Improvement Board, its representatives and constituencies.

Starry stonewort is an invasive plant species that is endangered in Great Britain, but is rapidly proliferating in Joslin Lake. It has the ability to form dense mats that completely eradicate bass and panfish spawning habitat. In addition, it can eliminate vertical plant structure and diversity in nursery areas eliminating cover and forage habitat. Continued documentation and control of the rate of encroachment on these habitats by starry stonewort should be a critical fishery management objective.

Although Joslin Lake contains an abundance of spawning habitat, we are just beginning to understand use of spawning grounds by warmwater fish. In light of the information we are gathering on other lakes, it may be that spawning area utilization may be less flexible than once thought. Therefore, it is recommended that documentation of critical fishery habitat utilization in Joslin Lake be continued until all critical habitat areas are defined, which will greatly benefit in making lake management decisions that benefit the fishery.

Joslin Lake lacks “in-lake” woody structure. Many trees were removed during the development of the shoreline. In lakes with wooded shorelines undercutting and wind cause large trees to fall into the lake this recruitment of woody habitat is a natural occurrence, but it takes decades for considerable amounts to accumulate in a lake through natural means. Woody habitat, though less productive, are analogous to oceanic coral reefs and have been indicated as some of the most important refuge and forage habitat in inland lakes. In addition fish such as channel catfish often spawn in the hollows of sunken timber and smallmouth bass often nest under woody debris. Largemouth bass are known to preferentially locate nest near submerged woody structure. Yellow perch preferentially select clean woody structure over aquatic vegetation for egg deposition. Many other native species of darters and minnows also utilize this type of structure for spawning, refuge and forage habitat.

Removal of 75% of woody structure from a lake in Wisconsin resulted in a dramatic decrease in abundance of yellow perch and a decrease in condition, reproduction, growth rate and forage behavior in largemouth bass (Sass et al, 2006).

FISH POPULATION MANAGEMENT GOALS

Present Status: Good recreational fishery for trophy sized panfish. Largemouth bass are abundant but slow growing. Yellow perch are present and represent a target species for population enhancement through habitat enhancement.

Suggested Goal: Maintain a recreational fishery providing trophy fishing for trophy sunfish and largemouth bass and more and larger yellow perch as a percentage of the overall fish population.

Objective 1
Strategy: Install woody habitat enhancement structures and document use.
Provide types and locations for woody habitat enhancement and provide a written report detailing, type, location and cost.
Provide fallen logs and woody structure yellow perch spawning and forage fish aggregations.

Success: Verified use by documentation of adults largemouth bass and egg deposition by yellow perch.

Objective 2
Strategy: Actively manage starry stonewort infestations to prevent encroachment on existing spawning areas.

Continue the current aquatic vegetation management program and target areas of encroachment near known bass and sunfish spawning areas.

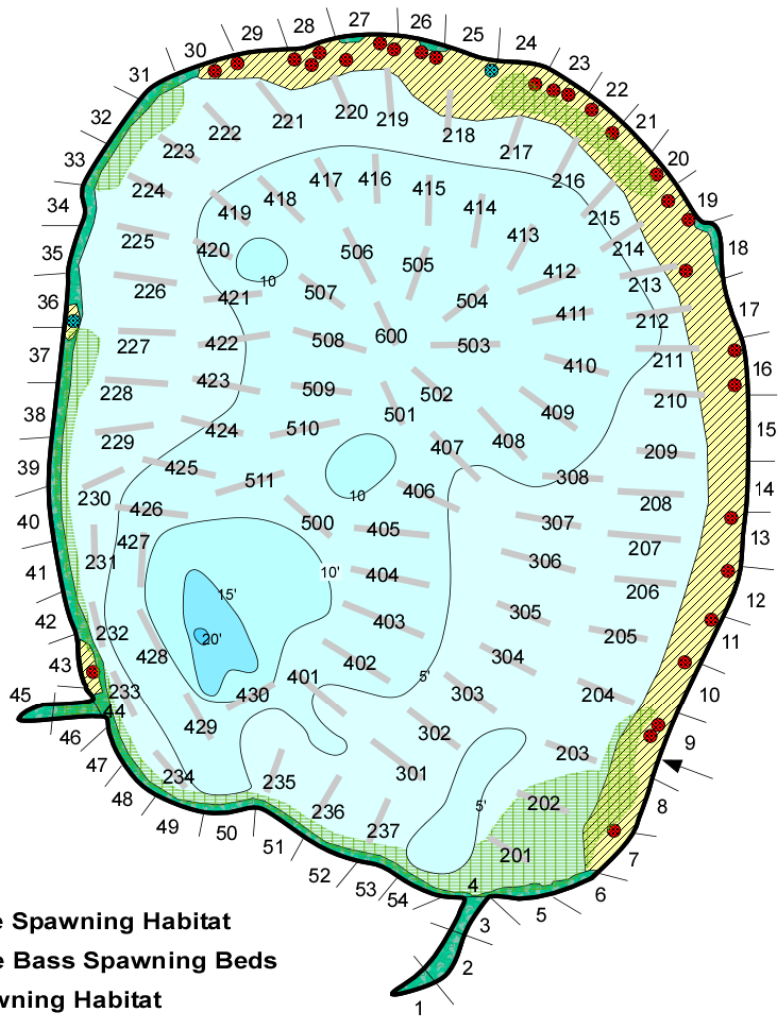
- Success:** Continuing verification of spawning habitat use in traditional spawning areas and maintaining these areas free of starry stonewort.
- Objective 3**
Strategy: Verify and monitor critical fishery habitat
Continue to monitor critical fishery habitat and protect and augment habitat where necessary.
Continue critical fish habitat assessments to detect changes in habitat use and availability that may affect the fishery.
Confirm location of critical spawning habitat areas.
- Success:** Delivery of an annual summary report verifying location and use of critical fishery habitat.

7.0 LITERATURE CITED

- Sass, G.G., Kitchell, J.F., Carpenter, S.R., Hrabik, T.R., Marburg, A.E., Turner, M.G., 2006. Fish community and food web responses to a whole-lake removal of coarse woody habitat. *Fisheries* 31, 321–330.
- Schindler, D.E., Geib, S.I., Williams, M.R., 2000. Patterns of fish growth along a residential development gradient in north temperate lakes. *Ecosystems* 3, 229–237.

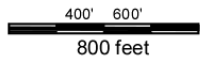
**APPENDIX 1
CRITICAL FISHERY HABITAT MAPS 2009**

JOSLIN LAKE CRITICAL FISHERY HABITAT ASSESSMENT MAP 2009



LEGEND

-  Nursery Habitat
-  Observed Active Spawning Habitat
-  Observed Active Bass Spawning Beds
-  Non Active Spawning Habitat
-  Starry Stonewort Encroachment
-  Submerged Large Woody Habitat



Joslin Lake
 187 Surface Acre
 Lyndon Twp. (T1S., R3E., Sec. 3, and 4), Michigan
SEAS LLC, P.O. Box 131404, Ann Arbor, MI 48113, 6/12/2009

Polygon size and locations are visual estimates and are not intended to represent the accuracy of survey grade, global positioning or geo-referenced data.

**APPENDIX 2
PICTORIAL KEY TO FISH OF JOSLIN LAKE**

BLACK BULLHEAD



BLACK CRAPPIE



BLUEGILL



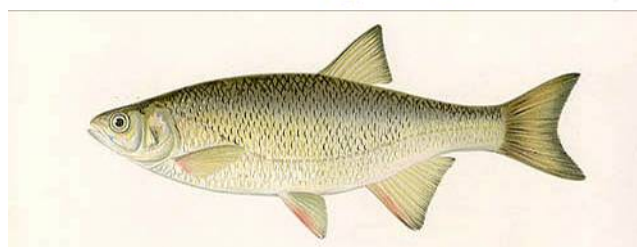
BROWN BULLHEAD



BOWFIN



GOLDEN SHINER



**HYBRID SUNFISH
(BLUEGILL X REDEAR)**



LAKE CHUBSUCKER



LARGEMOUTH BASS



LONGNOSE GAR



NORTHERN PIKE



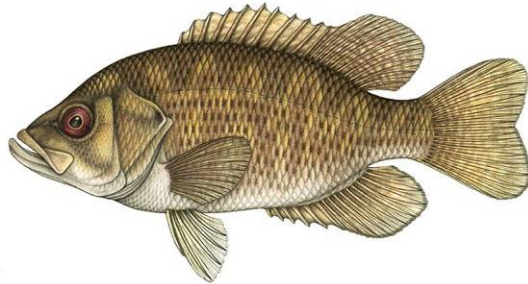
**PUMPKINSEED
SUNFISH**



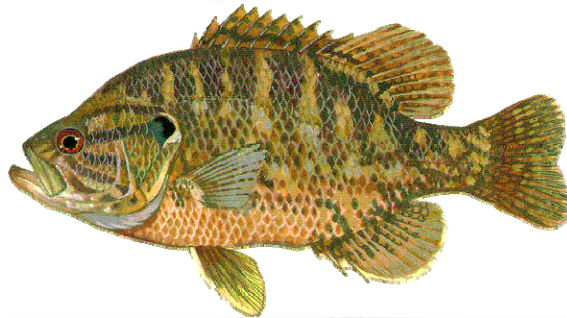
REDEAR SUNFISH



ROCK BASS



WARMOUTH



YELLOW BULLHEAD



YELLOW PERCH

