STUDY PERFORMANCE REPORT

State: Michigan **Project No.:** F-80-R-7

Study No.: 230521 **Title:** Influence of lotic and nearshore habitats on fish populations in Great Lakes and inland lake ecosystems, with emphasis on walleye.

Period Covered: October 1, 2005 to September 30, 2006

Study Objective: The objectives of this study are: 1) to assess the extent of natural reproduction of walleye in the Michigan waters of Green Bay via marking stocked fish with oxytetracycline (OTC) and describing their contribution to walleye year classes; 2) to assess the relative influence of river spawning habitat, estuary conditions, juvenile-adult growth habitat, and supplemental stocking on spawning runs of walleye (and estimates of percent natural reproduction) in various river-influenced systems in Michigan, and; 3) to determine if discrete river- and reef-spawning walleye stocks occur in select areas of Green Bay.

Summary: We estimated the walleye *Sander vitreus* spawning run of the Menominee River in spring 2006 to be 58,382 fish. We tagged 585 walleye in Little Bay de Noc (LBDN) and processed 127 walleye tag returns. I compared assessment methods for coolwater fish communities in lakes Huron and Michigan, and will be working with others to develop methods that both meet the multiple needs for data on fish communities in northern Green Bay and take advantage of existing equipment and personnel. I consulted with others regarding approaches for assessing estuary conditions, and will further explore opportunities for completing this job. I found that 71% of age-0 walleye in Big Bay de Noc (BBDN) in 2005 were of hatchery origin, and noted substantial levels of natural reproduction of walleye in LBDN.

Findings: Jobs 1 through 6 were scheduled for 2005-06, and progress is reported below.

Job 1. Title: Estimate size of walleye spawning runs in rivers.–From March 30 to April 14, 2006, personnel from Wisconsin DNR Fisheries and Marquette Fisheries Research Station conducted a multiple pass, mark-recapture survey of the Menominee River to estimate the size of the walleye run in the river below the most downstream dam. The primary objectives were to assess the size, age, and sex composition of the run.

Fish were sampled with two boomshocking units. Day-specific clips were given to fish collected each day, enabling the spawning run to be estimated using both closed and open population methods. Spines were collected from 20 fish per sex and inch group for aging. Tissue samples were also collected from a subset of fish for potential genetic analyses in the future.

Spring conditions in the river were somewhat different when compared to typical values. The "spring thaw" occurred relatively early due to unusually warm weather in late March. River flows on March 30 were at long-term median levels, but quickly increased due to meltwater, peaking on April 2. Then, flows declined gradually through the remainder of the sampling period. Typically, the river's discharge gradually increases through the first few weeks of April. These conditions did not appear to obviously disrupt the walleye run or affect sampling efficiency.

We captured a total of 9,488 walleyes, including 740 recaptures of fish marked during the 10-day sampling period. Seventy-two percent of our sample was made up of male walleyes less than 20 inches long. These males may represent the 2003 year class, which was strong in LBDN and elsewhere in the Great Lakes, and was expected to be strong in the Menominee River area. A large run of females from this year class can be expected within the next couple of years as they mature to spawning size. Spine ages (when available after processing) will be used to assess the age composition of the run.

The preliminarily estimate for the 2006 Menominee River spawning run was 58,382 walleyes (95% confidence interval of 15,044) using Shumacher-Eschmeyer (SE) equations. The estimate of the run by sex was 45,221 males and 13,161 females. Data from days 8-10 were excluded from this estimate due to the increased proportion of spent females observed (and likely emigration of spent fish) which would violate the assumption of a closed population. Cormack-Jolly-Seber (CJS) estimation assumes an open population, but confidence limits are not reported. The CJS estimate for the population using data up to day 7 produced very similar estimates for each sex (45,861 males and 11,559 females). Generally, the greatest agreement between population estimates occurred when population data up to day 7 were used.

Job 2. Title: Tag walleyes in LBDN and process tag returns.–In April 2006, we used individually-numbered monel bands to jaw tag 585 walleye collected from LBDN near the mouth of the Whitefish River. We processed tag returns for 127 sport-caught walleyes during this study period, 33 of which were tagged in LBDN. Numbers of tag returns for other tagging locations were as follows: BBDN (7); Cedar River (42); and Menominee River (45).

Job 3. Title: Review and develop sampling techniques.– I intend for our Green Bay sampling program to provide data to fulfill as many information needs as possible (e.g., walleye year-class assessments, walleye OTC samples, Lake Michigan Lakewide yellow perch assessment, general fish community assessment, evaluating fish community response to cormorant control, etc.). To this end, I compared our assessment procedures to those used in other nearshore areas sampled by Michigan Department of Natural Resources Fisheries Division, particularly those in Saginaw Bay and southern Lake Michigan. The area most comparable to northern Green Bay (particularly the bays de Noc) is Saginaw Bay, because both locations are characterized as shallow, relatively discreet water bodies. Differences exist in many respects (Table 1), particularly those associated with the vessel and amounts and types of gear that are deployed. In southern Lake Michigan, sampling consists of vessel-based gill-netting surveys occurring out of four ports, and July and August trawling with semi-balloon nylon otter trawls having 16-ft and 21-ft headropes. I will be working closely with researchers and managers to develop the best sampling strategy for Green Bay given the diverse information needs as well as the personnel and equipment constraints of our station.

I consulted with state, federal, and university researchers regarding the methods for assessing suitability of river estuary areas for larval walleye. From these contacts I learned that rivers with good walleye fry production had dense zooplankton populations in their estuaries (Haas and Thomas 1997). However, processing of zooplankton samples is time-intensive, costly, and seems infeasible given current workloads at our station. The possibility has been raised of assessing estuary productivity across multiple estuaries using remote sensing (i.e., satellite data on estuary temperature and chlorophyll conditions) and Geographical Information System (GIS) techniques (R. Haas, Michigan DNR, personal communication), and I will be exploring opportunities for collaborating with other researchers to assess study rivers in this manner.

Job 4. Title: Sample estuaries.–Field sampling of estuaries will not be conducted given the findings from the previous job. We will explore potential for using remote sensing techniques to characterize estuary conditions for larval walleye.

Job 5. Title: Collect OTC samples and summarize findings.–Walleye collected in fall 2005 were examined for OTC marks and the findings were summarized (Table 2). Big Bay de Noc was stocked with walleye in 2005, and these fish occur prominently both in the overall number of age-0 walleye caught (305) as well as the percent of walleye that were of hatchery origin (71%). In contrast, the same level of sampling effort in BBDN during 2004 only produced seven walleye (a non-stocked year). The catch of 157 age-0 walleye in LBDN (not stocked in 2005) suggested that substantial natural reproduction occurred there in 2005.

Job 6. Title: Write report.–This report was completed as scheduled.

References

Fielder, D.G., J. E. Johnson, J. R. Weber, M. V. Thomas, and R. C. Haas. 2000. Fish population survey of Saginaw Bay, Lake Huron, 1989-97. Michigan Department of Natural Resources, Fisheries Research Report 2052, Ann Arbor.

Haas, R.C., and M.V. Thomas. 1997. Nutrient levels and plankton populations of five Great Lakes tributaries and their relation to walleye year class strength (spawning success). Michigan Department of Natural Resources, Fisheries Research Report 2022, Ann Arbor.

Prepared by: Troy G. Zorn
Date: September 30, 2006

Table 1.–Comparison of various aspects of fish community assessment sampling in Saginaw Bay for 1994-97 (Fielder et al. 2000) and the bays de Noc for 2004-5. Note that half of special project sampling effort on bays de Noc is provided by management unit personnel.

Characteristic	Bays de Noc	Saginaw Bay
Boat length (ft)	20	50
Gill net length (ft) and composition	120, mono	1000, nylon
Otter trawl headrope length (ft)	10	35
Sample periods per year	4	1
Primary sampling season	Summer	Fall
Collections per site per year	4	2
Number of gill-netting sites	4	8
General survey effort (ft gill net per 1000 surface acres of water)	14	18
Special project effort (ft gill net per 1000 surface acres of water)	216	36
Ratio of special project to general survey effort on bay	15:1	2:1

Table 2.–Percent of walleye in Little Bay de Noc (LBDN) and Big Bay de Noc (BBDN) originating from natural reproduction with sample sizes shown in parentheses. An asterisk indicates years in which hatchery fish were stocked at the location.

	Percent wild		
Year class	Age-0	Age-1	Composite for year class
LBDN			
2004*	26% (62)	29% (99)	28% (161)
2005	97% (157)		97% (157)
BBDN			
2004	86% (7)	33% (3)	70% (10)
2005*	29% (305)		29% (305)