

## **Sources of Walleye Recruitment in Saginaw Bay, Lake Huron, and Recommendations for Further Rehabilitation**

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*Abstract.*—Historically, the walleye fishery in Saginaw Bay was among the largest in the Great Lakes, second only to that of Lake Erie. Walleye likely spawned in both tributaries and on off-shore reefs. While exploited heavily by the commercial fishery, an average yield of over 458,000 kg per year was sustained for nearly a century. The walleye population and fishery collapsed in 1944, however, due primarily to the loss of spawning habitat as a result of sedimentation, dam construction, industrial pollution, and eutrophication. Subsequent invasions of nonnative planktivores and their competition with, and predation on, larval walleyes is thought to have exacerbated the problem and suppressed natural recovery. Water quality improvements after 1970, along with the closure of the commercial fishery for walleye that year, laid the foundation for a walleye recovery. Large-scale walleye fingerling stocking began in the early 1980s and a sport fishery emerged by 1988. Runs of spawning walleyes also began in some tributaries. Recovery of the population, however, appeared to plateau by the early 1990s, far short of the historical or biological capacity of the bay. Questions arose as to what sources of recruitment were contributing to the modern population and what was limiting the recovery of the fishery. This study sought to survey the historic reef habitat to determine its condition and utilization by spawning walleyes, and to measure the contribution of hatchery walleyes in local recruitment. I surveyed 20 historic reefs using underwater video and sonar. Two reefs were sampled for the presence of spawners, egg deposition, and larval production for years 1997-2000. I also marked hatchery walleye with oxytetracycline and examined recruits for the mark to determine percent contribution of hatchery fish. Alternate year stocking was also employed. Reef surveys indicated that nearly all inner bay reefs thought historically important to spawning walleye were of low quality, suggesting a degraded condition. Some quality reef habitat remains in the outer portion of the bay. Sampling of reefs indicated only sparse usage, few spawners collected, and little egg deposition or larvae production measured. Oxytetracycline marked hatchery fish comprised an average of 80% of four year classes of locally reproduced recruits. Similarly, recruitment from stocked years was 86% greater than recruitment from nonstocked years. From this, it is apparent that the source of local recruitment (excluding immigration) contributing to the modern population is a combination of wild fish from tributary spawning and hatchery fish, with the latter contributing the majority. To make further progress towards recovery, a series of management recommendations are offered based on an adaptive management approach. Access to tributary spawning grounds by dam removal or fish passage needs to be increased to increase that source of recruitment. Increased stocking will not directly result in increased reproduction but could facilitate a balancing of predator/prey ratios, and likely increase the Saginaw Bay walleye population and fishery. Stocking plans should consider utilization of reef spawning strains, although the poor habitat and continued presence of alewives on the reefs make the reestablishment of reef-spawning tenuous.