

Potential Strategies for Recovery of Lake Whitefish and Lake Herring Stocks in Eastern Lake Erie

Kurt Oldenburg^{1,*}, Martin A. Stapanian², Phil A. Ryan³, and Erling Holm⁴

¹Ontario Ministry of Natural Resources
Lake Erie Management Unit
Box 429, 1 Passmore St.
Port Dover, Ontario N0A 1N0

²U.S. Geological Survey, Great Lakes Science Center
Lake Erie Biological Station
6100 Columbus Ave.
Sandusky, Ohio 44870

³Villa Nova Estate Ltd., RR4
Simcoe, Ontario N3Y 4K3

⁴Royal Ontario Museum
100 Queen's Park
Toronto, Ontario M5S 2C6

ABSTRACT. Lake Erie sustained large populations of ciscoes (Salmonidae: Coregoninae) 120 years ago. By the end of the 19th century, abundance of lake whitefish (*Coregonus clupeaformis*) had declined drastically. By 1925, the lake herring (a cisco) population (*Coregonus artedii*) had collapsed, although a limited lake herring fishery persisted in the eastern basin until the 1950s. In the latter part of the 20th century, the composition of the fish community changed as oligotrophication proceeded. Since 1984, a limited recovery of lake whitefish has occurred, however no recovery was evident for lake herring. Current ecological conditions in Lake Erie probably will not inhibit recovery of the coregonine species. Recovery of walleye (*Sander vitreus*) and efforts to rehabilitate the native lake trout (*Salvelinus namaycush*) in Lake Erie will probably assist recovery because these piscivores reduce populations of alewife (*Alosa pseudoharengus*) and rainbow smelt (*Osmerus mordax*), which inhibit reproductive success of coregonines. Although there are considerable spawning substrates available to coregonine species in eastern Lake Erie, eggs and fry would probably be displaced by storm surge from most shoals. Site selection for stocking or seeding of eggs should consider the reproductive life cycle of the stocked fish and suitable protection from storm events. Two potential sites in the eastern basin have been identified. Recommended management procedures, including commercial fisheries, are suggested to assist in recovery. Stocking in the eastern basin of Lake Erie is recommended for both species, as conditions are adequate and the native spawning population in the eastern basin is low. For lake herring, consideration should be given to match ecophenotypes as much as possible. Egg seeding is recommended. Egg seeding of lake whitefish should be considered initially, with fingerling or yearling stocking suggested if unsuccessful. Spawning stocks of whitefish in the western basin of Lake Erie could be utilized.

INDEX WORDS: Lake whitefish, lake herring, Lake Erie, recovery, rehabilitation.

INTRODUCTION

Coregonine populations in the Laurentian Great Lakes experienced a resurgence in the late 20th cen-

tury which has been linked to the declines of exotic fish species, restrictions on commercial harvest, and the control of sea lamprey (*Petromyzon marinus*) (Fleischer 1992, Ebener 1997). Abundance of native species, however, is generally far less than

*Corresponding author. E-mail: kurt.oldenburg@ontario.ca

historical levels. In Lake Erie, the composition of the fish community changed as oligotrophication proceeded (Ludsin *et al.* 1999) including a limited recovery of lake whitefish (*Coregonus clupeaformis*) since 1984 (Ryan *et al.* 1999). No recovery was evident, however, for the cisco lake herring (*Coregonus artedii*) (Ryan *et al.* 1999). We use the term “cisco” in this paper to define coregonine species other than lake whitefish.

Lake Erie sustained large populations of coregonines (ciscoes and lake whitefish) 120 years ago. Lake whitefish were the most popular commercial species in the latter half of the 19th century but by the end of the century, lake whitefish abundance had declined to the point where one fish dealer stated, “I think the whitefish are all out of Lake Erie—it is the lake herring that we are all after now” (Dominion Fishery Commission 1894). Strong lake herring fisheries persisted until 1925, when the lake herring population collapsed (Hartman 1972). However, a limited lake herring fishery persisted in Long Point Bay in the eastern basin until the 1950s.

Throughout the Laurentian Great Lakes, the coregonine populations continued to decline in the early- to mid-20th century, a result of over-fishing, loss and degradation of habitat, and competition and predation by the introduction of non-indigenous species (Ebener 1997, Baldwin *et al.* 1979). In addition to reducing species diversity of fishes, these pressures also altered species distribution so that the prevailing species were dominated by benthic and deep water species, rather than the pelagic nearshore species that dominated before the collapse (Fleischer 1992).

This paper investigates the potential for recovery and rehabilitation of lake herring and lake whitefish stocks in the eastern basin of Lake Erie. The practical interest in stocks is that there are ecological resources in eastern Lake Erie that can support coregonines, but these are not being utilized to any extent by the western basin spawning stock of whitefish, or by lake herring. Historical evidence of spawning in the eastern basin suggests that these fish may have been separate stocks. We review the reproductive ecology of the species, characteristics of historical spawning sites, and phenotypic descriptions of the stocks. Current ecological conditions and management procedures, including commercial fisheries, the recent establishment of exotic species, and the condition of predator populations, are examined to determine if they are favorable for recovery. Finally, we provide a synthesis

of this information in providing rehabilitation strategies and future directions for the rehabilitative effort for these species. The decision to rehabilitate coregonines in Lake Erie rests with the policies set out by lake managers. This paper deals with strategies to be considered in a restorative plan and does not reflect the policies of the Lake Erie Committee, its task groups or member agencies.

REPRODUCTIVE ECOLOGY AND HISTORICAL SPAWNING SITES

A stock is a group of fish (*e.g.*, whitefish) which spawn at a particular location and completes its life history within a spatial range that is linked to that spawning habitat. Stocks may only be recognizable when fish aggregate to spawn or they may exhibit different morphometric, meristic, or genetic characteristics. The historical records of spawning sites and recurring and recognizable body types within the population may be indicators of the historical presence of stocks in the eastern basin.

After the fall turnover in Lake Erie, large numbers of lake whitefish historically migrated to the western basin to spawn on the reefs and shoals and in the Detroit River. They returned to the cooler, deeper waters of the eastern basin in the summer months. The annual migration generally followed a clockwise direction (Goodyear *et al.* 1982, Hardy 1994). The Ontario Partnership Gill Net Survey suggests this migration is still occurring to some extent (Ontario Ministry of Natural Resources [OMNR] unpublished data). Lake herring also followed a similar migratory pattern (Goodyear *et al.* 1982). Historical evidence exists that coregonines also spawned in the eastern basin of Lake Erie (Figs. 1 and 2). Kerr (1864-1888) had noted that whitefish frequented reefs offshore of Port Maitland, Ontario and assumed they were spawning. Goodyear *et al.* (1982) indicated spawning of whitefish occurred in Long Point Bay, and on offshore shoals in Port Dover, Nanticoke, and Port Maitland. Spawning of lake herring occurred in the Long Point Bay area and along the south shore of Long Point. These studies did not indicate whether these eastern basin spawning populations migrated or interbred with the western basin populations, but we suggest they would have spent the summer months in the eastern basin due to favorable conditions and remained in the eastern basin to spawn. This would indicate a separate stock in the east basin that minimally exhibited different behavioral characteristics.

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