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LAKE HURON LAKE WHITEFISH DISTRIBUTION STUDY

BACKGROUND AND RATIONALE:

Lake whitefish are the primary species sought by commercial fisheries on Lake Huron. The commercial yield of lake whitefish accounted for 81% of the total lake-wide commercial yield of all fish species in 1999 and the proportion of lake whitefish in the lake-wide commercial yield continues to increase each year (Mohr and Ebener 2003). The lake-wide yield of lake whitefish peaked at 4.5 million kg in 1998 and has averaged 3.5 million kg over the last decade (Fig. 1). On average almost half of the lake whitefish harvest has been taken from the Canadian waters of the main basin of Lake Huron, while another 12% is harvested from Georgian Bay and the North Channel, with the remainder taken from the U. S. main basin.

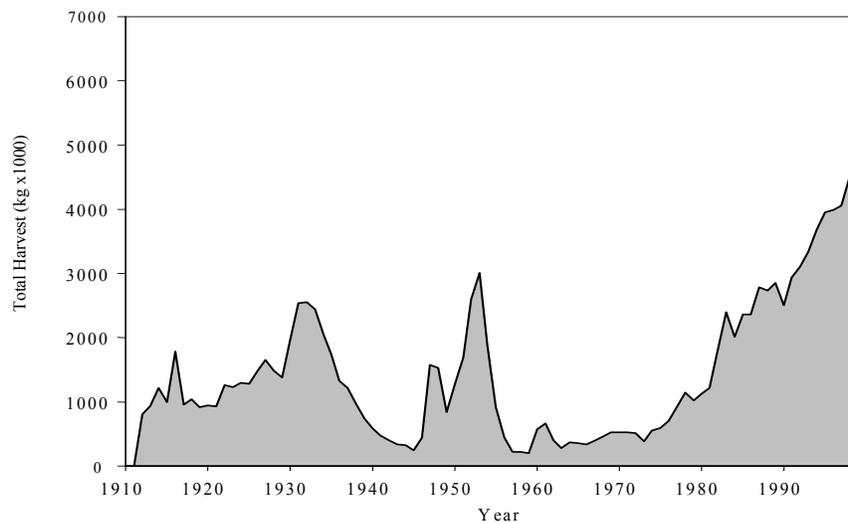


Fig. 1. Annual commercial yield of lake whitefish from Lake Huron, 1910-1999.

Management of lake whitefish in Lake Huron is based on the concept of “stocks”. The stock concept is that there are many spatially and genetically distinct localized populations that contribute in varying degrees to the total abundance of lake whitefish in the lake and the subsequent commercial yield (i.e. MacLean and Evans 1981; Spangler et al. 1981). There are eight stocks of lake whitefish currently recognized in Michigan waters (Bence and Ebener 2002) and 25 stocks in Ontario waters (Mohr et al. 1997). In Michigan waters these stocks are not based on any tagging or genetic studies, while in Ontario some of the stocks are based on previous tagging and genetic studies. For example, Casselman et al. (1981) presented evidence for the existence of at least 11 stocks of lake whitefish in the Ontario waters of Lake Huron based on tagging studies, genetics analysis, morphometrics, and meristics. No wide-scale study has been conducted in the Michigan waters of Lake Huron, although a localized study was conducted in the Saginaw Bay area (Hill 1982). At the time Casselman et al. (1981) published their findings the yield of lake whitefish from Lake Huron represented one-third of the current yields (Fig. 1). The

large increase in yield of lake whitefish from Lake Huron after 1981 occurred primarily in the southern main basin (Mohr and Ebener 2003) where few if any spawning stocks of lake whitefish had been identified (Casselman et al. 1981).

Management agencies in both Michigan and Ontario currently use population models to estimate abundance and mortality of lake whitefish stocks in Lake Huron and to set harvest limits from each stock. These population models assume that there is no immigration or emigration between stocks, or at least that immigration and emigration are in equilibrium with each other. In order for these models to function properly, these assumptions have to be met. Unfortunately, we have little faith in the current boundaries of lake whitefish stocks in Lake Huron because most stock boundaries were created with little if any reference to lake whitefish life history information.

PROJECT OBJECTIVES:

Our goal is to determine whether or not stocks of lake whitefish in the main basin of Lake Huron are spatially distinct. Our specific objectives in order of completion are:

1. To determine the spatial distribution and movements of hypothesized lake whitefish stocks in the main basin of Lake Huron.
2. To determine the contribution of hypothesized stocks to commercial fishery yields.
3. To develop a distribution model that describes the relative magnitude of movement among management areas, including seasonal movement, for population level modeling.
4. To determine what level of site fidelity, if any, exists for various lake whitefish stocks.
5. To determine if there are local stocks of lake whitefish that are at risk of overexploitation and that need special protection.

We hypothesize stocks of lake whitefish that spawn in the main basin near Alpena, Michigan and the Fishing Islands, Ontario are the primary source of recruitment to the fishery in the central and southern main basin. Our hypothesis is based on our knowledge that few if any significantly large spawning shoals exist in Lake Huron south of Alpena and Fishing Islands. We also hypothesize that the spatial distribution of these two stocks is substantially greater than the spatial distribution of the northern stocks (Casselman et al. 1981). Our second hypothesis is based on our understanding that there is much more spawning and nursery habitat in northern areas than in the southern main basin, therefore there is more opportunity for stocks to become distinct in these areas.