Preliminary Study of Lake Trout Mortality Following Stocking in Lake Ontario

by

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INTRODUCTION

Lake trout were historically abundant in all of the Great Lakes. Their decline and disappearance from Lake Erie and Lake Ontario by 1950 and 1960 respectively, was likely due to a combination of factors including overharvest, lamprey predation, and habitat degradation (Christie 1973, Hartman 1973). Although restoration efforts were initiated in the 1950s and 60s, the present restoration program began in 1976 in Lake Ontario and 1982 in Lake Erie. By the early 1980s rehabilitation plans were established for both lakes. The plans included recommendations on stocking and outlined specific goals to be achieved. Lake trout populations on both lakes are monitored in order to evaluate program success. Results are reported annually and often identify potential problems in the program that require additional assessment and/or changes. One such example is the recent decline in catches of juvenile lake trout.

In both Lakes Erie and Ontario, catches of juvenile lake trout during trawl and gill net surveys have dropped dramatically through the 1990's (Murray et al. 1999, Lantry et al. 1999, and Hoyle and Schaner 2000). Analysis of assessment data indicates that the mortality is occurring during their first year in the lake. These observations have raised questions about the post-stocking survival of the hatchery reared fish.

It is believed that mortality is relatively high immediately following stocking. Factors that may contribute to post stocking lake trout mortality include stress due to transport and stocking, changes in water quality and chemistry, predation, and availability of food for the stocked fish (Santucci and Wahl 1993). In general, mortality associated with stocking occurs within a couple of days (Belusz and Kendall 1978, Santucci and Wahl 1993, Turner 1988). For the lake trout restoration program, in Lakes Erie and Ontario, stocking occurs when lake temperatures are similar to the hatchery water temperature to minimize stress. Other abiotic factors, such as dissolved oxygen and pH are not monitored prior to stocking, but they could contribute to mortality.

The purpose of this study is to estimate yearling lake trout mortality associated with the stress of transport, stocking and changes in water quality. To eliminate other possible mortality factors, the fish will be held in net pens for a short period of time immediately following stocking. This should protect the fish from predators. Measurement of water chemistry parameters may identify potential causes of mortality.

METHODS AND MATERIALS

Superior strain yearling lake trout (approx. 12/lb or 32/kg) raised at the Allegheny National Fish Hatchery were transported by hatchery truck and released into a net pen in a manner consistent with nearshore stocking procedures. The pen was approximately 1.52 m wide, 6.1 m long and 1.83 m deep (17 m^3) and constructed of 1/4" (63.5 mm) mesh netting surrounded by an aluminum frame with floats along the top edge and a cover made of 3/8" (95.3 mm) mesh netting. The net pen was tied to a concrete wall at the mouth of the Niagara River. The pen was stocked with 1000 yearlings, and monitored for dead fish after 1, 24 and 48 hours. Fish behavior in the pens was noted. After 48 hours the remaining live fish were released into the surrounding water and the dead fish counted. Temperature, dissolved oxygen, pH and conductivity were measured at the hatchery, in the truck at the end of transport, and adjacent to the pen prior to stocking as well as after 1, 24, and 48 hours.

RESULTS AND DISCUSSION

Fish density in the hatchery raceways just before transporting was approximately 1500 fish/m^3. Transport in the truck tank, from the hatchery to the stocking site in the Niagara River, was 3.5 hours at a density of approximately 533 fish/m^3. Fish were netted from the truck into the net pen. The fish went straight to the bottom of the net pen when stocked and did not appear to be affected by the rise in temperature, dissolved oxygen and pH from the truck to the pen (Table 1). The lake trout generally remained at the bottom of the net for the 48 hour period. The density in the net pen was approximately 60 fish/m^3. No mortality occurred in the hatchery truck.

Table 1. Temperature, Dissolved oxygen, pH and conductivity at hatchery, in truck and in the Niagara River pen site.

	Date/Time	Temperature (Celsius)	Dissolved Oxygen (mg/l)	pH	Conductivity mS/cm
Hatchery	5/23 0600	9.67	–	–	–
Truck	5/23 0930	9.28	6.93	7.6	.2821
At stocking	5/23 0930	11.85	10.99	8.5	.2895
1 hour	5/23 1100	11.80	10.50	–	.2888
24 hours	5/24 1245	12.21	10.56	–	.2892
48 hours	5/25 0930	12.68	10.37	9.0	.2838

The net pen was tied to a sea wall in the main flow of the river, subjecting the fish to a steady, strong current, winds and waves. These conditions along with the size of the pen made it impossible to collect any dead fish during the study. Therefore, dead fish were counted at the end when the fish were released. The total number of dead fish after 48 hours was 5 (0.5%).

The temperature increased by 2.5^{o}C from the hatchery truck to the Niagara River. Temperatures that these fish were exposed to fell within a range of 8-15^{o}C that lake trout are normally found (Marcus et al. 1984), and close to the preferred temperature of 10.2^{o}C for this strain (O'Connor 1985).

It has been reported that dissolved oxygen (DO) concentrations should be at least 5.5 mg/L to protect lake trout at all life stages (Ryan and Marshall 1994). DO was lowest in the hatchery truck at the end of the trip (6.9 mg/L), but was sufficient for lake trout yearlings.

Lake trout are generally not found in lakes with a pH level lower than 5.5 due to recruitment failure (Beggs and Gunn 1986, Conlon et al. 1992). The pH was close to neutral in the hatchery truck, but went from 8.5 to 9.0 while the fish were in the pen. These values are well above that lower preferred limit. However, avoidance and mortality were observed in other species in water with pH greater than 9.5 (Serafy and Harrel 1993, Wagner et al. 1997). It is not clear from this study whether a pH of 9.0 may have been stressful to the lake trout.

Mortality in the first 48 hours post-stocking was very low indicating that stress associated with transport and stocking did not contribute substantially to survival and recruitment. However, conditions in the pen may have contributed to mortality. Although none of the water quality parameters were out of the ranges preferred by lake trout, they were exposed to high flows, wave action, and rapid changes in water temperature, dissolved oxygen and pH. This preliminary study was done to assess the feasibility of determining post-stocking survival of lake trout. In the future, we would like to conduct a similar study at the regular nearshore and offshore stocking sites of the lake trout restoration program.

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