EVALUATION OF POST-STOCKING SURVIVORSHIP OF TWO SIZES LAKE TROUT STOCKED IN US WATERS OF LAKE ERIE, 2000 – 2004

Preliminary Report

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Introduction

Increasingly poor juvenile lake trout survival was observed in annual Lake Erie coldwater gill net assessment in the 1990s. Subsequent catches of age 5 and older lake trout has declined since 1997 due to the lack of recruitment of stocked fish moving into the spawning stock (Markham et al. 2004). This decrease in survival may be due to recent ecological changes in the lake such as increased water clarity, increases in abundance of oligotrophic piscivores including adult lake trout and burbot, and decreased zooplankton production. Information from previous stockings indicates that larger yearlings survived better to age 5, but this data was confounded by different stocking methods, multiple strains, and minimal size differences. For this study, we evaluated the survivorship of larger-sized lake trout yearlings compared to normal-size lake trout yearlings to determine if rearing and stocking protocols could be modified to reduce post-stocking mortality. Survival of the two groups was determined from returns of lake trout in the existing annual gill net assessment program.

Methods

All lake trout stocked in Lake Erie are raised at the Allegheny National Fish Hatchery (ANFH) in Warren, PA. Lake trout yearlings are normally distributed 40,000 fish per raceway at the hatchery a few months before stocking. For this study, the large-lot lake trout were split into two raceways of 20,000 fish each and raised to be approximately 7-8 fish/pound at stocking. The comparison normal-lot fish were raised at the usual density of 40,000 fish per raceway to a size of approximately 13 fish/pound at stocking. The two sizes were raised from 1999 through 2003 and stocked in 2000 through 2004 (Table 1). Coded wire tags (CWT) (Northwest Marine Technology, Inc.) were used to uniquely mark each group of fish for future identification. Yearling sizes at stocking were not consistent from year to year due to annual variability in water temperatures and stocking date. This was especially evident in the 2003 year class which hatched later than normal and experienced an outbreak of furunculosis which slowed their growth, resulting in a much smaller size at stocking in 2004. Stocking strains were kept consistent between the lots within years, but changed due to availability. Superior strains were stocked from 2000 – 2002 and Finger Lakes strain in 2003 and 2004. For each year all fish were boat stocked in the same manner off of the RV ARGO with the exception of

2001 when they were shore stocked from the hatchery truck. The exact location stocked was the same in each year, but changed between years (Table 1).

Survival of the different groups was determined from lake trout catches in the existing annual coldwater gill net assessment program in New York waters only. A standardized, random design gill net sampling protocol has been employed to assess the lake trout population in New York waters of Lake Erie since 1986. Sampling is conducted in August of each year when the lake is stratified. Approximately 60 gill nets are set in areas A1 and A2 from Dunkirk west to the New York/Pennsylvania border (Figure 1). All lake trout are processed for total length, weight, sex, maturity, stomach contents, fin clips and sea lamprey attacks. Scale samples and otoliths were collected and snouts retained for CWT retrieval and reading in the laboratory. Length and weight data of only those fish with coded wire tags identified for this study were reported. The recovery of CWTs enabled us to compare survival of juveniles based on stocking size and year. The lake trout for this preliminary report were followed for at least three years to examine changes in the number collected as they aged. These size-at-stocking groups will continue to be followed through the rest of their life to determine overall results.

Table 1. Lake trout year class, strain, stocking date, age, size, number stocked and location stocked for each year, 2000-2004.

Year Class	Strain	Date Stocked	Age in Months	# Fish/lb.	No. Stocked	Clip/ CWT	Location
1999	Superior	5/9/2000, 5/11/2000	16	13	40,000	AD/ 231611	N. of Dunkirk (90')
	Superior	5/10/2000, 5/11/2000	16	7	40,000	AD/ 231610	N. of Dunkirk (90')
2000	Superior	5/30/2001, 5/31/2001	16	11.5	40,000	AD/ 600103	Barcelona Harbor
	Superior	5/31/2001, 61/2001, 6/4/2001	16	7	40,000	AD/ 600105	Barcelona Harbor
2001	Superior	5/7/2002	16	14	40,000	AD/ 600114	N. of Dunkirk (70')
	Superior	5/8/2002	16	8.7	40,000	AD/ 600113	N. of Dunkirk (70')
2002	Finger Lakes	5/7/2003	16	15	40,000	AD/ 600127, 151646	N. of Dunkirk (70')
	Finger Lakes	5/8/2003	16	13.5	40,000	AD/ 600122	N. of Dunkirk (70')
	Finger Lakes	5/9/2003, 5/15/2003	16	10, 10.5	40,000	AD/ 600126	N. of Dunkirk (70')
2003	Finger Lakes	5/5/2004	16	23.5	40,000	AD/ 600129	N. of Barcelona (70')
	Finger Lakes	5/5/2004	16	18	40,000	AD/ 600130	N. of Barcelona (70')

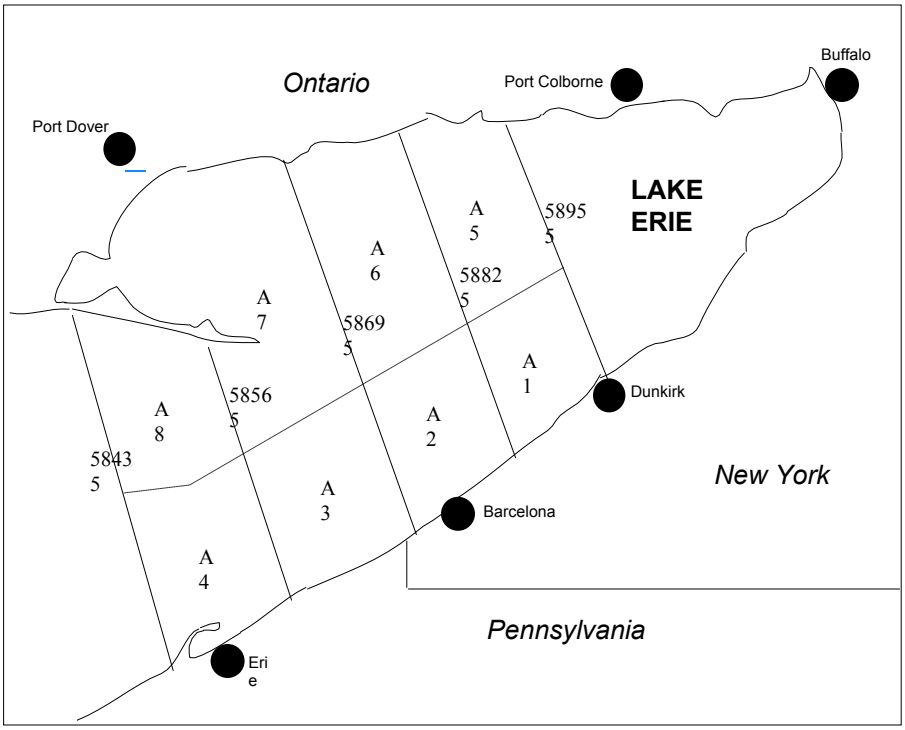
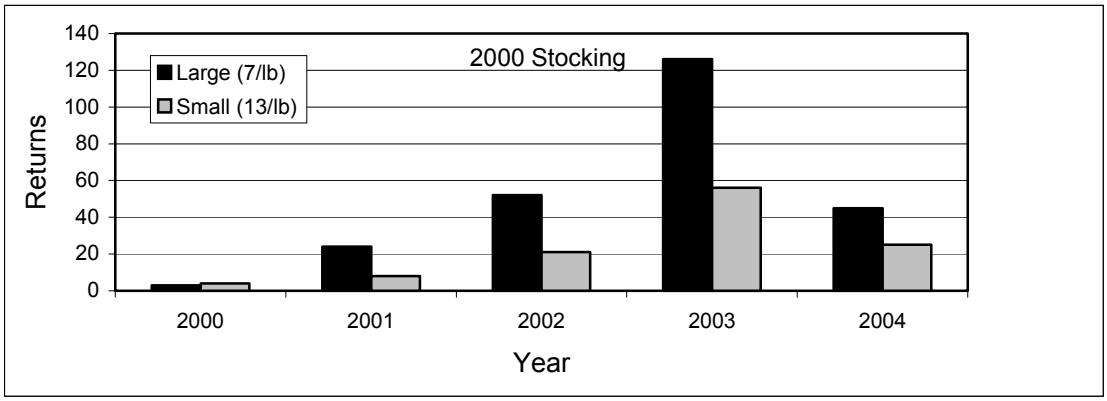
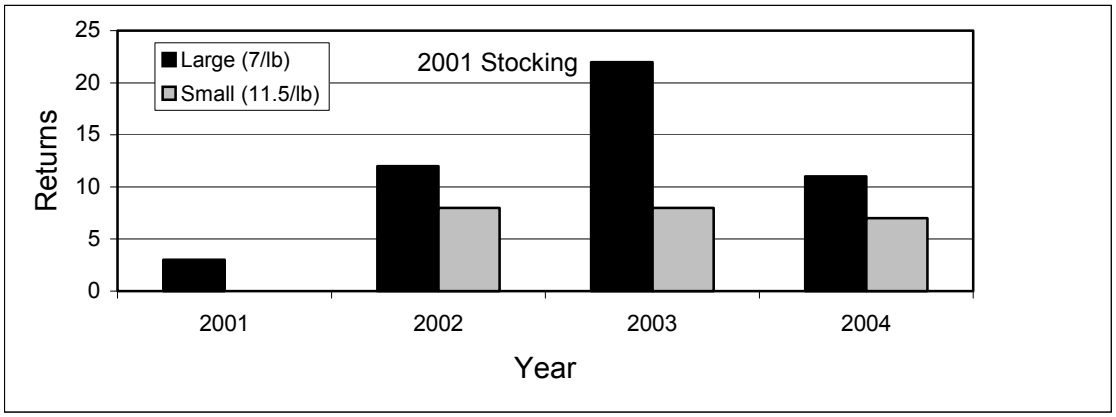


Figure 1. Standard sampling areas (A1 – A8) used for assessment of lake trout in the eastern basin of Lake Erie.

Results

The number of fish collected each year in the coldwater gill net assessment from the paired planting of large versus small yearling lake trout stocking size is shown in Figure 2. These results indicate an approximate 2:1 overall return in favor the larger stocked fish. With the exception of first year returns of the 2000 stocking, large lot fish have had higher return rates than small lot fish in each year for the 2000, 2001, and 2002 stockings (Figure 2). Cumulative returns favored the larger stocked fish from the 2000 stocking 2.19:1 (250 large, 114 small) (t-test; $P<0.001$), the 2001 stocking 2.09:1 (48 large, 23 small) (t-test; $P<0.05$), and the 2002 stocking 1.67:1 (87 large, 52 small) (t-test; $P<0.05$). No age 1 fish from the 2003 stocking were collected in 2003, and not enough age 2 from the 2003 stocking or age 1 from the 2004 stocking of lake trout were caught during coldwater assessment surveys in 2004 to assess return rates of these paired plantings. Return rates of these stockings will be evaluated over the next 5 years. Significant differences in mean size were not consistent between years (Figure 3). For the 2000 stocking, the large group was significantly longer and heavier than the small at age 2 and age 4 (t-test; $P < 0.05$). For the 2001 stocking, the large group was significantly longer at age 2, and the large group was significantly heavier at age 2 and age 4 (t-tests; $P < 0.05$). For the 2002 stocking, there was no significant difference in length or weight (t-tests; $P > 0.05$) between the large and small group at any age. In general, this indicates that the fish from the small group catch up in length and weight somewhere between age 2 and age 5.





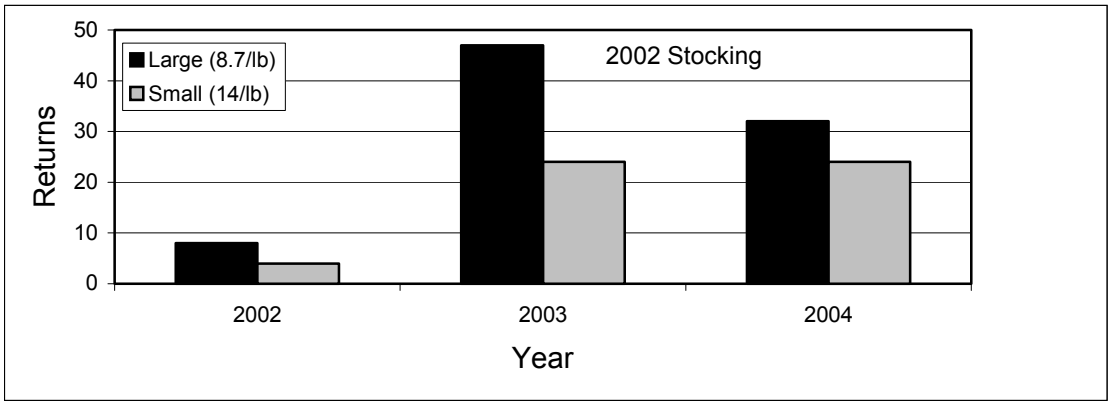
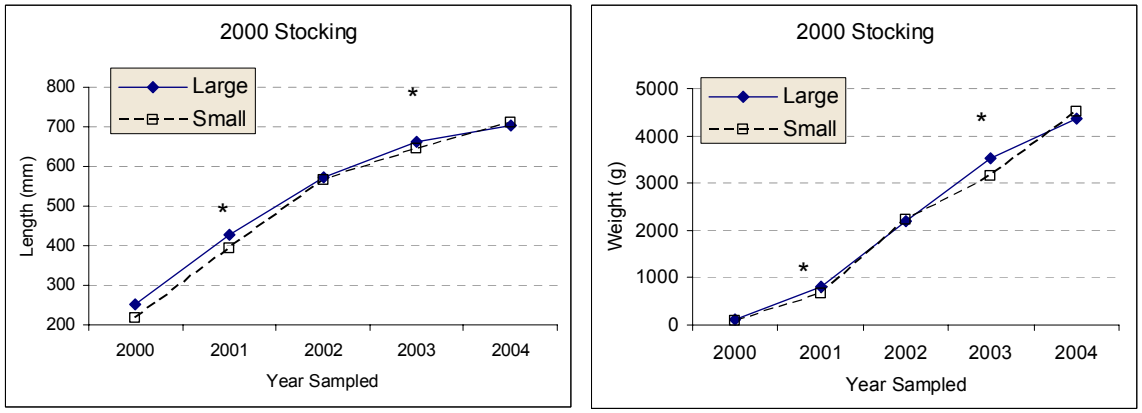


Figure 2. Number of tagged lake trout from the large vs. small stocking comparison study collected annually in the coldwater gill net assessment program from the 2000, 2001 and 2002 stockings.

(a)



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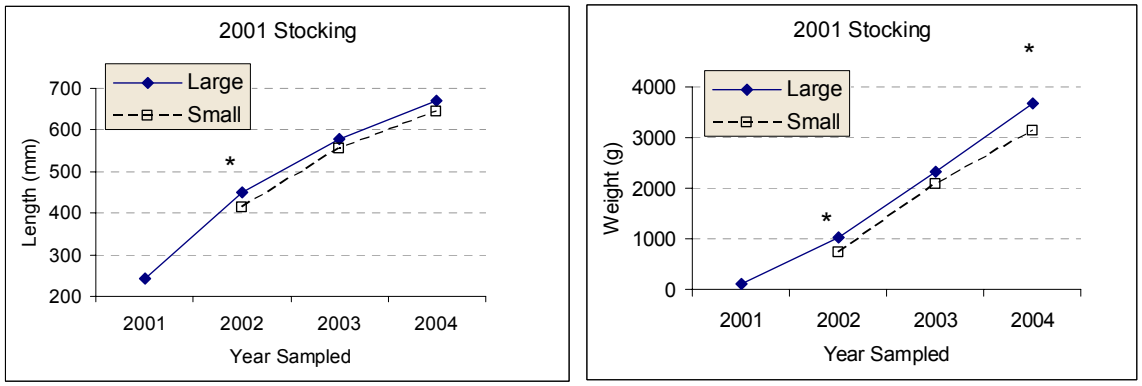

(c)

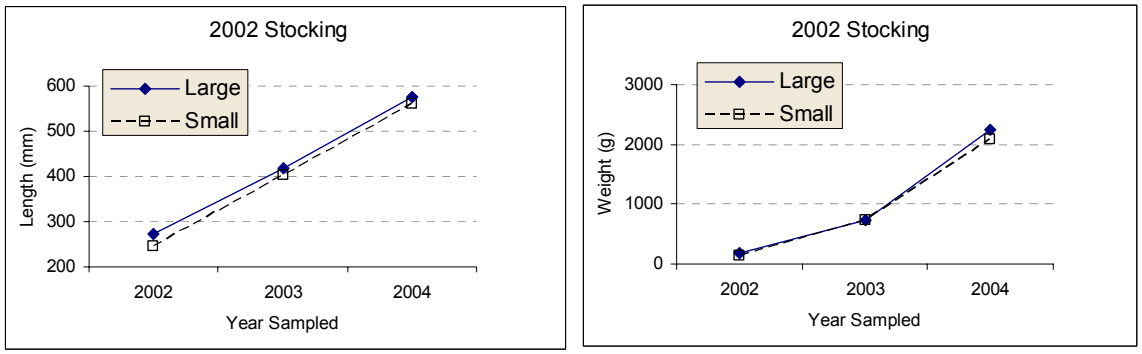

Figure 3. Annual mean length and weight of large and small lake trout collected in the coldwater gill net assessment program for fish stocked in (a) 2000, (b) 2001, and (c) 2002. Asterisks indicate a significant difference between large and small stocked fish for that sampling year.

Discussion

This study indicates that the larger Superior strain fish do survive better than the smaller fish. It appears that the small fish catch up in length and weight to the large fish by age 5. It is still early to tell if the results will be the same for the Seneca strain fish stocked in the last two years of the study. A study in Lake Michigan compared CPU of two sizes of lake trout and found no difference in CPU of the large and small groups (Bronte et al. unpublished). The large group in their study was 10-12 fish/pound and the small was 20 fish/pound. These are smaller than the fish in our study. They were also Lewis Lake strain lake trout versus the Superior and Seneca strains used in our study. At least 2 more years of data are needed for the 2004 stocked large and small fish to determine if there is a difference in their catch rates. The next steps will be to determine if the increased survival of larger fish offsets the greater cost in splitting the 40,000 fish into two raceways and if the hatchery has the space to split the 120,000 lake trout raised for Lake Erie from 3 to 6 raceways.

Another factor not examined in this study was differences in the condition or health of each group. Was size the only advantage the large group had once it was released or was it also "heathier" relative to the smaller fish? A tool used in some hatcheries to determine the health of the fish in their hatchery environment is the Goede Index (Goede and Barton 1990). It is based on standard sampling and observation of eye, gill, pseudobranch, thymus, mesenteric fat deposit, spleen, hind gut, kidney, liver, gall bladder, hematocrit, serum protein, leukocrit, length, weight, condition factor, fins, opercles and general condition of skin and gonads. This necropsy method can provide a health status profile of a fish population such as our large and small size fish groups in the hatchery.

This is a preliminary report on the findings of the study one season after the last paired stocking occurred in 2004. At least 2 more years of returns from the coldwater assessment program are needed to evaluate all the paired stockings for at least 3 years.

References

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