F-80-R-6, Michigan
Study 230743 **New Study: 2004-05**

Name of Study: Evaluation of Eagle Lake and Lake Michigan steelhead-strain rainbow trout stocked into inland lakes in Michigan.

A. Background: MDNR Fisheries Division annually stocks approximately 450,000 rainbow trout in inland lakes (Fish stocking records 2002). Most of these fish are stocked as yearlings. In spring 2003 Fisheries Division stocked nearly 400,000 yearling Eagle Lake strain rainbow trout into 82 inland lakes. Eagle Lake rainbow trout were the only strain stocked in 2003. Half of these yearling rainbow trout were stocked into only ten lakes.

Fisheries Division has stocked a variety of rainbow trout strains in the past. These strains included Arlee, Shasta, Girard Kamloops, Harrison Lake, Gerrard Kamloops (Duncan River strain), and Lake Michigan steelhead. Rearing of the Arlee strain ceased because a high percentage developed cataracts in the hatchery. Shasta were eliminated because they generally did not survive well after stocking. Girard Kamloops are no longer imported to Michigan because the pathogen *Nucleospora salmonis (Enterocytozoan salmonis)* was found in the broodstock at Ennis National Fish Hatchery. This parasiteis not presently found in the Great Lakes Basin. The Harrison Lake strain grew poorly in the hatchery and exhibited low survival after planting, presumably due to high predation rates. Lake Michigan steelhead were stocked into inland lakes on a few occasions when it was necessary to remove them from raceways to create more rearing space.

In the early 1990s, the relative growth and survival of the principal strains of rainbow trout in the hatchery system at that time –Eagle Lake (EL) , Shasta (SH), and Lake Michigan steelhead (STT)– were evaluated in two small inland lakes (Nuhfer 1996). Point estimates for survival and standing crop were consistently highest for STT in the small lakes. There was little evidence that any strain was more likely to emigrate from the experimental lake that had an outlet (Nuhfer 1996). Plans to evaluate relative return to creel of these rainbow trout strains in Higgins Lake were thwarted because funding for an angler census or reward tag study was not available.

Fisheries Division has advocated use of angler census to evaluate plantings of trout into large inland lakes for at least the last two decades. Until recently, a lack of funding for on-site angler census has precluded such evaluations. The recent expansion of the angler census program for inland waters has provided an opportunity to evaluate trout plantings in the larger inland lakes where a majority of trout are stocked.

Fin-clipped STT and EL rainbow trout are presently available for planting into selected inland lakes in 2004. It is hypothesized that STT may survive better, particularly in large lakes, and provide better returns to creel than EL because they are less domesticated and well adapted to large-lake environments. This study proposal describes the study design for evaluating these stockings.

B. Objective: To determine the relative survival, growth, and return to creel of STT- and EL-strain rainbow trout stocked into inland lakes.

C. Justification: The cost of annual stockings of 400,000 rainbow trout into inland lakes is approximately $292,000. The highest level of evaluation effort should target larger inland lake stockings because half of yearling rainbow trout are planted into 10 of 82 lakes stocked. Smaller plantings should also be evaluated because rainbow trout are the trout species most commonly stocked into small- and medium-sized inland lakes.

D. Expected Results and Benefits: We expect that the results of this study will show the relative survival, growth, and return to sport anglers of steelhead- and Eagle Lake-strain rainbow trout stocked into large- and medium-sized inland lakes. This study will also determine if rainbow trout plantings into certain inland lakes are cost effective. Judgments of relative strain suitability for stocking will be based on samples drawn from both on-site angler surveys and netting surveys. A primary benefit of the study will be better information to guide decisions on which strain(s) of rainbow trout to stock into Michigan lakes of various types. Knowledge of rainbow trout strain performance in lakes is needed to maximize economic and social values provided by stocking.

E. Background: Rainbow trout plantings into inland lakes in the past were usually evaluated by netting surveys and informal angler reports. In recent years, some plantings were also evaluated by hook-and-line survey methods. Finally, there have been some angler census evaluations of inland lake plantings but most historical catch data for large lakes were collected by conservation officers via a non-randomized general creel census conducted from 1928-64 (Laarman 1976). Randomized angler census has also been conducted on a modest number of small- and medium- sized lakes stocked with trout but most of these censuses focused on periods of peak angler activity (Eschmeyer 1936; Ryckman and Lockwood 1985; Waybrant and Thomas 1988; Johnson and Rakoczy 1997; Lockwood 2000, 2001). These data suggest that rainbow trout harvest relative to numbers stocked may be quite low, although this cannot be determined with certainty because the entire season was not censused.

There is a need for more rigorous evaluations of rainbow trout plantings to determine if they are cost effective. There is also a need to determine if STT survive better or provide greater returns to anglers than the EL that are presently the only rainbow trout strain stocked into Michigan's inland lakes.

F. Procedure: Annual paired plantings of fin-clipped yearling STT (RP clip) and EL (LP clip) rainbow trout will be made into seven inland lakes each spring from 2004 through 2009 (Table 1). Relative catch and mean total length of each strain will be determined from on-site creel census data (Table 1). The first year of evaluation in each lake will begin the first year that creel census data are collected. Netting or other sampling such as hook-and-line surveys will very likely be needed to collect sample sizes large enough to determine statistically significant differences in survival. For example, census clerks only observed 67 rainbow trout during the census of Higgins Lake conducted from winter 2001 through winter 2002. This sample size will not be adequate for statistically valid comparisons of strains unless there are relatively large differences in survival or catchability between strains. Total sample sizes ranging from 100 to 250 rainbow trout will likely be needed.

Levels of sampling effort by methods other than angler census will be adjusted adaptively to achieve required sample sizes based on the ratio data collected by angler census. The period for netting evaluations spans a five-year period for most lakes listed in Table 1. Thus, discretionary time available for netting or other sampling methods may be used at any time during the evaluation period to collect adequate sample sizes. Initial netting or other non-census collections will be scheduled early in the evaluation period (to the extent possible). This will allow managers to schedule additional effort if catch rates in nets prove to be low.

Job 1. Fin clip approximately 60,000 STT and 60,000 EL rainbow trout each year for stockings made from 2004-2009. This job will be performed by hatchery personnel.

Job 2. Perform fish quality assessments on each strain of rainbow trout as close as possible prior to stocking.

- Measure total length and weight of 60-fish autopsied for a quality assessment for each strain and each large lake planting (Elk, Big Glen, and Walloon lakes). .
- Measure total length of an additional 40 fish from each lot so that total sample size (for length) is 100 for each strain and large-lake planting site.
- Rate fin clip quality on each lot of 100 fish described above using the rating system below.

  (1) = Good – fin will not regenerate
  (2) = Fair – fin will partially regenerate but be easily recognized by most creel clerks.
  (3) = Poor – fin will regenerate and not be recognized by most clerks.
  (4) = fin not clipped
  (5) = wrong fin clipped

Job 2 will be performed by hatchery personnel at Thompson State Fish Hatchery.

Job 3. Stock equal numbers of each strain into the study lakes identified for paired plantings in Table 1. Transport both strains on the same truck at the same time to the extent possible to minimize potential differences in stress related to transport or receiving water conditions. Attempt to plant the fish after STT have started to smolt, but avoid high water temperatures at receiving waters to the extent possible.

Job 4. Conduct creel census. Collect scale samples and biological data from all rainbow trout observed by census clerks. These samples will be used to evaluate growth of naturally reproduced rainbow trout, trout from plantings made before fin clipped fish were stocked and relative growth of paired plantings of marked rainbow trout.

Job 5. Collect additional rainbow trout by netting or other methods to obtain larger sample sizes. The level of effort needed to achieve this objective will be determined adaptively by first considering the numbers and relative ratios of marked rainbow trout examined by census clerks. Collections by netting and other methods may occur any time within the evaluation period shown in Table 1. Management units will determine the level of discretionary sampling time that is available for this effort and will conduct the sampling. Data to be recorded will include:

- Fin clip information
- Scale samples
- Total length
- Total weight of each rainbow trout collected by lethal methods such as gill netting

Job 6. Assemble and analyze data. Fin clip data collected by census clerks will be summarized in time to guide scheduling of netting surveys in subsequent years. This job will be accomplished by a combination of research, hatchery, and management unit personnel.

Job 7. Write annual performance report

Job 8. Write research manuscript(s)

Job 9. Publish report through the Fisheries Division's editing and finishing process for Research and Technical reports.

Job 10. Write final report

H. Geographical Location: Thompson State Fish Hatchery, Central Lake Michigan Management Unit, Northern Lake Michigan Management Unit, Lake Erie Management Unit, Hunt Creek Fisheries Research Station, Lewiston, Michigan.

I. Personnel: Andrew J. Nuhfer and Todd Wills Research Biologists, Hunt Creek Fisheries Research Station; and Tom Adams, Fisheries technician at Hunt Creek; Jan VanAmberg and Tom Tighe, Thompson State Fish Hatchery, Management Unit biologists and technicians. Research Administrative personnel, and contract editor.

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Table 1.–Proposed stocking and sampling methods for evaluating the relative performance of STT and EL rainbow trout stocked into Michigan inland lakes.

Lake name (acres)	County	Number Requested STT (level 2)	Number Requested Eagle Lk (level 2)	Evaluation period	Regulation type	Evaluation type On-site creel (OSC)
Elk Lake (7,730 acres)	Antrim, Kalkaska, and Gr. Traverse	21,500	21,500	2005-09	E-15" minimum, open all year	(OSC) (netting as needed to achieve adequate sample size 2007-09)
Big Glen Lake (4,865 acres)	Leelanau	10,000	10,000	2008-09	E-15" minimum, open all year	(OSC) (netting as needed to achieve adequate sample size 2008-09)
Walloon (5,487 acres)	Charlevoix	14,000	14,000	2007-09	B-12" minimum, open all year	(OSC), (netting as needed to achieve adequate sample size 2005-09)
Shupac Lake (107 acres)	Crawford	2,700	2,700	2006-09	A-12" minimum, open for trout season	(OSC) (netting as needed to achieve adequate sample size 2006-09)
Heart (65 acres)	Otsego	2,000	2,000	2006-09	B-12" minimum, open all year	(OSC) (netting as needed to achieve adequate sample size 2006-09)
Big Chub (75 acres)	Otsego	2,500	2,500	2006-09	B-12" minimum, open all year	(OSC) (netting as needed to achieve adequate sample size 2006-09)
Maceday Lake (419 acres)	Oakland	6,000	6,000	2005-09	C-8" minimum, Open all year	(OSC, trout season 2005) (Netting or hook and line surveys as needed to achieve adequate sample size 2005-09).
	Sums>>>	58,700	58,700			