

## STUDY PERFORMANCE REPORT

State: Michigan

Project No.: F-80-R-5

Study No.: 230482

Title: Investigations into causes of, and solutions for, variable survival of Chinook salmon stocked into Lake Huron

Period Covered: October 1, 2003 to September 30, 2004

**Summary:** From 1993-2000, study fish were marked, reared, and stocked at Oscoda, Swan River, Harbor Beach, Tawas, and Port Austin as planned. Two roving “head hunters” were employed in all study years on Lake Huron to collect snouts with coded-wire tags from angler-caught Chinook salmon. Coded-wire tags from Chinook salmon were processed and the data entered. Tag recovery rates from the sportfishery suggested survival of groups of Chinook salmon from acclimation raceways at Oscoda was more than twice that of conventionally-planted fish. Weir collections and fall electrofishing were used to assess growth and condition and proportions of study groups returning to stocking sites as mature fish. In the AuSable River, test (acclimated) fish were observed more than 5 times as frequently as the control (conventionally stocked) groups in the spawning runs, suggesting acclimation raceways there enhanced both survival and homing. Similarly, raceway-acclimated Chinook salmon at Harrisville Harbor appear to be performing much better than conventionally stocked Chinook from other ports. Return rates from a netpen at Harbor Beach were not consistently different from conventional stockings, possibly because of exposure of the pen to unusually warm temperatures in a power plant thermal discharge. The 1997 and 1998 year classes appeared to be weak across all experimental stocking sites. All jobs but Job 4 are completed. For Job 4, the last of the year-2000-stocked cohorts were measured in the fishery and at the weirs as age-4 fish in 2004; we are currently extracting tags from 2004 and analyzing data in preparation for the final report.

**Findings:** Only Job 4 was scheduled for 2003-04 (as updated in the 2004-05 amendment), and progress is reported below.

**Job 4. Title: Read coded-wire tags and tetracycline marks, enter and analyze data, and prepare annual reports and publications.**—Tag extraction and data entry for all coded-wire tag returns received through 2003 were completed at the Charlevoix Fishery Research Station. Tags from age-4 chinooks stocked in 2000 continued to come in during 2004 and these tags will be read and data entered during 2005. Some coded-wire tags caught in prior years were returned by anglers this year and the tags must be read and the database updated accordingly.

Data summaries were done (Table 2) in preparation for the final report. We are reporting in Table 2 return rates for Port Sanilac, Lexington, AuGres, and Harrisville, which were not part of this study, because the results of these test plants might not otherwise be evaluated. To date, it appears that return rates for Swan River, our “benchmark” for comparison with other sites, have been declining over the study period (Figure 1). In fact, return rates were lower at nearly all sites after 1996; rates for all Lake Huron sites averaged 220 per 100,000 stocked from 1990-1996, but only 76 from 1997-2002. An exception during the later period was that return rates to date from the acclimation raceways at Harrisville averaged 221 for the 2000 and 2001 cohorts. The acclimation raceways at Harrisville and Oscoda produced instances of exceptionally high return rates while net pens at Harbor Beach appear not to have produced enhanced return rates.

The 2003-2004 annual performance report was prepared. Data from this study and from Study 703 (Chinook reproduction in Lake Huron) are being used by the Lake Huron Technical Committee in the maintenance of the Lake Huron bioenergetics model and by Lake Huron agencies in evaluating stocking methods and rates.

**Prepared by:** James E. Johnson and John Clevenger  
**Date:** September 30, 2004

Table 1.—Stocking schedule for Study 482. “Pen” refers to acclimation raceways at the stocking site; “direct plant” refers to conventional stocking directly from the hatchery.

Species	Strain/Source	Age	Test	Year	Number	Mark	Location
Chinook	Platte Hatchery	fingerling	Benchmark	1995	100,000	AD/CWT	Swan River
Chinook	Platte Hatchery	fingerling	Pen/River	1995	100,000	AD/CWT	AuSable
Chinook	Platte Hatchery	fingerling	Pen/Beach	1995	100,000	AD/CWT	AuSable
Chinook	Platte Hatchery	fingerling	Pen	1995	100,000	AD/CWT	Harbor Beach
Chinook	Platte Hatchery	fingerling	Direct plant	1995	100,000	AD/CWT	Harbor Beach
Chinook	Platte Hatchery	fingerling	Benchmark	1996	100,000	AD/CWT	Swan River
Chinook	Platte Hatchery	fingerling	Pen/River	1996	100,000	AD/CWT	AuSable
Chinook	Platte Hatchery	fingerling	Pen/Beach	1996	100,000	AD/CWT	AuSable
Chinook	Platte Hatchery	fingerling	Pen	1996	100,000	AD/CWT	Harbor Beach
Chinook	Platte Hatchery	fingerling	Direct plant	1996	100,000	AD/CWT	Harbor Beach
Chinook	Platte Hatchery	fingerling	Benchmark	1997	100,000	AD/CWT	Swan River
Chinook	Platte Hatchery	fingerling	Pen/River	1997	100,000	AD/CWT	AuSable
Chinook	Platte Hatchery	fingerling	Pen/Beach	1997	100,000	AD/CWT	AuSable
Chinook	Platte Hatchery	fingerling	Pen	1997	100,000	AD/CWT	Harbor Beach
Chinook	Platte Hatchery	fingerling	Direct plant	1997	100,000	AD/CWT	Harbor Beach
Chinook	Platte Hatchery	fingerling	Benchmark	1998	100,000	AD/CWT	Swan River
Chinook	Platte Hatchery	fingerling	Pen	1998	100,000	AD/CWT	Harbor Beach
Chinook	Platte Hatchery	fingerling	Direct plant	1998	100,000	AD/CWT	Harbor Beach
Chinook	Platte Hatchery	fingerling	Direct plant	1998	100,000	AD/CWT	Pt Austin
Chinook	Platte Hatchery	fingerling	Direct plant	1998	100,000	AD/CWT	Tawas
Chinook	Platte Hatchery	fingerling	Direct plant	1999	100,000	AD/CWT	Pt Austin
Chinook	Platte Hatchery	fingerling	Direct plant	1999	100,000	AD/CWT	Tawas
Chinook	Platte Hatchery	fingerling	Direct plant	2000	100,000	AD/CWT	Pt Austin
Chinook	Platte Hatchery	fingerling	Direct plant	2000	100,000	AD/CWT	Tawas

Table 2a.—Coded-wire tag returns per 100,000 stocked by study site and objective. AuSable River acclimation raceways (acclimation) vs. direct plant

Year class	Ages	Direct river	Acclimation
1993	0.0	0.00	0.00
	0.1	30.72	63.35
	0.2	63.50	125.62
	0.3	54.28	93.41
	0.4	6.14	16.10
	0.5	2.05	0.00
Total		156.70	298.48
1994	0.0	0.00	1.08
	0.1	24.52	73.44
	0.2	30.36	98.28
	0.3	56.04	157.68
	0.4	1.17	6.48
	0.5	0.00	0.00
Total		112.09	336.95

Table 2b.—Coded-wire tag returns per 100,000 stocked by study site and objective. Au Sable River, acclimated Chinook salmon release-site comparison.

Year class	Ages	River release	Beach release
1995	0.0	0.00	0.00
	0.1	52.03	80.40
	0.2	87.50	115.87
	0.3	98.14	140.71
	0.4	15.37	30.74
	0.5	0.00	1.18
Total		253.03	368.91
1996	0.0	0.00	0.00
	0.1	42.03	42.04
	0.2	81.85	96.09
	0.3	79.64	66.06
	0.4	8.85	9.61
	0.5	0.00	0.00
Total		212.38	213.80
1997	0.0	0.00	0.00
	0.1	9.20	2.50
	0.2	25.30	9.99
	0.3	21.85	19.97
	0.4	0.00	0.00
	0.5	0.00	0.00
Total		56.36	32.46

Table 2c.-Coded-wire tag returns per 100,000 stocked by study site and objective. Harbor Beach net pen vs. direct plant.

Year class	Ages	Net-pen	Direct plant
1995	0.0	1.11	0.00
	0.1	32.17	33.43
	0.2	106.50	94.01
	0.3	75.44	111.77
	0.4	18.86	44.92
	0.5	0.00	1.04
Total		234.08	285.17
1996	0.0	0.00	0.00
	0.1	38.35	19.39
	0.2	104.41	86.70
	0.3	145.96	83.27
	0.4	23.44	9.13
	0.5	0.00	0.00
Total		312.16	198.49
1997	0.0	0.00	0.00
	0.1	7.55	8.16
	0.2	32.37	28.55
	0.3	21.58	26.51
	0.4	0.00	2.04
	0.5	0.00	0.00
Total		61.50	65.25
1998	0.0	0.00	0.00
	0.1	19.07	7.34
	0.2	22.88	9.79
	0.3	17.80	12.23
	0.4	0.00	0.00
	0.5	0.00	0.00
Total		59.74	29.36

Table 2d.—Coded-wire tag returns per 100,000 stocked by study site and objective. Stocking site evaluations.

Plant year	Ages	Swan River	Tawas River	Port Austin	Port Sanilac	Lexington	AuGres	Harrisville acclimated
1998	0.0	0.00	0.00	0.00	-	-	-	-
	0.1	29.05	6.76	3.56	-	-	-	-
	0.2	40.67	10.14	10.67	-	-	-	-
	0.3	18.59	1.69	15.41	-	-	-	-
	0.4	1.16	0.00	0.00	-	-	-	-
	0.5	0.00	0.00	0.00	-	-	-	-
Total		89.48	18.60	29.64	-	-	-	-
1999	0.0	0.00	0.00	0.00	-	-	-	-
	0.1	25.54	9.90	37.32	-	-	-	-
	0.2	47.89	19.79	41.72	-	-	-	-
	0.3	43.63	26.39	50.50	-	-	-	-
	0.4	6.39	0.00	0.00	-	-	-	-
		0.00	0.00	0.00	-	-	-	-
Total		123.44	56.08	129.54	-	-	-	-
2000	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.1	9.14	9.14	10.71	10.50	19.24	20.35	30.97
	0.2	24.00	25.58	26.18	31.50	35.51	20.35	48.32
	0.3	51.42	10.96	22.61	0.00	7.40	22.38	184.60
	0.4	-	-	-	-	-	-	-
	0.5	-	-	-	-	-	-	-
Total		84.56	45.68	59.51	42.00	62.15	63.07	263.89
2001	0.0	0.00	-	-	0.00	0.00	0.00	0.00
	0.1	14.17	-	-	16.07	10.38	24.17	38.27
	0.2	53.13	-	-	18.99	11.87	30.21	140.31
	0.3	-	-	-	-	-	-	-
	0.4	-	-	-	-	-	-	-
	0.5	-	-	-	-	-	-	-
Total		67.29	-	-	35.06	22.25	54.37	178.58
2002	0	0.00	-	-	0.00	0.00	0.00	0.00
	0.1	7.32	-	-	0.00	0.00	5.41	6.57
	0.2	-	-	-	-	-	-	-
	0.3	-	-	-	-	-	-	-
	0.4	-	-	-	-	-	-	-
	0.5	-	-	-	-	-	-	-
Total		7.32	-	-	0.00	0.00	5.41	6.57

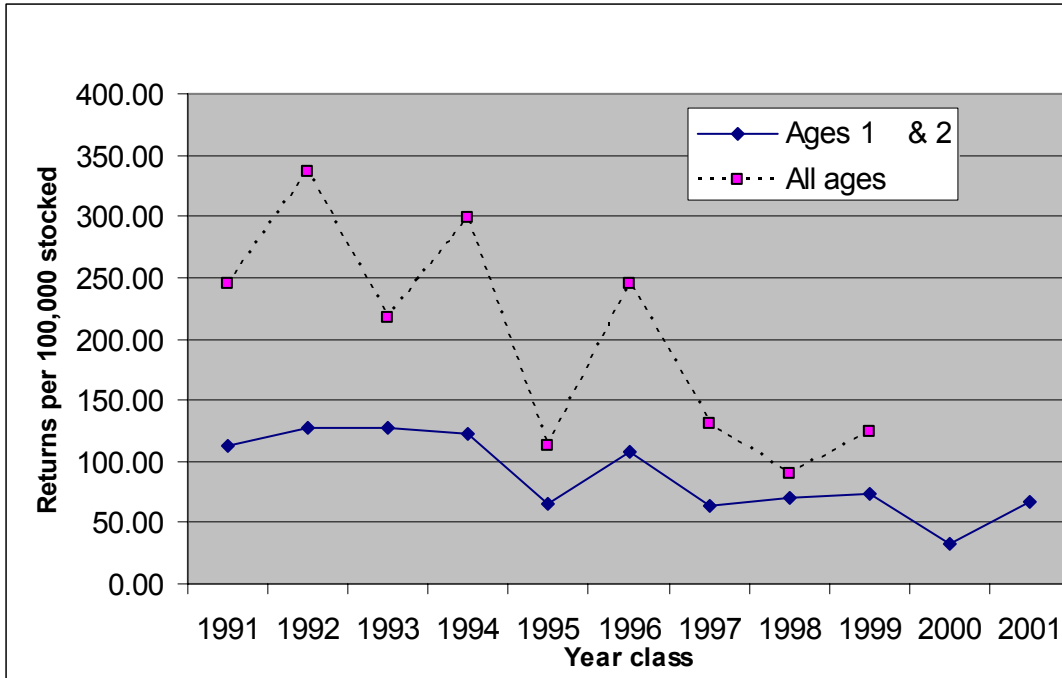


Figure 1.—Returns per 100,000 of coded-wire-tagged Chinook salmon stocked at the Swan River, north-central Lake Huron, near Rogers City.