

STUDY PERFORMANCE REPORT

State: Michigan

Project No.: F-81-R-16

Study No.: 230464

Title: Statewide fish marking and mark recovery program.

Period Covered: October 1, 2014 to September 30, 2015

Study Objectives: 1) To coded-wire tag and adipose fin clip experimental lots of fish at state fish hatcheries; 2) To design, develop, and manage databases for research studies that use coded-wire tags and other identifying marks; and 3) To coordinate activities conducted in Michigan related to the Great Lakes-wide Mass Marking initiative.

Summary: Approximately 1,235,000 Chinook Salmon *Oncorhynchus tshawytscha*, 58,000 Rainbow Trout *Oncorhynchus mykiss*, 180,000 Atlantic Salmon *Salmo salar*, and 570 Lake Sturgeon *Acipenser fulvescens* were marked with a coded-wire tag (CWT) and adipose fin clip in 2015. Marked and unmarked Atlantic Salmon, Brown Trout *Salmo trutta*, Chinook Salmon, Coho Salmon *Oncorhynchus kisutch*, Lake Trout *Salvelinus namaycush*, and Rainbow Trout were sampled from index surveys, sport fisheries, tribal fisheries, weirs, and fish ladders. Chinook Salmon (N = 5,906), Rainbow Trout (N = 482 fish) and Lake Trout (N = 943) accounted for the majority of the 7,357 fish collected in 2014 for CWT processing.

Findings: Jobs 1 through 6 were scheduled for 2014-15, and progress is reported below.

Job 1. Survey design and coordination.—This is a support project for all research and assessment projects that use CWT and the specific study, survey, data collection, and data recovery designs vary by study. During 2014-15, this study supported Federal Aid in Sport Fish Restoration and State Wildlife Grant studies 230485, 230486, 230513, 230563/237026, and 230692 and the survey design details are included in annual progress reports for those studies. Charlevoix Fisheries Research Station (CFRS) personnel coordinated with principal investigators for those studies, along with United States Fish and Wildlife Service (USFWS) marking and tag recovery crews, to ensure marking and mark recovery were implemented according to study designs.

Job 2. Conduct surveys and process samples.—Approximately 1,235,000 Chinook Salmon, 58,000 Rainbow Trout, 180,000 Atlantic Salmon, and 570 Lake Sturgeon were marked with a coded-wire tag (CWT) and adipose fin clip in 2015 (Table 1). The total number of fish marked in 2015 was slightly greater than the number marked in 2014 (Table 1).

Marked and unmarked Atlantic Salmon, Brown Trout, Chinook Salmon, Coho Salmon, Lake Trout, and Rainbow Trout were collected in 2014-15 from assessment samples, sport fisheries, tribal fisheries, and harvest weirs (Table 2). These collections resulted in proportional samples of marked and unmarked fish. Permanent and seasonal Fisheries Division staff, along with seasonal USFWS employees, also worked at fishing tournaments during the summer, to collect tagged fish and associated biological samples (e.g., caudal sections for OTC samples, stomach samples). Additional proportional and non-proportional samples of marked fish were obtained from the sport fisheries through creel census, fishing tournaments, and anglers and charter boat operators who observed an adipose-fin clipped fish and voluntarily returned the head to a designated drop-off site (Table 2).

Job 3. Manage and maintain database.—All adipose-clipped fish collected during the 2014 and 2015 field seasons (see Job 2) were examined for presence of a CWT. Tags were removed, read, and recorded into a database. A significant portion of work in this job involves data sharing and exchange with other fisheries agencies. Database maintenance and improvement work is ongoing. Data entry was completed for all CWTs processed during 2014-15 using the standard entry format.

Job 4. Analyze data, modeling.—A total of 7,357 CWT fish collected in 2014 have been processed at the CFRS (Table 2). This number probably represents most of the fish with CWTs collected in 2014 that will be turned in for analysis, although volunteer anglers may continue to return some additional fish. Chinook Salmon (N = 5,906) were the species with the highest number of CWTs recovered and processed, followed by Lake Trout (943) and Rainbow Trout (482). Overall, the majority of tag collections were from sport fisheries (73%) and weir returns (21%). The total number of fish processed in 2014 was greater than the number processed in 2013, and above the average for the period 1990–2013 (Table 3). Data were provided to other researchers and managers (both within and outside the Michigan Department of Natural Resources (MDNR)) for additional analysis and modeling applications as requested.

Job 5. Write annual performance report.—This annual progress report was completed as scheduled. In addition, a study summary was prepared (Attachment 1).

Job 6. Write other reports.—As indicated above, data were provided to other researchers and managers for additional analysis and modeling applications. Updated lake- and port-specific reports were generated and made available to the public as part of the fish marking and tagging page on the MDNR Internet site (www.michigan.gov/taggedfish). The following report resulted from efforts on this study.

¹Clevenger, J. A., Jr. 2015. Summary of the Chinook and coho salmon harvest from Michigan weirs on tributaries of Lakes Michigan and Huron, 2014. Michigan Department of Natural Resources, Fisheries Division internal report.

Prepared by: David Clapp, Randall M. Claramunt, and John Clevenger

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¹ Clevenger 2015 is provided with the Annual Performance Report for F-81, Study 230513 for 2014-15.

Table 1.—Number of fish marked with CWTs, 1990–2015. Number tagged is not corrected for tag retention or fin-clip rates. Inc. = data not available at the time this report was produced.

Year	Atlantic Salmon	Chinook Salmon	Lake Trout	Rainbow Trout	Lake Sturgeon	All species
1990	0	1,140,491	98,361	142,618	0	1,381,470
1991	50,315	1,464,558	97,344	0	0	1,612,217
1992	51,498	1,328,518	111,000	0	0	1,491,016
1993	78,580	1,420,863	0	32,597	0	1,532,040
1994	35,259	1,423,681	100,303	35,476	0	1,594,719
1995	70,853	515,240	107,957	36,320	0	730,370
1996	48,101	515,282	0	349,727	0	913,110
1997	45,211	512,938	0	435,148	0	993,297
1998	54,159	485,634	59,200	392,172	0	991,165
1999	0	270,280	0	378,864	3,195	652,339
2000	0	800,294	0	0	10,744	811,038
2001	0	1,115,262	151,176	0	4,370	1,270,808
2002	0	1,090,252	0	0	9,456	1,099,708
2003	0	763,238	0	0	5,291	768,529
2004	0	760,079	0	0	7,322	767,401
2005	0	759,959	0	0	0	759,959
2006	0	725,052	0	0	7,962	733,014
2007	0	306,640	0	0	2,579	309,219
2008	0	301,583	0	59,835	675	362,093
2009	0	304,912	0	59,390	1,716	366,018
2010	0	742,103	0	59,816	7,113	809,032
2011	0	2,821,230 ^a	3,937,284 ^a	144,852	4,027	6,907,393 ^b
2012	0	2,263,915 ^a	3,971,533 ^a	160,205	8,130	6,403,783 ^b
2013	0	1,256,160 ^a	inc. ^{a,b}	157,000	5,976	1,419,136 ^b
2014	50,659	1,230,627 ^a	inc. ^{a,b}	57,429	3,398	1,342,113 ^b
2015	180,063	1,235,133 ^a	inc. ^{a,b}	58,184	567	1,473,947 ^b
Total	664,698	25,553,924	8,634,158 ^b	2,559,633	82,521	37,494,934 ^b
Average (1990–2014)	19,385	972,752	375,398 ^b	100,058	3,278	1,440,839 ^b

^a Marking of Chinook Salmon and Lake Trout in 2011–2015 was conducted in cooperation with the United States Fish and Wildlife Service (USFWS), through implementation of the Great Lakes Mass Marking initiative (<http://www.glfsc.org/massmarking/>).

^b Final numbers for marked Lake Trout had not been obtained from USFWS at the time this report was prepared.

Table 2.—Number of fish collected / processed in 2014 from various sources and examined for the presence of CWTs. Tags were removed and read at the Charlevoix Fisheries Research Station or by USFWS staff in Green Bay, Wisconsin. Percentage of total fish from each source and species is shown in parentheses.

Source	Atlantic Salmon	Brown Trout	Chinook Salmon	Coho Salmon	Lake Trout	Rainbow Trout	Other	All species	
								#	(% of total)
Assessment /									
Index samples:									
Gill net	0	0	0	0	367	0	0	367	(5.0)
Electrofishing	0	0	0	0	0	101	0	101	(1.4)
Sport-caught:									
Charter boat	0	0	98	0	20	1	0	119	(1.6)
Creel clerk	3	4	954	0	183	93	0	1,237	(16.8)
Headhunter /									
Tournament	1	1	1,754	2	243	70	0	2,071	(28.2)
Volunteer	13	2	1,559	0	129	217	0	1,920	(26.1)
Tribal samples:									
Gill net	0	0	0	0	0	0	0	0	(0.0)
Other	0	0	0	0	0	0	0	0	(0.0)
Weir samples:									
Harvest weirs	0	0	1,538	0	0	0	0	1,538	(20.9)
Fish ladders	0	0	0	0	0	0	0	0	(0.0)
Other:									
Other	0	0	3	0	1	0	0	4	(0.0)
All sources	17	7	5,906	2	943	482	0	7,357	
(% of total)	(0.2)	(0.1)	(80.3)	(0.0)	(12.8)	(6.6)	(0.0)		(100.0)

Table 3.—Number of fish collected from various sources and examined for the presence of CWTs, 1990–2014. Tags were removed and read at the Charlevoix Fisheries Research Station or by USFWS staff in Green Bay, Wisconsin.

Year	Atlantic Salmon	Chinook Salmon	Coho Salmon	Lake Trout	Rainbow Trout	Other	All species
1990	0	276	66	343	857	3	1,545
1991	0	1,347	30	717	1,362	6	3,462
1992	2	2,193	22	929	2,146	8	5,300
1993	85	2,975	33	1,039	737	14	4,883
1994	268	4,141	18	1,771	386	21	6,605
1995	104	4,916	14	2,918	252	6	8,210
1996	81	3,638	55	3,493	440	29	7,736
1997	212	2,355	52	3,476	546	31	6,672
1998	166	1,447	59	3,115	2,110	22	6,919
1999	98	1,301	11	2,491	3,733	48	7,682
2000	84	749	18	2,512	3,821	27	7,211
2001	16	771	8	1,836	2,643	17	5,291
2002	1	1,794	48	1,431	1,424	10	4,708
2003	1	3,269	22	1,250	311	2	4,855
2004	0	3,706	30	930	111	14	4,791
2005	0	2,471	5	923	54	5	3,458
2006	0	3,257	494	663	60	4	4,478
2007	0	2,223	13	568	37	10	2,851
2008	0	1,853	10	887	36	4	2,790
2009	0	1,618	2	596	51	1	2,268
2010	0	1,269	2	323	88	3	1,685
2011	0	1,909	1	183	164	1	2,258
2012	1	3,861	6	261	328	3	4,460
2013	1	5,291	5	312	328	3	5,940
2014	17	5,906	2	943	482	7	7,357
Total	1,137	64,536	1,026	33,910	22,507	299	123,383
Average (1990–2013)	47	2,443	43	1,374	918	12	4,834

Statewide Fish Marking and Mark Recovery Program

David Clapp, Randall M. Claramunt, and John Clevenger
Charlevoix Fisheries Research Station

Background

Fish have been marked, using a variety of methods, for well over two hundred years. The first marks were simple external tags, such as wires or ribbons. In recent years, methods of externally marking fish have included branding, tattooing, and optical pattern recognition. Internal tags or marks have also evolved considerably in recent years, and now include both artificial as well as natural marks. Artificial marks include implanted coded-wire tags, dyes on otoliths ("ear bones") or other hard parts, visible implants, and radio and ultrasonic implants. Natural internal marks include genetic marks, chemical / elemental marks, and biological marks (e.g., unique parasites, others). All of these various methods are used extensively, and each has unique advantages that are dependent on the goals of the marking program.

Coded-wire tag marking of fish by Fisheries Division began in the mid-1980s, and oversight of the program moved to the Charlevoix Fisheries Research Station around 1990. Since 1990, more than 25 million trout and salmon have been marked with coded-wire tags (Photo 1), and more than 100,000 tags have been recovered to provide information critical to the successful management of these important fish populations. In recent years, additional marking programs (e.g., oxytetracycline marking of Lake Michigan and Lake Huron stocked Chinook salmon, isotope analysis of Chinook salmon and steelhead, Great Lakes Mass Marking Program) have been initiated and play an equally important role in Great Lakes management efforts.



Photo 1. Cooperating USFWS biologists tagging fish with coded-wire tags in an auto-fish marking trailer in support of the Great Lakes Mass Marking Program.

The objectives of the statewide fish marking program are to coded-wire tag and adipose fin clip experimental lots of fish at state fish hatcheries; to design, develop, and manage databases for research studies that use coded-wire tags and other identifying marks; and to coordinate activities conducted in Michigan related to the Great Lakes-wide Mass Marking initiative. Marking studies have been implemented for a variety of reasons—including estimating fish growth, mortality, exploitation (harvest), and movement—and fish marking data collected as a result of this program are used extensively in resource management decisions. For example, coded-wire tag marking has been used to measure relative return of Chinook Salmon and steelhead stocked by different methods (net pen v. direct plant) and at different sites (upstream v. downstream, different ports), to evaluate the success of the Atlantic Salmon stocking program, and in implementing the MDNR Lake Sturgeon rehabilitation plan to mention a few of the many ways this information gets put to work for Michigan's fisheries. Angler cooperation is an essential

component of most of these studies, as we need assistance in retrieving marked fish from our waters (Photo 2).



Photo 2. MDNR staff collecting information from tagged fish at a Lake Michigan tournament.

Key study results

- Approximately 1,235,000 Chinook Salmon, 58,000 Rainbow Trout, 180,000 Atlantic Salmon, and 570 Lake Sturgeon were marked with a coded-wire tag (CWT) and adipose fin clip in 2015. The total number of fish marked in 2015 was slightly greater than the number marked in 2014.
- A total of 7,357 CWT fish collected in 2014 have been processed at the Charlevoix Fisheries Research Station. Chinook Salmon (N=5,906) were the species with the highest number of CWTs recovered and processed, followed by Lake Trout (943) and Rainbow Trout (482). Overall, the majority of tag collections were from sport fisheries (73%) and weir returns (21%). The total number of fish processed in 2014 was greater than the number processed in 2013, and above the average for the period 1990–2013. Processing of tagged fish from 2015 collections is still ongoing.

Where you can find study details

Additional information concerning returns of tagged fish to specific Great Lakes ports can be found at http://www.michigan.gov/dnr/0,4570,7-153-10364_52259_10949_11238_11359-171648--,00.html. Additional general information concerning the Fisheries Division fish marking program can be found at http://www.michigan.gov/dnr/0,1607,7-153-10364_52259_48361---,00.html and specific study details can be found at http://www.michigan.gov/dnr/0,4570,7-153-10364_52259_19056-333302--,00.html.