

## STUDY PERFORMANCE REPORT

State: Michigan

Project No.: F-81-R-16

Study No.: 230513

Title: Evaluation of returns of salmonids to weirs in Michigan's waters of the Great Lakes.

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

**Study Objectives:** (1) To annually monitor and record returns of Chinook Salmon *Oncorhynchus tshawytscha*, Coho Salmon *Oncorhynchus kisutch*, and steelhead trout *Oncorhynchus mykiss* to Michigan weir operation facilities; (2) To mark Chinook Salmon, Coho Salmon, and steelhead trout at index sites and provide annual estimates of size-at-age; (3) To collect data and report on contracted salmon harvest operations; and (4) To provide annual data summaries of weir returns to be used in management unit reports, GLFC reports, Michigan Department of Natural Resources (MDNR) web site updates, and for distribution to interested researchers and the public.

**Summary:** Data were collected during 2014 on Chinook and Coho Salmon returning to six MDNR harvest weir facilities. Returns of Chinook Salmon to Lake Huron and Lake Michigan weirs in 2014 were lower than in 2013. For both lakes, 2014 returns were also below the long-term averages. Returns of Coho Salmon to Lake Michigan weirs in 2014 were lower than in 2013 and below the long-term average from the 1987–2013 time series. Data collection for 2015 weir returns is ongoing. We completed the audit report for 2014 operations as scheduled, and it is available electronically. Chinook Salmon and steelhead were marked and stocked at three weir index sites in spring of 2015, as scheduled.

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

**Job 1. Survey design and coordination.**—Survey design calls for collection of data on returning salmonids at six Michigan Department of Natural Resources (MDNR) harvest weir facilities, during the period of weir operation. We established the period of weir operation by evaluating hatchery egg-take needs as well as operational constraints of the contractor for Salmon processing and disposal. Data collected include total number and weight of fish harvested (by species), as well as biological data on individual Chinook and Coho Salmon (including total length, weight, sex, fin clips, egg status, and disease status). Biological data collection protocol currently involves subsampling 15% of the Chinook Salmon run and 7.5% of the Coho Salmon run; these subsampling percentages were unchanged for 2014-15.

Index marking of Chinook Salmon and steelhead is a part of the survey design for this study. Chinook Salmon and steelhead were marked and stocked at three weir index sites in spring of 2014, as scheduled (see also Study 230464 performance report). We also continued the collection of index-marked fish in 2014-15.

Coordination occurred through attendance at the annual weir meeting with MDNR staff and contractors, as well as through regular coordination with the MDNR Fish Marking Review Committee, management units, and hatchery, weir, and harvest sampling staff.

**Job 2. Conduct surveys and process samples.**—In coordination with management unit personnel, data were collected during fall 2014 on Chinook and Coho Salmon returning to six MDNR harvest weir facilities. Returns of Chinook Salmon to Lake Michigan harvest facilities

(total=8,188) were below the long-term average (28,895 fish; Table 1). Lake Huron returns of Chinook Salmon to the Swan River weir in 2014 (4,474 fish) were lower than the long-term average for that facility (16,323 fish; Table 1). Returns of Coho Salmon to Lake Michigan weirs (9,258 fish) in 2014 were lower than in 2013 and well below the long-term average from 1987–2013 (45,777 fish; Table 2). Data collection for 2015 weir returns is ongoing.

Chinook Salmon and/or steelhead were marked and stocked in the Little Manistee River, Medusa Creek, and the Swan River (as scheduled) in spring of 2015. Tagging and fin-clip operations were coordinated with SFR Study 230464 “Statewide fish marking and mark recovery program”, and additional details are available in the annual progress report for that study. Weir returns, including marked fish collected at weir facilities (Table 3), provided managers with standardized size and age indices for Chinook Salmon, Coho Salmon, and steelhead from Lakes Michigan and Huron (Table 4).

**Job 3. Manage data and maintain database.**—Collection of data from contracted 2015 weir harvest operations is not yet complete. At the end of the weir harvest season (approximately December 1), these data will be compiled for the 2015 audit report. This report will assist in reconciling financial arrangements between the MDNR and the harvest contractor (currently, American Canadian Fisheries – contract #751B2200074), which is covered under SFR Project F-62.

All biological data collected from Chinook Salmon, Coho Salmon, steelhead and Brown Trout *Salmo trutta* are archived in databases. Staffs from the Charlevoix Fisheries Research Station (CFRS) and the Fish Production Section are responsible for updating databases with current information and checking the accuracy of past information. Archives of aging structures collected from steelhead and Brown Trout during MDNR weir operations for Lakes Michigan and Huron are maintained at the Charlevoix Fisheries Research Station (CFRS).

A database developed for the Little Manistee Weir incorporates all stocking, harvest, and biological collections at the facility from 1991 to 2010. The database was updated, and now includes information from the Medusa Creek Weir (1985 to 2010) and Jordan River Weir (1984). Post-2010 biological data are entered into Excel then integrated into the database when harvest information is updated. Little Manistee River data are available back to 1968 and entry of pre-1991 harvest and biodata information from the Little Manistee River is continuing. We have coordinated with Platte River State Fish Hatchery staff to complete harvest and biological data entry for the Upper and Lower Platte River weirs. The harvest information is now up-to-date for the Lower Platte River Weir from 1983-2013 and Upper Platte River Weir from 1984–2013. Platte River State Fish Hatchery continue work on updating biodata information for Platte River weirs. Biological data from Pere Marquette River barrier surveys (1977, 1983–1985, 1989–1991, 1995, 1997–2000) are complete and in the format of biological data in the combined database. Boardman River weir data are compiled through 2011 and need to be integrated into the new database format. We will initiate similar efforts for the Swan River weir collections in the future. We have initiated conversations to centralize data collection and storage in Citrix.

**Job 4. Analyze data, modeling.**—CFRS staff are continuing to develop data summary formats appropriate for web distribution. For example, weekly updates of 2014 harvest operations are currently available on the Fisheries Division Intranet page. Additional multiyear data summaries were included with the annual audit report for weir operations (Clevenger 2015). We developed databases and programs to simplify data summary and analysis, and to standardize output formats for Little Manistee, Boardman, and Medusa Creek Weir operations. Detailed summaries for all salmonine species encountered at the Little Manistee Weir facility have been published in a MDNR Fisheries Report (see Job 6).

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

**Job 6. Write other reports.**—The following report detailing harvest by species, weir facility, and date of collection for 2014 weir operations is complete and provided with this report (Clevenger 2015). In addition, a technical report summarizing Little Manistee River weir harvest operations from 1991 to 2007 was completed by hatchery and CFRS staff (Sapak and Jonas 2015).

Clevenger, 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 internal report.

Sapak, J. M., and J. L. Jonas. 2015. History of the Little Manistee River weir and fall Chinook salmon egg-take. Michigan Department of Natural Resources, Fisheries Report 06, Lansing.

**Prepared by:** Randall M. Claramunt, Jory L. Jonas, John Clevenger, and David F. Clapp.  
**Dated:** September 30, 2015

Table 1.—Number of Chinook Salmon harvested from weirs on tributaries to Lakes Michigan and Huron each fall from 1987–2014.

| Sample year         | Lake Michigan weirs |                 |        |        |                         | Lake Huron weirs |        |                        |        |
|---------------------|---------------------|-----------------|--------|--------|-------------------------|------------------|--------|------------------------|--------|
|                     | Boardman            | Little Manistee | Medusa | Platte | Thompson <sup>a,b</sup> | Total            | Swan   | Van Ettan <sup>b</sup> | Total  |
| 1987                | 4,902               | 31,841          | 11,230 | 7,787  | inc.                    | 55,760           | 51,447 | 12,472                 | 63,919 |
| 1988                | 6,129               | 12,519          | 2,353  | 4,649  | inc.                    | 25,650           | 30,830 | 9,081                  | 39,911 |
| 1989                | 5,809               | 18,338          | 3,040  | 1,899  | inc.                    | 29,086           | 30,119 | 3,891                  | 34,010 |
| 1990                | 6,236               | 19,499          | 6,533  | 1,761  | inc.                    | 34,029           | 19,521 | inc.                   | 19,521 |
| 1991                | 5,556               | 21,062          | 2,127  | 4,398  | inc.                    | 33,143           | 23,048 | 8,319                  | 31,367 |
| 1992                | 3,139               | 15,747          | 4,038  | 4,171  | inc.                    | 27,095           | 37,862 | 7,913                  | 45,775 |
| 1993                | 2,299               | 12,911          | 3,021  | 3,109  | inc.                    | 21,340           | 34,994 | 2,300                  | 37,294 |
| 1994                | 3,025               | 11,888          | 3,030  | 1,162  | inc.                    | 19,105           | 19,771 | 1,218                  | 20,989 |
| 1995                | 4,547               | 13,079          | 4,714  | 3,943  | inc.                    | 26,283           | 30,320 | –                      | 30,320 |
| 1996                | 5,705               | 17,120          | 6,548  | 4,145  | inc.                    | 33,518           | 25,615 | –                      | 25,615 |
| 1997                | 3,040               | 15,443          | 4,036  | 1,659  | inc.                    | 24,178           | 17,219 | –                      | 17,219 |
| 1998                | 2,665               | 7,326           | 1,277  | 2,380  | inc.                    | 13,648           | 11,654 | –                      | 11,654 |
| 1999                | 6,004               | 18,773          | 3,551  | 3,242  | inc.                    | 31,570           | 24,884 | –                      | 24,884 |
| 2000                | 4,549               | 13,030          | 3,904  | 2,345  | 624                     | 24,452           | 11,552 | –                      | 11,552 |
| 2001                | 5,231               | 18,289          | 8,068  | 4,511  | –                       | 36,099           | 12,282 | –                      | 12,282 |
| 2002                | 5,489               | 19,392          | 10,417 | 6,053  | –                       | 41,351           | 9,645  | –                      | 9,645  |
| 2003                | 6,211               | 14,367          | 12,792 | 7,988  | –                       | 41,358           | 10,979 | –                      | 10,979 |
| 2004                | 7,795               | 15,615          | 15,465 | 7,169  | –                       | 46,044           | 6,193  | –                      | 6,193  |
| 2005                | 7,875               | 11,064          | 9,936  | 3,557  | –                       | 32,432           | 3,143  | –                      | 3,143  |
| 2006                | 12,663              | 12,731          | 16,340 | 2,840  | –                       | 44,574           | 2,482  | –                      | 2,482  |
| 2007                | 5,020               | 10,698          | 8,537  | 2,542  | –                       | 26,797           | 1,465  | –                      | 1,465  |
| 2008                | 3,904               | 5,170           | 6,860  | 973    | –                       | 16,907           | 4,175  | –                      | 4,175  |
| 2009                | 2,637               | 8,285           | 4,294  | 1,153  | –                       | 16,369           | 3,930  | –                      | 3,930  |
| 2010                | 2,967               | 5,776           | 5,562  | 892    | –                       | 15,197           | 3,246  | –                      | 3,246  |
| 2011                | 7,271               | 14,136          | 7,955  | 966    | –                       | 30,328           | 5,433  | –                      | 5,433  |
| 2012                | 4,529               | 12,329          | 5,302  | 1,038  | –                       | 23,198           | 2,815  | –                      | 2,815  |
| 2013                | 2,529               | 6,406           | 4,390  | 919    | –                       | 14,244           | 6,096  | –                      | 6,096  |
| 2014                | 1,286               | 2,771           | 4,074  | 57     | –                       | 8,188            | 4,474  | –                      | 4,474  |
| Average (1987–2013) | 5,101               | 14,179          | 6,493  | 3,232  | –                       | 29,028           | 16,323 | –                      | 17,997 |

<sup>a</sup> Data compilation on harvest from Thompson Creek (Lake Michigan) is incomplete; harvest at this facility in most years did not exceed 1,000 fish.

<sup>b</sup> The harvest weir at Van Ettan Creek has not been operated since 1994; the harvest weir at Thompson Creek has not been operated regularly since 2000.

Table 2.—Number of Coho Salmon harvested from weirs on tributaries to Lake Michigan each fall from 1987–2014.

| Sample year            | Weir                  |                    |                     |         |                         | Total   |
|------------------------|-----------------------|--------------------|---------------------|---------|-------------------------|---------|
|                        | Boardman <sup>a</sup> | Little Manistee    | Medusa <sup>a</sup> | Platte  | Thompson <sup>a,b</sup> |         |
| 1987                   | 306                   | 15,101             | inc.                | 50,300  | inc.                    | 65,707  |
| 1988                   | 477                   | 4,467              | inc.                | 28,310  | inc.                    | 33,254  |
| 1989                   | 288                   | 14,023             | inc.                | 44,612  | inc.                    | 58,923  |
| 1990                   | 141                   | 10,030             | inc.                | 22,516  | inc.                    | 32,687  |
| 1991                   | 64                    | 12,300             | inc.                | 25,730  | inc.                    | 38,094  |
| 1992                   | 25                    | 13,400             | inc.                | 33,072  | inc.                    | 46,497  |
| 1993                   | 182                   | 18,096             | inc.                | 38,911  | inc.                    | 57,189  |
| 1994                   | 1,530                 | 562                | inc.                | 29,491  | inc.                    | 31,583  |
| 1995                   | 147                   | 355                | inc.                | 51,997  | inc.                    | 52,499  |
| 1996                   | 209                   | 2,584              | inc.                | 49,816  | inc.                    | 52,609  |
| 1997                   | 3,804                 | 781                | inc.                | 85,556  | inc.                    | 90,141  |
| 1998                   | 1,127                 | 1,471              | inc.                | 83,059  | inc.                    | 85,657  |
| 1999                   | 101                   | 526                | inc.                | 43,017  | inc.                    | 43,644  |
| 2000                   | 5,934                 | 590                | 10                  | 102,682 | 735                     | 109,951 |
| 2001                   | 599                   | 926                | 0                   | 82,024  | –                       | 83,549  |
| 2002                   | 1,344                 | 530                | 2                   | 119,276 | –                       | 121,152 |
| 2003                   | 163                   | 618                | 1                   | 22,947  | –                       | 23,729  |
| 2004                   | 1,407                 | 1,106              | 0                   | 16,061  | –                       | 18,574  |
| 2005                   | 3                     | 2,094              | 0                   | 14,317  | –                       | 16,414  |
| 2006                   | 824                   | 129                | 0                   | 9,526   | –                       | 10,479  |
| 2007                   | 1,754                 | –                  | 0                   | 30,711  | –                       | 32,465  |
| 2008                   | 18                    | –                  | 0                   | 11,636  | –                       | 11,654  |
| 2009                   | 59                    | –                  | 0                   | 16,431  | –                       | 16,490  |
| 2010                   | 212                   | –                  | 3                   | 10,032  | –                       | 10,247  |
| 2011                   | 11,694                | –                  | 8                   | 13,905  | –                       | 25,607  |
| 2012                   | 2,539                 | –                  | 26                  | 34,547  | –                       | 37,112  |
| 2013                   | 1,486                 | –                  | 4                   | 28,582  | –                       | 30,072  |
| 2014                   | 569                   | –                  | 1                   | 8,688   | –                       | 9,258   |
| Average<br>(1987–2013) | 1,350                 | 4,984 <sup>c</sup> | inc.                | 40,706  | inc.                    | 45,777  |

<sup>a</sup> Data compilation on harvest from the Boardman River, Thompson Creek, and Medusa Creek is incomplete; harvest at these facilities in most years did not exceed 1,000 fish.

<sup>b</sup> The harvest weir at Thompson Creek has not been operated regularly since 2000.

<sup>c</sup> Starting in 2007, all Coho Salmon were passed over the weir and not harvested. Average harvest is for the period 1987-2006.

Table 3.—Number of coded-wire tagged Chinook Salmon recovered at Lake Michigan and Lake Huron harvest weirs, 2000–2014.

| Year | Lake Michigan |                 |        |        |          | Lake Huron | Total |
|------|---------------|-----------------|--------|--------|----------|------------|-------|
|      | Boardman      | Little Manistee | Medusa | Platte | Thompson | Swan       |       |
| 2000 | 0             | 0               | 1      | 9      | 39       | 157        | 206   |
| 2001 | 18            | 39              | 84     | 72     | 9        | 126        | 348   |
| 2002 | 34            | 165             | 385    | 146    | 7        | 156        | 893   |
| 2003 | 51            | 385             | 916    | 37     | 14       | 176        | 1,579 |
| 2004 | 29            | 541             | 1,056  | 18     | 3        | 151        | 1,798 |
| 2005 | 35            | 372             | 783    | 87     | 14       | 50         | 1,341 |
| 2006 | 56            | 515             | 1,445  | 32     | 0        | 33         | 2,081 |
| 2007 | 27            | 309             | 661    | 6      | 0        | 44         | 1,047 |
| 2008 | 19            | 134             | 422    | 4      | 0        | 129        | 708   |
| 2009 | 20            | 258             | 342    | 8      | 0        | 68         | 696   |
| 2010 | 31            | 247             | 284    | 13     | 0        | 97         | 672   |
| 2011 | 99            | 448             | 574    | 28     | 0        | 144        | 1,293 |
| 2012 | 135           | 353             | 523    | 58     | 0        | 145        | 1,214 |
| 2013 | 257           | 456             | 631    | 86     | 0        | 397        | 1,827 |
| 2014 | 127           | 397             | 478    | 25     | 0        | 572        | 1,599 |

Table 4.—Representative size-at-age (weight, kg) of Chinook Salmon, Coho Salmon, and steelhead trout sampled at MDNR harvest weirs, 2000–2014. Data are average weight of age-0.3 female Chinook Salmon (CHS) from Little Manistee River, Medusa Creek, and Swan River weirs; age-1.1 female Coho Salmon (COS) from the Upper Platte River weir; and age-1.3 female steelhead (STH) from the Little Manistee River. “–” indicates samples were not available for a given year, species, or age group.

| Sample year | Weir                                 |                             |                           |                                   |                                      |
|-------------|--------------------------------------|-----------------------------|---------------------------|-----------------------------------|--------------------------------------|
|             | Little Manistee<br>(age 0.3, F, CHS) | Medusa<br>(age 0.3, F, CHS) | Swan<br>(age 0.3, F, CHS) | Upper Platte<br>(age 1.1, F, COS) | Little Manistee<br>(age 1.3, F, STH) |
| 2000        | 7.0                                  | 7.0                         | 10.4                      | 2.7                               | 4.5                                  |
| 2001        | 9.1                                  | 6.2                         | 8.8                       | 2.9                               | 4.5                                  |
| 2002        | 6.2                                  | 4.6                         | 8.7                       | 1.4                               | 4.4                                  |
| 2003        | 6.1                                  | 6.7                         | 6.4                       | 2.5                               | 4.3                                  |
| 2004        | 5.4                                  | 5.8                         | 5.8                       | 2.2                               | 3.6                                  |
| 2005        | 4.7                                  | 5.3                         | 3.8                       | 1.9                               | 3.9                                  |
| 2006        | 4.9                                  | 6.1                         | 5.8                       | 2.4                               | 3.6                                  |
| 2007        | 4.3                                  | 5.0                         | –                         | 2.4                               | 3.3                                  |
| 2008        | 4.5                                  | 5.6                         | 4.9                       | 1.5                               | 3.0                                  |
| 2009        | 6.1                                  | 6.1                         | 6.0                       | 3.4                               | 3.5                                  |
| 2010        | 4.5                                  | 5.4                         | 4.8                       | 2.1                               | 3.0                                  |
| 2011        | 6.7                                  | 7.5                         | –                         | 2.9                               | 3.4                                  |
| 2012        | 5.1                                  | 5.5                         | 5.4                       | 3.0                               | –                                    |
| 2013        | 6.9                                  | 7.5                         | 7.7                       | 2.5                               | –                                    |
| 2014        | 5.4                                  | 6.1                         | 5.9                       | 2.0                               | –                                    |

## **Evaluation of Returns of Salmonids to Weirs in Michigan's Waters of the Great Lakes.**

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### *Background*

A fish weir is an obstruction placed wholly or partially across a river, which is designed to hinder the passage of fish. Weirs are historically used to catch fish, although they can be used to redirect fish as well; Fisheries Division uses them to catch salmon and steelhead in order to obtain eggs for our hatchery system and to collect key biological data. Eggs taken at the weirs are sent to state fish hatcheries where they are raised and stocked all over Michigan. Salmon harvest weirs in Michigan are located on the Little Manistee River near Stronach, Medusa Creek near Charlevoix, on the Boardman River in Traverse City, on the Platte River near Honor (upper and lower weirs), and on Swan Creek near Rogers City. Coho salmon eggs are taken at the upper Platte River weir, and Chinook salmon eggs are taken at the Swan Creek and Little Manistee River weirs. The Little Manistee River Weir is also used in the spring to collect steelhead eggs. The other weirs are backup locations for egg take operations or provide harvest facilities to prevent nuisance die-offs of salmon that have spawned.

Data on returns of stocked salmon and trout to Michigan rivers is used in many Great Lakes management and research efforts. Managers use weir return information, along with the other indicators, to make decisions about stocking levels, fishing regulations, and in evaluating progress toward meeting overall fisheries goals for lakes Michigan and Huron. We rely on returns of known-age fish at weirs to provide us with an annual index of salmon and steelhead growth. In addition, contracted salmon harvest operations provide additional options to examine salmon populations, and Fisheries Division monitoring ensures these contracted harvest operations meet contract requirements.

The objectives of this project are to: (1) Annually monitor and record returns of Chinook Salmon, Coho Salmon, and steelhead trout to Michigan weir operation facilities; (2) Mark Chinook Salmon, Coho Salmon, and steelhead trout at index sites and provide annual estimates of size at age; (3) Collect data and report on contracted salmon harvest operations; and (4) Provide annual data summaries of weir returns to be used in Management Unit reports, GLFC reports, MDNR web site updates, and for distribution to interested researchers and the public.

### *Key study results*

- Chinook Salmon and/or steelhead were marked and stocked in the Little Manistee River, Medusa Creek, and the Swan River (as scheduled) in spring of 2015 (Photo 1). Tagging and fin-clip operations were coordinated with the Statewide Fish Marking and Mark Recovery Program. We also continued the collection of marked fish in 2014-15. Weir returns of these fish provided managers with standardized size and age indices for Chinook Salmon, Coho Salmon, and steelhead from lakes Michigan and Huron.



Photo 1. Stocking marked fingerling Chinook Salmon into the Medusa Creek Weir holding pen.

- In 2014, returns of Chinook Salmon to Lake Michigan harvest facilities (total=8,188) were below the long-term average (28,895 fish; Photo 2). Lake Huron returns of Chinook Salmon to the Swan River weir in 2014 (4,474 fish) were lower than the long-term average for that facility (16,323 fish).



Photo 2. Salmon harvest operations at the Medusa Creek Weir.

- Returns of Coho Salmon to Lake Michigan weirs (9,258 fish) in 2014 were lower than in 2013 and well below the long-term average from 1987–2013 (45,777 fish).
- Data collection for 2015 weir returns is ongoing.