

## STUDY PERFORMANCE REPORT

State: Michigan

Project No.: F-80-R-2

Study No.: 487

Title: Performance, survival and production of steelhead strains in tributaries of Lake Michigan and Lake Huron.

Period Covered: October 1, 2000 to September 30, 2001

**Study Objectives:** To evaluate strain performance of winter (Michigan) and summer (Skamania) strains of steelhead. To evaluate the performance of steelhead in six rivers, Lake Michigan and Lake Huron. To evaluate returns of steelhead from upstream and downstream plants in rivers. To describe year-to-year variation in growth and survival of steelhead populations in Michigan. To define the quality, condition, and health of different strains and batches of hatchery-produced fish.

**Summary:** We completed the stocking of steelhead marked with coded-wire tags (CWTs) for this study in 1999 (Table 1). Study fish are recruiting to the fishery and are being recovered through volunteer angler returns, Great Lakes and river creel clerks, headhunters hired to look for study fish, and by Department of Natural Resources (DNR) personnel conducting assessment work for other studies. CWTs were collected from the river fishery in 1998, and from 1999 until the present, we have conducted full river creel surveys on the Muskegon and Manistee rivers. There was a creel survey on the Au Sable River in 1999 and 2000. In 1996 and 1997, we collected 216 heads from fish marked for our study and in 1998, we recovered 2,120 fish of which 1,633 had tags. The number of fish collected in 1999 was 3,798, nearly twice the previous years returns, and 3,180 had tags. Return rates remained high in the year 2000, 3,432 steelhead were collected and 2,705 had tags. We are still collecting and analyzing heads returned from the 2001 fishery. In general, early results indicate that the furthest upstream plants are returning at better rates to fisheries than downstream plants, and both strains are returning at similar rates to the Lake Michigan fishery.

### **Job 4. Title: Evaluate performance of upstream and downstream plants.**

**Findings:** It is still premature to fully quantify the differences between upstream, midstream and mouth plants. Michigan strain steelhead have been returning to spawn in river systems since 1997, while Skamania strain fish returned for the first time to study river systems in 1998. Adult fish of both strains are documented in Great Lakes and river creel collections, and variation is present across year-classes and among ages within a year-class (Tables 2 and 3). For example, for Skamania strain steelhead planted in the Manistee River in 1997, the upstream site (Tippy Dam) provided higher return rates than downstream plants to Great Lake fisheries. However, fish planted in 1998 exhibited no detectable differences in return rates from mid- or up-stream stocking sites (Table 2). Age-3 Michigan strain steelhead planted as yearlings in the Manistee and Muskegon rivers in 1998, returned at better rates to Great Lakes fisheries from mouth plant sites than from mid-stream locations (Table 3). However, 2-year old fish showed lower or equal return rates when stocked at the mouth as compared to the mid-stream sites (Table 3).

Data accumulated by July of 2001 indicated the furthest up-stream plants provided the best return rates from the Manistee, Muskegon, and Au Sable rivers to open-lake fisheries compared with mid-stream or mouth plants (Table 4). In the Sturgeon River there were few fish returned from open-lake fisheries. When evaluated however, the Skamania strain steelhead returned at higher rates from the upstream site, while Michigan strain steelhead returned best when planted at the mouth (Table 4). Initial results for the St. Joseph River were even more complex. We stocked steelhead at six sites on the St. Joseph River - the mouth, three mid-stream, and two up-stream locations. Returns of Michigan- and Skamania- strain steelhead to open-lake fisheries were similar for fish stocked at mouth, mid- and up-stream sites. Fish stocked in Arden Pond, an extensive rearing facility, provided the highest return rates to the Lake Michigan fishery for both strains of steelhead stocked into the St. Joseph River. The similarity in return rates for fish stocked at mouth and upstream locations on the St. Joseph River were remarkable given that there is nearly 60 miles of stream and six dams to navigate before reaching Lake Michigan from the furthest upstream location. We continue to collect and compile data from 2001 collection efforts.

Results from the Au Sable River, based on open-lake returns as of July 2001, indicated a similar pattern to that observed for most of the Lake Michigan rivers. The upstream plants of Michigan strain steelhead are returning to the Lake Huron fishery at a greater rate than mouth plants (Table 4).

**Job 5. Title: Estimate growth and survival of marked steelhead to lake and river fisheries.**

**Findings:** Marked Skamania-strain steelhead first returned to river fisheries in 1998, and only limited data were collected from river systems by individuals hired as part-time employees (head hunters). In 1999 and 2000 creel surveys were conducted allowing for optimal collection of data to evaluate catch rates, effort allocations, and movements within river systems. We have collected a significant amount of data from river creel surveys in both 1999 and 2000 (Table 5); these data were entered into standard database files. Over 786 heads were returned from Lake Michigan river creel surveys in 1999 and 698 had tags. In 2000, 1,942 heads were returned from river creel surveys and 1,712 had tags. It is still too early to distinguish the implications behind the return rates of strains or stocking locations in the river fisheries. Only 2 years of data were available for analysis (1999 and 2000), and 2001 data are being collected and compiled. Data have been collected but we have not yet evaluated the growth of steelhead in lake and river systems. The relative return rates of treatment groups of steelhead in the open-lake fisheries of lakes Huron and Michigan are the primary measure of survival. However, the return rates of steelhead in river fisheries can be compared to open-lake estimates to help explain variation in survival. The Manistee and Muskegon rivers showed significant returns of upstream plants to river fisheries, and the Au Sable River displayed a similar but less pronounced pattern (Table 5). Returns of Michigan strain fish to St. Joseph River fisheries were similar across all stocking sites including Arden Pond. However, the return rates of Skamania in the St. Joseph River were somewhat different. As we observed in the open-lake fisheries, return rates were highest for fish planted in Arden Pond, and were similar for all mid- and up-stream locations (Table 3). One difference was observed however, as a significantly lower return rate was observed for fish planted at the mouth (Table 5). River creel surveys on the Muskegon, Manistee, and Au Sable rivers initiated in 1999 have greatly increased the available data enhancing our ability to evaluate systems other than Lake Michigan and the St. Joseph River. Only 2 years of data are available from the Au Sable River as creel surveys were discontinued in 2001.

To evaluate the contribution of steelhead planted in a given river system to the Lake Michigan sport fishery, we summarized the returns of marked steelhead by river of origin (Table 6). The

Muskegon River seems to be providing the best input to the Lake Michigan fishery, followed by the St. Joseph, and Manistee rivers.

**Job 6. Title: Evaluate performance characteristics of steelhead strains.**

**Findings:** The Michigan strain appears to be returning at a slightly better rate to the Lake Michigan fishery when evaluated for systems with paired plantings. The Michigan strain was represented by 5,391 (adjusted per 100,000 stocked) fish, while the Skamania strain was represented by 4,162 (adjusted per 100,000 stocked; Table 4). Given recent observations regarding variability among different ages of fish and year classes it is still premature to draw firm conclusions regarding this result (Tables 2 and 3). The third year of river creel is being conducted and early results indicate that Michigan strain fish contribute higher numbers of fish to river fisheries than do Skamania when evaluating systems and stocking sites that had received both strains. The seasonal components of the fisheries remain to be evaluated and it is important to note that though stocked at the same age, Skamania return to river fisheries one year later than the Michigan strain.

**Job 8. Title: Analyze data and write reports.**

**Findings:** Data collection for this project is closely coordinated with study 427. This progress report was prepared as scheduled. Presentations to angling groups and interested parties have been prepared as requested.

**Prepared by:** Jory Jonas and John Clevenger  
**Date:** September 30, 2001

Table 1.—Stocking locations and number of marked (coded-wire tag and adipose fin clip) steelhead, by strain, stocked into Michigan study rivers during 1996-1999. Number in parenthesis represent fish marked for additional study by the State of Indiana comparing size-at-stocking rearing strategies.

| River      | Stocking Location                            | 1996     |          | 1997                         |          | 1998                         |          | 1999                         |          |
|------------|--|----------|----------|------------------------------|----------|------------------------------|----------|------------------------------|----------|
|            |  | Skamania | Michigan | Skamania                     | Michigan | Skamania                     | Michigan | Skamania                     | Michigan |
| St. Joseph | Pier 33                                      | 0        | 9,961    | 15,811                       | 15,076   | 10,608                       | 9,982    | 11,054                       | 15,030   |
|            | Sportsman's Club-Arden                       | 10,723   | 10,921   | 15,440                       | 11,652   | 11,615                       | 11,697   | 10,265                       | 10,577   |
|            | Shamrock Park-Berrien                        | 0        | 9,847    | 15,666                       | 14,923   | 10,667                       | 10,173   | 11,108                       | 10,049   |
|            | Buchanan City Launch                         | 10,697   | 9,801    | 15,672                       | 14,780   | 10,556                       | 10,107   | 10,823                       | 9,987    |
|            | St. Patrick's Park<br>Mishawaka-Lincoln Park |          |          | 15,535<br>31,755<br>(31,209) | 19,819   | 16,135<br>32,013<br>(32,237) | 20,317   | 15,989<br>31,726<br>(32,009) | 20,054   |
|            | Indiana-Merrifield Park S. Bend              | 0        | 20,931   |                              |          |                              |          |                              |          |
| Manistee   | Manistee                                     |          | 14,795   |                              | 15,102   |                              | 16,727   |                              | 15,080   |
|            | High Bridge                                  | 15,357   | 15,787   | 16,494                       | 14,787   | 17,071                       | 15,044   | 12,555                       | 15,444   |
|            | Tippy Dam                                    | 21,340   | 15,950   | 16,000                       | 15,005   | 17,105                       | 15,110   | 12,961                       | 15,010   |
| Manistique | Manistique Public Access Site                |          | 8,161    |                              | 8,549    |                              | 8,134    |                              | 8,008    |
| Muskegon   | Muskegon Lake outlet                         |          | 10,163   |                              | 10,056   |                              | 10,180   |                              | 10,095   |
|            | Henning Park                                 |          | 21,489   |                              | 19,965   |                              | 20,218   |                              | 20,022   |
|            | Pine Street                                  |          | 22,072   |                              | 20,198   |                              | 20,180   |                              | 20,058   |
| Sturgeon   | Big Bay DeNoc-499 Bridge                     | 5,397    | 5,430    | 5,021                        | 5,116    | 3,682                        | 5,128    |                              | 5,216    |
|            | Sturgeon River                               | 6,284    | 5,345    | 4,998                        | 4,983    | 5,103                        | 5,222    |                              | 5,145    |
| Au Sable   | Harbor                                       |          | 28,426   |                              | 21,095   |                              | 22,134   |                              | 25,050   |
|            | Rea Road                                     |          | 27,172   |                              | 24,812   |                              | 25,027   |                              | 25,426   |
| TOTAL      |  | 69,798   | 236,251  | 183,601                      | 235,918  | 166,792                      | 225,380  | 148,490                      | 230,451  |

Table 2.—Comparison of year-class variation and age-specific changes in return rates for two nearly fully recruited year-classes (1996 and 1997) of summer steelhead (Skamania strain) stocked in Michigan tributaries to Lake Michigan. Returns are from 1999 and 2000 collection efforts. The number of fish is adjusted per 100,000 fish stocked/site/river/year.

| Plant<br>year | Ages  | St Joseph River |               |                  |          |           | Manistee River |             |
|---------------|-------|-----------------|---------------|------------------|----------|-----------|----------------|-------------|
|               |       | Pier 33         | Arden<br>Pond | Shamrock<br>Park | Buchanan | Mishawaka | Tippy Dam      | High Bridge |
| 1997          | 1     | 0               | 0             | 0                | 0        | 0         | 0              | 0           |
|               | 2     | 30              | 47            | 64               | 38       | 48        | 49             | 27          |
|               | 3     | 90              | 117           | 149              | 53       | 136       | 62             | 33          |
|               | 4     | 40              | 117           | 181              | 61       | 66        | 62             | 33          |
|               | Total | 160             | 281           | 394              | 152      | 250       | 174            | 93          |
| 1998          | 1     | 0               | 0             | 0                | 0        | 0         | 0              | 0           |
|               | 2     | 38              | 26            | 53               | 11       | 43        | 18             | 18          |
|               | 3     | 63              | 129           | 75               | 33       | 79        | 58             | 60          |
|               | Total | 101             | 155           | 128              | 44       | 122       | 76             | 78          |

Table 3.—Comparison of year-class variation and age-specific changes in return rates for two nearly fully recruited year classes (1996 and 1997) of winter steelhead (Michigan strain) stocked in Michigan tributaries to Lake Michigan. Returns are from 1999 and 2000 collection efforts. The number of fish is adjusted per 100,000 fish stocked/site/river/year.

| Plant year | Ages  | St Joseph River |            |               | Manistee River |           |          | Muskegon River |           |                      | Au Sable River |         |             |        |
|------------|-------|-----------------|------------|---------------|----------------|-----------|----------|----------------|-----------|----------------------|----------------|---------|-------------|--------|
|            |       | Pier 33         | Arden Pond | Shamrock Park | Buchanan       | Mishawaka | Manistee | High Bridge    | Tippy Dam | Muskegon Lake outlet | Muskegon Park  | Henning | Pine Street | Harbor |
| 1997       | 1     | 0               | 0          | 0             | 0              | 0         | 0        | 0              | 0         | 0                    | 16             | 5       | 0           | 0      |
|            | 2     | 73              | 145        | 65            | 88             | 128       | 15       | 52             | 64        | 126                  | 132            | 18      | 61          |        |
|            | 3     | 138             | 304        | 137           | 162            | 204       | 73       | 200            | 96        | 203                  | 203            | 47      | 96          |        |
|            | 4     | 29              | 43         | 50            | 96             | 23        | 15       | 37             | 43        | 38                   | 88             | 37      | 39          |        |
|            | Total | 240             | 492        | 252           | 345            | 356       | 95       | 289            | 203       | 385                  | 428            | 101     | 196         |        |
| 1998       | 1     | 0               | 17         | 20            | 0              | 10        | 7        | 0              | 0         | 5                    | 5              | 0       | 6           |        |
|            | 2     | 40              | 94         | 61            | 50             | 128       | 41       | 41             | 60        | 66                   | 86             | 55      | 70          |        |
|            | 3     | 60              | 128        | 51            | 10             | 69        | 7        | 61             | 70        | 46                   | 102            | 110     | 64          |        |
|            | Total | 100             | 239        | 133           | 61             | 207       | 54       | 101            | 130       | 117                  | 193            | 165     | 140         |        |

Table 4.—Steelhead coded-wire tag returns from lake-caught (lakes Michigan and Huron) fish from 1996 through July of 2001 (all years combined). Numbers are adjusted to a stocking rate of 100,000 fish/site/river/year.

| River                           | Stocking location             | Classification | Skamania strain |                            | Michigan strain |                            |
|---------------------------------|-------------------------------|----------------|-----------------|----------------------------|-----------------|----------------------------|
|                                 |                               |                | Number          | Number per 100,000 stocked | Number          | Number per 100,000 stocked |
| St. Joseph River                | Pier 33                       | Mouth          | 34              | 357                        | 83              | 785                        |
|                                 | Sportsmans Club-Arden Pond    | Mid-17P        | 100             | 1,128                      | 83              | 1,008                      |
|                                 | Shamrock Park-Berrien Springs | Mid-23         | 53              | 562                        | 72              | 697                        |
|                                 | Buchanan City Launch-Smittys  | Mid-32         | 54              | 565                        | 75              | 692                        |
|                                 | Mishawaka-Lincoln Park        | Up-55          | 102             | 408                        | 117             | 661                        |
| Indiana-Merrifield Park S. Bend | Up-60                         | — <sup>a</sup> | — <sup>a</sup>  | 40                         | 227             |                            |
| Manistee River                  | Manistee                      | Mouth          | —               | —                          | 50              | 358                        |
|                                 | High Bridge                   | Mid            | 62              | 436                        | 50              | 369                        |
|                                 | Tippy Dam                     | Up             | 90              | 552                        | 100             | 719                        |
| Manistique River                | City of Manistique            | Mouth          | —               | —                          | 20              | 257                        |
| Muskegon River                  | Muskegon Lake outlet          | Mouth          | —               | —                          | 71              | 772                        |
|                                 | Henning Park                  | Mid            | —               | —                          | 131             | 797                        |
|                                 | Pine Street                   | Up             | —               | —                          | 180             | 974                        |
| Sturgeon River                  | Big Bay DeNoc-499 Bridge      | Mouth          | 4               | 70                         | 9               | 183                        |
|                                 | Sturgeon River                | Up             | 4               | 83                         | 5               | 50                         |
| Au Sable River                  | Harbor                        | Mouth          | —               | —                          | 130             | 606                        |
|                                 | Rea Road                      | Up             | —               | —                          | 140             | 689                        |
| Total                           |                               |                | 503             | 4,161                      | 1,356           | 9,844                      |

<sup>a</sup> No Skamania were stocked in 1996 by the State of Indiana

Table 5.—Adjusted number of marked steelhead returned in mouth-, mid- and up-stream river fisheries during 1999 and 2000 (the number of fish is adjusted per 100,000 fish stocked/site/river/year). Michigan strain and Skamania returned are both provided.

| River              | Classification                  | Stock site                 | Number Michigan strain | Number Skamania strain |
|--------------------|---------------------------------|----------------------------|------------------------|------------------------|
| Au Sable River     | Mouth                           | Harbor                     | 1,182                  |                        |
|                    | Up                              | Rea Road                   | 1,555                  |                        |
| Big Manistee River | Mouth                           | Manistee                   | 1,054                  |                        |
|                    | Mid                             | High Bridge                | 3,220                  | 1,284                  |
|                    | Up                              | Tippy Dam                  | 5,144                  | 1,706                  |
| Muskegon River     | Mouth                           | Muskegon Lake Outlet       | 1,591                  |                        |
|                    | Mid                             | Henning Park               | 3,774                  |                        |
|                    | Up                              | Pine Street                | 5,683                  |                        |
| St. Joseph River   | Mouth                           | Pier 33                    | 3,491                  | 472                    |
|                    | Mid-17P                         | Sportsmans Club-Arden Pond | 3,234                  | 1,895                  |
|                    |                                 | Shamrock Park-             |                        |                        |
|                    | Mid-23                          | Berrien Springs            | 3,569                  | 829                    |
|                    | Mid-32                          | Buchanan City Launch-      |                        |                        |
|                    | Up-55                           | Smittys                    | 3,699                  | 880                    |
| Up-60              | Mishawaka-Lincoln Park          | 3,805                      | 768                    |                        |
|                    | Indiana-Merrifield Park S. Bend | 1,294                      | —                      |                        |

Table 6.—Description of the number of marked Michigan and Skamania steelhead caught in lakes Michigan and Huron. The number caught indicates the actual number of heads returned from 1996 to 2000. The adjusted number indicates the number caught adjusted to a stocking rate of 100,000 fish/site/river/year.

| River of origin  | Number caught |          | Number per 100,000 stocked |          |
|------------------|---------------|----------|----------------------------|----------|
|                  | Michigan      | Skamania | Michigan                   | Skamania |
| Manistee River   | 200           | 152      | 482                        | 494      |
| St. Joseph River | 470           | 499      | 794                        | 878      |
| Muskegon River   | 382           |          | 886                        |          |
| Au Sable River   | 270           |          | 648                        |          |
| Sturgeon River   | 14            | 8        | 116                        | 77       |
| Manistique River | 20            |          | 257                        |          |