

MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS  
FISHERIES DIVISION

JOB PROGRESS REPORT

STATE: Montana PROJECT: Statewide Fisheries Investigations

PROJECT NO: F-46-R-2 STUDY TITLE: Survey and Inventory of Warm  
Water Streams

JOB NO: III-b JOB TITLE: Southeast Montana Warm Water Streams  
Investigations

SEGMENT (FISCAL) PERIOD: July 1, 1988 through June 30, 1989

REPORT PERIOD: April 1, 1988 through March 31, 1989

ABSTRACT

Of 18 sauger tag returns, from sauger tagged just downstream from the Cartersville Diversion Dam, only one moved upstream over the diversion dam. Significant numbers of sauger young-of-year (YOY) were found in the section in 1988. Yellowstone River sauger ate at least four fish species. Approximately 25 million eggs were collected from Yellowstone River walleye at Intake. Overall, 28% of these eggs survived to hatching. LHRHa significantly improved ripening percentage of green walleye females without effect on egg viability. Eggs fertilized with turbid river water survived at least as well as eggs fertilized with settled or filtered river water. Limited sampling failed to locate any northern pike in Bennie Peer Creek.

OBJECTIVES AND DEGREE OF ATTAINMENT

1. To determine effect of Yellowstone River low-head diversion dams on game fish distribution and abundance; provide for additional angler days for warm water species at upstream points. Work was done toward this objective on the Yellowstone River in the Forsyth area.
2. To understand the significance to game fish of Yellowstone River non-game species. Sauger food items from the Yellowstone River near Forsyth were examined.
3. To obtain a minimum flow on the Tongue River downstream of the T&Y diversion of 525 cfs for the period April 1 through May 10. The Montana Department of Natural Resources and Conservation has verbally agreed to a plan to release the needed flows from Tongue River Dam. Formal written concurrence with the plan is expected later this month. Tongue River Water Users must also agree to this plan.

4. To ensure that legally mandated instream flows are met. These flows were not met for extended periods in summer 1988 because of extreme drought conditions. Water users junior to the Yellowstone Reservation were required to cease water use.
5. To collect up to 50 million walleye eggs each year with average survival to hatching of 60%. We collected 25 million eggs in 1988; 28% survived to hatching.
6. To maintain existing water quality and bank-channel condition. Projects were reviewed under two state laws. These projects were approved as planned, modified, or denied, depending on the kind and degree of effect on river banks and channels. Projects done in violation of one of the two state laws were restored to previous condition.

### Methods

River fish populations were sampled with boat-mounted electrofishing gear. A 17-foot long jet powered boat with a Coffelt VVP unit and boom mounted electrodes was used on the Yellowstone River. Fish were weighed to the nearest gram and length measured to the nearest millimeter. Fish were tagged using Floy "anchor" and "cinch-up" tags.

I obtained sauger gut contents by pressing with the thumb on the ventral side of the fish in the region of the gut, causing regurgitation. The efficiency of this technique was previously demonstrated by dissection of the gut following attempts to cause regurgitation with external pressure.

Fish were sampled from Bennie Peer Creek with a back-pack electrofisher and with a 1/4" bag seine.

Walleye females captured by electrofishing were held in nylon mesh lives cars or in metal tanks drilled out with 1 inch diameter holes to allow water flow. LHRHa was obtained from Syndel Laboratories, Vancouver, British Columbia. Fish treated with hormones received 0.02 mg/kg body weight of LHRHa the day of capture and the same dose 48 hours later if ripening had not already occurred. LHRHa was dissolved in 0.7 percent saline and injected into the peritoneal cavity with a 20 gauge inch long needle.

All water used for fertilization was taken from the Yellowstone River. Untreated water was dipped directly from the river as each pan of eggs was fertilized. Water referred to as "settled water" was dipped into a steel tank in the river so that it's temperature would be the same as river water. This water was allowed to settle and clarify at least an hour before being used for fertilization. Water referred to as "filtered water" was obtained from the "settled water" tank and was pressure filtered

through Millipore Corp. filter pads. These pads were type AP of pore size "prefilter." Both "settled" and "filtered" water were of obviously greater water clarity than untreated water. All eggs were fertilized at water temperatures in the range 47-54 F. This was within the optimal range found by Koenst and Smith (1976).

Eggs from different hormone and fertilization water treatments were kept separate in nylon mesh trays floated in the river. Eggs were bagged separately in the field for transportation to the hatchery and were cultured separately in jars at the Miles City Hatchery.

## RESULTS

### Yellowstone River Fish Population Work

Recent investigations on fish density and movement have centered on the Cartersville Diversion Dam on the Yellowstone River at Forsyth. I suspect this structure impedes sauger movement upstream because sauger density is much lower upstream of the diversion dam.

In September and October 1988 sport and game species were tagged in a six kilometer river section immediately downstream of the Cartersville Diversion Dam. A total of 233 sauger were tagged in 1988 (Table 1). No tags from these fish have been returned to date.

Sauger were also tagged in this section in 1987 (Stewart 1988). Nine sauger were tagged in May 1987 and 249 in fall 1987. Of the total of 258 sauger tagged in 1987, 18 have been returned to date by anglers. Of these 10 were returned in spring 1988 from the vicinity of the mouth of the Tongue River (5) or the vicinity of the mouth of the Powder River (5). Five were caught by anglers in the tagging section. Two more were caught at other downstream points. Only one sauger was caught at an upstream point. This fish moved upstream over the Cartersville Diversion Dam and was caught in September 1988 just downstream of the Huntley Diversion Dam a few miles downstream from Billings.

Length frequency of sauger sampled downstream from Cartersville Diversion Dam was compiled for the 233 sauger sampled in fall 1988 (Table 2). Percentages for the various size groups is very similar to those fish sampled in 1987 (Stewart 1988) with the exception of young-of-year (YOY) sauger. YOY were not found in 1987, but 21 (9% of the sample) were found in 1988. These YOY sauger ranged in length from 166 to 217 mm total length.

### Sauger Gut Contents

I examined gut contents of the 233 fall sampled sauger from the Yellowstone River near Forsyth. Only 18 fish (7.7%) had food items in the gut. All food items were fish. Number of sauger containing the following items were: stonecat (3), shorthead redhorse (1), burbot (1), unidentified sucker (1), unidentified fish (12).

### Walleye Egg Collection

Average size of walleye spawners in 1988 was smaller than previous years for males (Table 3) but only a small sample was weighed and measured. The 1988 calculated average length and weight may be misleading. Average weight of females in 1988 was the heaviest measured in 5 years, but the 1988 average length was exceeded slightly in 1986. General abundance of walleye in the Intake area seemed similar to previous years.

Approximately 25 million walleye eggs were collected at Intake in 1988. Averaging over the various egg experiments, 28% of eggs survived to hatching.

LHRHa was effective in ripening female walleye (Table 4). For LHRHa injected fish 88% ripened within a week following the first injection. Only 39% of uninjected fish ripened in one week. This difference was statistically significant at the 99% level of confidence, using the "students t" test.

Experiments were also done to determine the effect of injected LHRHa on egg eye-up percentage. General results of these experiments are shown in Table 5. Overall, eggs from uninjected fish eyed-up at a 31.8% rate; the corresponding figure for eggs from injected fish was 24.6%. However, this difference was not statistically significant. The calculated "students t" was 1.16, well below the value of 1.71 required for significant at the 90% level.

Both filtered and settled water resulted in eye-up percentages lower than those for eggs fertilized in untreated river water (Table 5). This was true for both LHRHa treated and untreated walleye females. Obviously, there was no advantage to settling or filtering river water for egg fertilization.

### Bennie Peer Creek

In fall 1985, Richland County completed a project on Bennie Peer Creek in violation of the Stream Protection Act. The project area was along the county road crossing of Bennie Peer Creek a few hundred feet upstream of the confluence of the creek with the Yellowstone River. The project consisted of replacing a bridge with a five foot culvert and digging a cutoff channel. A new

bridge was placed over the cutoff channel for the county road. Low flows go through the old channel and culvert. Higher flows go through both channels, with the cutoff channel carrying most of the water during runoff periods. The culvert quickly became plugged with debris, water ponded behind the culvert and only small amounts of water were able to flow downstream through the culvert.

This stream had been found to support northern pike (Elser, Gorges and Morris 1980). Northern pike in this small stream are felt to be largely spawning migrants from the Yellowstone River. Most of the movement into Bennie Peer Creek probably occurs during early spring at times of snow melt runoff. I questioned the suitability of the new, steepened cutoff channel to pass northern pike upstream.

To stabilize the cutoff channel and to aid northern pike in moving upstream, five one foot high drop structures were built in the cutoff channel. Questions still remained concerning the suitability of the cutoff channel to pass northern pike. I planned to sample fish in the stream to see if northern pike were able to move upstream of the cutoff channel.

Early spring and late summer sampling in 1988 upstream of the cutoff channel failed to locate any northern pike. Streamflows were extremely low throughout the drought year of 1988, so questions concerning northern pike passage are still unanswered. Very little sampling was done because I felt that streamflows in 1988 were too low to attract northern pike into Bennie Peer Creek from the Yellowstone River.

On April 4, 1988 approximately 300 yards of Bennie Peer Creek was electrofished with a backpack unit. The location was immediately downstream of the Highway 23 bridge. No fish were sampled but a dead carp and a dead white sucker were observed. Flow was estimated at one cfs. Two pools in the same area were seined on September 2, 1988. Species sampled were fathead minnow, flathead chub, carp, river carpsucker (YOY) and brook stickleback.

An area just upstream of the cutoff channel was also sampled on September 2, 1988. Approximately 100 yards of deeper run and pool was seined. Species found were fathead minnow, flathead chub and carp YOY.

#### LITERATURE CITED

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- Koenst, W.M. and L.L. Smith. 1976. Thermal requirements of the early life history stages of walleye and sauger. J. Fish Res. Bd. Can 33:1130-1138.

Stewart, P.A. 1988. Southeast Montana warm water streams investigations. Job. Prog. Rept. F-46-R-1, Job III-b. NE. Dept. Fish, Wildl and Parks. 10 pp.

Waters Referred to:

|                          |           |
|--------------------------|-----------|
| Bennie Peer Creek        | 7-21-0083 |
| Yellowstone River Sec 01 | 7-21-1350 |
| Yellowstone River Sec 02 | 7-21-1400 |
| Tongue River Sec 01      | 7-21-1150 |

Key Words:

Sauger-movement, passage, gut contents  
Walleye egg collection, ripening with hormones  
Northern pike-passage

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Table 1. Size means and ranges for fish species captured in a 6 kilometer section of the Yellowstone River immediately downstream from the Cartersville Diversion Dam near Forsyth in September and October, 1988.

| Species             | Number<br>Sampled | Mean<br>Length<br>(mm) | Mean<br>Weight<br>(gm) | Length<br>Range<br>(mm) | Weight<br>Range<br>(gm) |
|---------------------|-------------------|------------------------|------------------------|-------------------------|-------------------------|
| Sauger              | 233               | 390                    | 561                    | 166-618                 | 20-2010                 |
| Walleye             | 6                 | 480                    | 1172                   | 363-581                 | 450-2070                |
| Smallmouth bass     | 70                | 179                    | 237                    | 85-422                  | 5-1410                  |
| Channel catfish     | 56                | 447                    | 1044                   | 277-720                 | 150-3580                |
| Freshwater drum     | 9                 | 350                    | 636                    | 290-445                 | 280-1400                |
| Northern pike       | 4                 | 712                    | 2420                   | 561-805                 | 1160-3200               |
| Black crappie       | 9                 | 188                    | 123                    | 137-253                 | 35-290                  |
| Yellow perch        | 1                 | 233                    | -                      | -                       | -                       |
| Burbot              | 2                 | 308                    | 135                    | 295-320                 | 120-150                 |
| Brown trout         | 1                 | 330                    | 410                    | -                       | -                       |
| Green sunfish       | 1                 | 117                    | 20                     | -                       | -                       |
| Shovelnose sturgeon | 4                 | 774 <sup>a/</sup>      | 2100                   | 708-832                 | 1390-2940               |

a/ Fork length

Table 2. Length frequency distribution for 233 sauger captured in the Yellowstone River near Forsyth, MT, September and October 1988.

| Length class (mm) | Number | Percentage of Total |
|-------------------|--------|---------------------|
| 150-199           | 14     | 6.0                 |
| 200-249           | 7      | 3.0                 |
| 250-299           | 1      | 0.4                 |
| 300-349           | 36     | 15.5                |
| 350-399           | 65     | 27.9                |
| 400-449           | 58     | 24.9                |
| 450-499           | 30     | 12.9                |
| >500              | 22     | 9.4                 |

Table 3. Size of walleye sampled from the spawning run in April at Intake, Yellowstone River.

| Year           | N   | Mean Length (mm) | Mean Weight (gm) | Length Range (mm) | Weight Range (gm) |
|----------------|-----|------------------|------------------|-------------------|-------------------|
| <u>Males</u>   |     |                  |                  |                   |                   |
| 1984           | 129 | 499              | 1340             | 366-631           | 350-2970          |
| 1985           | 46  | 505              | 1350             | 362-619           | 460-2700          |
| 1986           | 141 | 508              | 1493             | 361-625           | 450-3100          |
| 1987           | 109 | 510              | 1446             | 377-630           | 490-2600          |
| 1988           | 22  | 468              | 1146             | 388-620           | 500-3000          |
| <u>Females</u> |     |                  |                  |                   |                   |
| 1984           | 78  | 569              | 2040             | 470-695           | 1090-3650         |
| 1985           | 42  | 581              | 2214             | 498-704           | 1500-3700         |
| 1986           | 40  | 600              | 2428             | 505-674           | 1410-3600         |
| 1987           | 187 | 570              | 2150             | 483-710           | 1200-4000         |
| 1988           | 207 | 592              | 2500             | 480-730           | 1300-5000         |

Table 4. Effect of LHRHa injection on ripening of green female walleye, April 1988.

| Date of capture        | Number of fish | <u>Ripening within one week</u> |            |
|------------------------|----------------|---------------------------------|------------|
|                        |                | Number                          | Percentage |
| <u>Injected Fish</u>   |                |                                 |            |
| 4-9                    | 6              | 6                               | 100        |
| 4-10                   | 14             | 13                              | 93         |
| 4-13                   | 13             | 13                              | 100        |
| 4-14                   | 18             | 16                              | 89         |
| 4-15                   | 19             | 18                              | 95         |
| 4-16                   | 33             | 28                              | 85         |
| 4-17                   | 26             | 26                              | 100        |
| 4-18                   | 27             | 24                              | 89         |
| 4-19                   | 38             | 30                              | 79         |
| 4-20                   | 14             | 9                               | 64         |
| Total or mean          | 208            | 163                             | 68         |
| <u>Uninjected fish</u> |                |                                 |            |
| 4-11 & 12              | 14             | 4                               | 29         |
| 4-21                   | 12             | 7                               | 58         |
| 4-22 & 23              | 5              | 1                               | 20         |
| Total or Mean          | 31             | 12                              | 39         |

Table 5. Walleye egg eye-up percentages for eggs from females injected or not injected with LHRHa and fertilized in three types of water.

| Date                   | <u>River water</u> |                  | <u>Settled River Water</u> |                  | <u>Filtered River water</u> |                  |
|------------------------|--------------------|------------------|----------------------------|------------------|-----------------------------|------------------|
|                        | Percent            | Millions of eggs | Percent                    | Millions of eggs | Percent                     | Millions of eggs |
| <u>Injected Fish</u>   |                    |                  |                            |                  |                             |                  |
| 4-14                   | 46                 | 0.40             |                            |                  | 32                          | 0.67             |
| 4-16                   | 11                 | 0.35             | 7                          | 0.52             | 9                           | 0.62             |
| 4-18                   | 43                 | 1.90             | 16                         | 1.10             | 31                          | 1.72             |
| 4-20                   | 33                 | 2.64             | 35                         | 2.33             | 39                          | 0.80             |
| 4-22                   | 20                 | 2.54             | 21                         | 1.28             | 17                          | 1.64             |
| 4-24                   | 16                 | 0.98             | 9                          | 0.77             | 8                           | 0.72             |
| Wt mean<br>or total    | 29.2               | 8.81             | 22.7                       | 6.00             | 23.5                        | 6.17             |
| <u>Uninjected fish</u> |                    |                  |                            |                  |                             |                  |
| 4-14                   | 0                  | 0.23             |                            |                  |                             |                  |
| 4-16                   |                    |                  |                            |                  | 18                          | 0.35             |
| 4-18                   | 60                 | 0.24             |                            |                  | 34                          | 0.75             |
| 4-20                   | 49                 | 0.57             | 36                         | 0.45             |                             |                  |
| 4-22                   | 37                 | 0.41             | 21                         | 0.53             |                             |                  |
| 4-24                   | 31                 | 0.48             |                            |                  |                             |                  |
| Wt mean<br>or total    | 37.5               | 1.93             | 27.9                       | 0.98             | 28.9                        | 1.10             |

