MONTANA DEPARTMENT OF FISH AND GAME REPORT

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Fisheries Division

Job Progress Report

Annual Progress Report

# HABITAT DEVELOPMENT OF YOUNG CREEK, TRIBUTARY TO LAKE KOOCANUSA

July 1, 1973 - June 30, 1974

By

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Reservoir Investigation Project

MONTANA DEPARTMENT OF FISH AND GAME
FISHERIES DIVISION

JOB PROGRESS REPORT

Project Title: Habitat Development of Young Creek, Tributary to Lake Koocanusa

Job Title: Stream fish population determinations and migration patterns for Young Creek, July 1969 through July 1974


## ABSTRACT

This report covers the period through July 31, 1974 so that most of the data from the upstream and downstream migration could be included.

The spawning run of westslope cutthroat trout entering Young Creek from Lake Koocanusa increased to about 300 fish. Nearly all of these fish appeared to be adfluvial westslope cutthroat with some of them being from imprint plants made in Young Creek. Approximately 1,400 cutthroat smolts were captured in the downstream trap by August 1, 1974. High flows from a record snowpack prevented efficient trap operation and some downstream migrants were not caught in the trap. Survival and growth of the imprint fry plants in the stream were excellent. Overall, the hatchery-reared cutthroat appear to be following the typical adfluvial westslope life cycle quite closely.


## BACKGROUND

Young Creek was selected to determine the feasibility of establishing spawning runs of an adfluvial [1/] strain of westslope cutthroat (Salmo clarki subsp.) in suitable tributary streams of Lake Koocanusa. Young Creek has its source on the east slopes of the Purcell Mountains in Lincoln County, Montana and flows east approximately 15 miles to its confluence with Lake Koocanusa.

The gradient in the developed section is moderately high, averaging 120 feet per mile. Peak annual flows have averaged over 100 cfs and the average annual low flows have been between 5 and 10 cfs. Water temperatures have ranged from 32°F. to 65°F. with the highs in August averaging 60°F. Young Creek is a moderately productive stream with total alkalinities and standard conductivities of over 130 ppm and 200 micromhos per cc., respectively, in the summer and fall. Fish species found in the stream included fluvial and resident westslope cutthroat, rainbow (Salmo gairdneri) and brook trout (Salvelinus fontinalis).

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1/ Adfluvial refers to fish that migrate from a lake or reservoir into a stream to spawn, whereas fluvial fish migrate from a river to spawn in a tributary stream.

The Corps of Engineers designed and built an upstream-downstream fish trap immediately above full-pool elevation in the fall of 1969. Initial development work on the project consisted of removal or alteration of barriers to fish migration from the junction of the North and South Fork downstream to the mouth (a distance of about 11 miles) in the summer of 1970. The existing fish population in the upper seven miles of this section was eliminated using rotenone in August, 1970, and the initial imprint plant of 50,000 adfluvial westslope cutthroat was made in September 1970. Annual plantings of about 50,000 subfingerling cutthroat have been made from 1970-1972 with about 32,000 being planted in 1973.

Adfluvial cutthroat live from one to three years in the natal stream before emigrating into the lake or reservoir. They grow and mature for one to three years in the lake before returning to spawn. The majority spend two years in the natal stream and two years in the lake before maturing and returning to spawn. The first adfluvial cutthroat were planted in 1970 as Age 0+ fish. The majority of these fish should have emigrated in 1972 and returned to spawn for the first time in 1974. Smolting appeared to be delayed by one year from slow growth rates and comparatively low densities, May and Huston (1973).

## PROCEDURES

Both adult and juvenile fish were cold branded using liquid nitrogen as the coolant. Four different brand symbols and sizes were utilized to distinquish age classes (Table 1) and separate adults from juveniles. The fish were branded on the right side mid-way between the dorsal fin and lateral line. Spent adults and juveniles over 7.0 inches caught in the downstream trap were also jaw-tagged. Thirty scale samples were taken per inch group and most fish were measured and weighed. Methods outlined by Vincent (1971) were used during electrofishing operations and population parameters were calculated by a computer program. A 30-day Foxboro thermograph was used to monitor water temperatures and a continuous flow recorder was installed and operated by the United State Geological Survey.

Table 1. Brand symbols placed on juvenile and adult fish emigrating from Young Creek in 1974

| Brand symbol | Brand size | Length group | Age of most fish |
|---|---|---|---|
| ⊢ | 1/4" | 2.0 - 3.9" | 1 |
| V | 1/4" | 4.0 - 5.9" | 2 |
| H | 3/8" | 6.0 - 9.9" | 2 & 3 |
| T | 1/2" | 10.0 - 18.0" | 4 & older |

## OBJECTIVES

The primary objective of this project is to establish and maintain a spawning run of an adfluvial strain of westslope cutthroat trout in Young Creek.

The objectives of this fiscal-year segment were: (1) maintain fish passage, (2) make imprint plants of adfluvial cutthroat, (3) evaluate growth and survival of imprint plants in stream, (4) monitor movements of adult spawners into stream and emigration of juveniles, (5) determine growth, movement and survival of juveniles in the reservoir through a tagging and marking study and (6) evaluate trapping and sorting facilities.

## FINDINGS

### Habitat Development and Maintenance

Young Creek was surveyed for potential barriers to fish migration from the junction of the North and South Forks to the mouth, a distance of 11 miles. Problem areas were limited to about five sites. Flows were recorded throughout the year to obtain basic flow data. Communication was maintained with the rancher who is developing the new irrigation diversion from Young Creek.

### Spawning Run

The data gathered from the 1973 and 1974 spawning runs are summarized in Table 2. The 1974 run (306 adult fish) was about three times larger than the 1973 run. The coloration pattern and body configuration indicated that most fish were the adfluvial strain of cutthroat. The run extended from May 4 to June 23, about three weeks longer than recorded previously. Record high flows and lower than normal water temperatures probably combined to delay the run. The high flows also prevented efficient sampling to determine spawning areas and how far upstream adults moved to spawn. Several adults were caught by anglers four miles upstream from the trap.

Table 2. Parameters of cutthroat trout spawning run from Lake Koocanusa into Young Creek, 1973-1974

| Parameter | Year 1973 | Year 1974 |
|---|---|---|
| Number of spawners | 102 | 306[1/] |
| Sex ratio (male:female) | 1.0:1.04 | 1.0:1.6 |
| Average length (male) | 12.6 | 13.7 |
| Average length (female) | 13.2 | 14.2 |
| Number of repeat spawners from past years | 2 | 4 |
| Number of fish marked or tagged as juveniles emigrating from Young Creek | 1 | 7 |
| Estimated fecundity[2/] | 43,680 | 150,130 |

1/ Calculated from a modified Peterson Index
2/ Fecundity based on data collected from Hungry Horse Creek where a one-pound female contained about 1,000 eggs.

The trap efficiency for the adults was only about 75 percent this year as compared to near 100 percent in 1973. Flows of over 80 cfs for extended periods during the run reduced trap efficiency.

The number of repeat spawners (four) and the number of fish (seven) marked as juveniles when emigrating from Young Creek were comparatively low. Most of the adults returning to spawn in 1974 should have been survivors from the smolts which emigrated to the reservoir in 1972. This was a high-water year and trap efficiency was comparatively low, thereby enabling many fish to return to the reservoir unmarked. High mortalities from disease and/or predation could also have been a significant factor in the low return of marked juvenile fish. Nicola and Cordone (1973) found that fin removal seriously affected the survival of fingering rainbow trout in Castle Lake, California. The use of cold branding as a marking tool for juveniles since 1974 may eliminate the problem of differential mortalities between marked and unmarked fish and increase the number of fish in the run. In spite of comparatively low numbers of smolts which emigrated from Young Creek in 1972 and the large numbers of smolts which migrated downstream out of the reservoir in the 1972-73 winter, the 1974 run was large.

Instream Fish Populations

Fish population data from the two sections where population estimates were made are summarized in Tables 3, 4a and 4b. Section 1 (1,150 feet long) is located in the lower four miles of Young Creek which was not chemically treated. Comparatively few adfluvial cutthroat have been planted in this area. Prior to the Young Creek development, this section contained resident and fluvial cutthroat with a few brook trout. Section 3 (1,500 feet long) is located in the middle of the area which was chemically treated to reduce resident fish populations and has received annual plants of about 6,000 adfluvial subfingerlings per mile from 1970 to 1972 and about 4,000 per mile in 1973 and 1974. Prior to treatment, the species complex consisted of resident cutthroat and brook trout in about equal numbers. Data from Section 1 provide base line information on the influence of an adfluvial cutthroat trout population superimposed upon a resident and fluvial cutthroat trout population, whereas Section 3 is sampled to determine growth, survival and standing crops of the imprint plants, along with rate of re-invasion by brook trout.

The species complex in Section 1 in 1973, almost 97 percent cutthroat and 3 percent brook trout, indicated that cutthroat have become relatively more numerous than brook trout in the past few years. The age structure of the population in 1973 was somewhat different than in 1972. This is most likely a result of emigration of the older fish in 1973 prior to sampling and the influence of imprint plants. The standing crop in terms of pounds of fish per 1,000 feet of stream was almost identical in 1972 and 1973 as were the growth rates and condition factors. The standing crop of about 60 pounds of cutthroat trout per surface acre in both years demonstrates that this is a productive section of stream.

Cutthroat trout comprised 96 percent of the fish collected in Section 3 as compared to only 4 percent for brook trout. Those results are comparable to the two previous years and show very little re-population of this section by brook trout.

Table 3. Population estimates of cutthroat trout in Section 1, Young Creek, 1972 and 1973

| Age Class | Average length in inches | Average weight in pounds | Percent age composition | Number per 1,000 feet | Pounds per 1,000 feet | Pounds per surface acre | Average condition factor |
|---|---|---|---|---|---|---|---|
| July 18, 1972 | | | | | | | |
| 1 | 3.4 | .02 | 65.5 | 237 | 4.4 | -- | -- |
| 2 | 5.8 | .08 | 20.9 | 76 | 5.9 | -- | -- |
| 3 | 7.3 | .16 | 13.0 | 47 | 7.4 | -- | -- |
| 4 | 10.4 | .28 | 0.6 | 2 | 0.6 | -- | -- |
| Totals | | | | 362 (±29%)[1/] | 18.3 | 63.6 | 37.6 |
| September 13, 1973 | | | | | | | |
| 1 | 3.8 | .02 | 80.4 | 392 | 9.0 | -- | -- |
| 2 | 5.4 | .06 | 15.1 | 74 | 4.5 | -- | -- |
| 3 | 7.2 | .14 | 3.2 | 16 | 2.3 | -- | -- |
| 4 | 8.5 | .21 | 1.3 | 7 | 1.4 | -- | -- |
| Totals | | | | 489 (±20%) | 17.2 | 57.6 | 37.5 |

1/ 95 percent confidence limits in parenthesis

Table 4a. Population estimates of cutthroat trout in Section 3 of Young Creek, 1972 and 1973

| Age Class | Average length in inches | Average weight in pounds | Percent age Composition | Number per 1,000 feet | Pounds per 1,000 feet | Pounds per surface acre | Average Condition factor |
|---|---|---|---|---|---|---|---|
| July 20, 1972 | | | | | | | |
| 1 | 3.1 | .02 | 70.5 | 457 | 7.5 | -- | -- |
| 2 | 4.6 | .04 | 28.7 | 186 | 7.8 | -- | -- |
| 3 | 7.3 | .15 | 0.8 | 5 | 0.7 | -- | -- |
| Totals | | | | 648(±26%)[1/] | 16.0 | 53.2 | 41.3 |
| September 11, 1973 | | | | | | | |
| 1 | 3.5 | .02 | 77.9 | 564 | 11.0 | -- | -- |
| 2 | 5.0 | .05 | 18.8 | 136 | 7.0 | -- | -- |
| 3 | 6.2 | .10 | 3.3 | 24 | 2.4 | -- | -- |
| Totals | | | | 724(±45%) | 20.4 | 68.7 | 40.0 |

1/ 95 percent confidence limits in parenthesis

Table 4b. Annual instream survival rates of adfluvial cutthroat planted in Young Creek - Section 3

| Year class | Number planted by 1,000 feet of stream | Percent annual survival rate to[1/] 1971 | 1972 | 1973 |
|---|---|---|---|---|
| 1970 | 1,350 | 29 | 47 (14) | 13 ( 2) |
| 1971 | 1,350 | -- | 33 | 30 (10) |
| 1972 | 1,350 | -- | -- | 42 |

1/ Percent of original number surviving to second and third year shown in parenthesis

The section contains an excellent population of adfluvial cutthroat juveniles. The standing crop estimate was 724 Age 1 and older fish weighing 20.4 pounds per thousand feet of stream or 69 pounds of fish per surface acre of water. The growth rates in this section were comparable to pre-treatment rates, indicating that the reduction in insect populations from rotenone was temporary.

The annual instream survival rates of the imprint plants from Age 0+ fingerling stage to Age 1+ have been excellent ranging from 29 to 42 percent. The lack of competition from large resident fish has contributed to the high survival rates. The instream survival rate of the 1970 plant from Age 1+ to Age 2 was about 30 percent. These comparatively low instream survival rates are likely due to many fish emigrating from Young Creek between July, 1972 and September, 1973. Thus the actual survival of each year class is believed to be higher than the instream survival rates.

A section was sampled immediately upstream from the meadow to determine if brook trout had re-populated the area in numbers. This was not the case as over 95 percent of the fish collected were cutthroat.

Outmigrant Juveniles

The number of smolts increased markedly from 1972 to 1973 (Table 5). Initial data collected in 1974 also indicate an increase in smolts from previous years. The timing of the migration and the trap efficiency varies from year to year depending on the magnitude and duration of the flows. For example in 1974, an unusually high water year, the downstream trap was inoperable due to high water 44 days as compared to only 7 days in 1973, a low water year. Thus, the trap catch likely represents only a part of the total number of juveniles emigrating.

The age composition and growth rates of the 1973 trap catch are summarized in Table 6. More Age 3 fish (1970 year class) were present than normal and these fish from the initial plant had slower growth rates than the other year classes. These data are in accord with the data collected by electrofishing. Preliminary analysis of the 1974 emigration indicates that the majority of the fish are Age 2. Overall, the fish from the imprint plants appear to be following the typical life cycle of adfluvial cutthroat quite closely.

Evaluation of Fish Trapping Facilities

The installation of 1/2 inch mesh screen in three bays of the downstream trap enabled us to operate it during flows as high as 70 cfs with relatively good efficiency. It did not appear that many fingerling-sized fish were lost through the mesh at these flows.

A modified self-cleaning screen was installed in the bypass channel to prevent loss of juveniles through this area when considerable water was passed through to attract spawners and/or to reduce flows over the downstream trap. Although the screen requires continual maintenance it did prevent many juveniles from escaping down the bypass channel. In spite of these improvements, flows of over 80 cfs from a record snowpack precluded trap operation for 44 days this spring. The high flows also hindered the program to determine trap efficiency by releasing marked fish upstream and recapturing them in the trap.

Table 5. Parameters of juvenile cutthroat trout emigrating from Young Creek

| Parameter | Year 1972 | 1973 | 1974 |
|---|---|---|---|
| Period trap operated | March 17-Nov. 13 | April 6-Sept. 28 | April 1-July 31[1/] |
| Number days trap inoperable due to high flows | 16 | 7 | 44 |
| Number of smolts | 352 | 1,408 | 1,466 |
| Peak migration period | July and October | June and September | July |
| Estimated number of outmigrants | 500-1,000 | 2,000-3,000 | 3,000+ |

[1/] Data collection for report ended on this date

Table 6. Average growth of juvenile cutthroat trout caught in Young Creek trap, June, 1973, (numbers of trout in parenthesis)[1/]

| Year Class | Age | Average length at capture | Average weight at capture | Percent of total fish aged | Back calculated length at age 1 | 2 | 3 |
|---|---|---|---|---|---|---|---|
| 1972 | 1 | (12) 3.1 | .01 | 14.1 | 2.3 | --- | --- |
| 1971 | 2 | (38) 5.4 | .06 | 37.6 | 2.1 | 4.6 | --- |
| 1970 | 3 | (42) 6.9 | .11 | 48.3 | 1.7 | 4.0 | 6.3 |

1/Length in inches, Weight in pounds

The operation and efficiency of the upstream trap was also hampered by high flows. Approximately 75 spawners passed through the trap without being caught. One possible leak was through the velocity barrier when the downstream trap was removed. This situation can be corrected by placing baffles in the velocity barrier. Periodic inspections and repair of holes in the upstream trap leads should bring upstream trap efficiency close to 100 percent.

Migration and Exploitation

The return of tags by anglers has been less than three percent of the fish tagged. Three tags have been returned from the lower part of the Elk River in Canada about 17-20 miles north of Young Creek, 4 tags from the vicinity of Young Creek Bay and one tag from Cripple Horse Bay which is over 40 miles downstream from Young Creek. Fishing pressure has been very light in the reservoir primarily because of poor boating access.

## RECOMMENDATIONS

1. Baffles should be placed in the velocity barrier to prevent adult spawners from escaping through it.

2. The one-half inch mesh hardware cloth should be placed in all of the downstream trap bays to increase the ability to fish the trap at flows of over 80 cfs.

3. The program to determine downstream trap efficiency by releasing marked smolts upstream from the trap should be continued.

4. The areas utilized for spawning should be determined.

5. The meadow area should be sampled to determine if mechanical removal of brook trout is justified.

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| Waters referred to: | | |
|---|---|---|
| | Young Creek | 11-7780-01 |
| | Lake Koocanusa | 11-8690-05 |

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