MONTANA FISH, WILDLIFE & PARKS

FISHERIES DIVISION
JOB PROGRESS REPORT

STATE:	MONTANA	PROJECT TITLE:	STATEWIDE FISHERIES INVESTIGATIONS
PROJECT NO.:	F-78-R-1	STUDY TITLE:	SURVEY AND INVENTORY OF COLDWATER LAKES
JOB NO.:	II-a (partial)	JOB TITLE:	NORTHWEST MONTANA COLDWATER LAKE INVESTIGATIONS, SPECIES OF SPECIAL CONCERN SEGMENT

PROJECT PERIOD: JULY 1, 1994 THROUGH JUNE 30, 1995

ABSTRACT

Genetic analysis was done on samples collected from six lower Clark Fork River drainage streams and all were classified as pure westslope cutthroat trout (*Oncorhynchus clarki lewisi*). A genetic survey of fish populations in the Kootenai River drainage included collection and analysis of fish from 31 streams and 2 high mountain lakes. This survey was intended to better define the exterior boundaries of native inland rainbow trout (*O. mykiss subsp*) as well as locate pure westslope cutthroat trout and bull trout (*Salvelinus confluentus*) populations. Follow-up genetic surveys were made of four high mountain lakes in the South Fork Flathead River drainage subjected to "swamp-out" stocking efforts.

BACKGROUND

Historically the westslope cutthroat trout (Wct) and the bull trout (Dv) were native to most of western Montana while the inland (redband) rainbow trout was considered native only to parts of the Kootenai River drainage downstream of Kootenai Falls located near Troy, Montana. These native species have been displaced, replaced or hybridized with other fish species through much of their original range. Montana has been utilizing starch gel electrophoresis as a major tool to determine species make-up of stream and lake dwelling salmonids since 1980. Almost all of the effort in the 1980s was geared to finding pure Wct populations by doing a genetic survey of the North Fork and South Fork Flathead River drainage and trying to restore westslope cutthroat in high mountain lakes in the latter drainage. Primary efforts in the 1990s have been survey of streams tributary to Noxon Rapids and Cabinet Gorge reservoirs in the lower Clark Fork River drainage, genetic survey of the Yaak River drainage above Yaak Falls, and follow-up surveys of restoration efforts.

In April 1994 a petition was submitted to list the redband rainbow trout in the Montana-Idaho portion of the Kootenai River drainage under the Endangered Species Act. A Yaak River genetics survey indicated that inland rainbow trout still existed as pure populations in a few streams. Very limited genetic testing done in the Libby Creek drainage above Kootenai Falls showed that rainbow trout populations included both the coastal and inland strains. The U.S. Fish and Wildlife Service, Kootenai National Forest and the Department combined on an extensive genetic sampling of streams and lakes located both above and below Kootenai Falls in summer 1994.

OBJECTIVES AND DEGREE OF ATTAINMENT

Activity 1 - Survey and Inventory
Objective: To survey and monitor the characteristics and trends of fish populations, angler harvest and preferences, and to assess habitat conditions in selected waters.

This objective was attained. Initial genetic analysis was done on six fish populations in the lower Clark Fork River drainage to determine status of suspected westslope cutthroat. Fish from 31 streams and 2 lakes in the Kootenai River drainage were collected and genetically analyzed to determine presence of inland rainbow trout and westslope cutthroat trout. Results of the Kootenai River surveys are presented in a special report submitted to the U.S. Fish and Wildlife Service in June 1995.

Activity 2 - Fish Population Management
Objective: To implement fish stocking programs and/or fish eradication actions to maintain fish populations at levels consistent with habitat conditions and other limiting factors.

This objective was attained. Repeat genetic analysis was done on fish collected from four lakes in the South Fork Flathead River drainage. These surveys were done to determine genetic changes brought about by planting westslope cutthroat on top of non-native or hybridized fish populations from 1985 through 1989. Initial estimates of time required to replace non-native or hybridized trout populations with westslope cutthroat trout was somewhere between 20 to 40 years. Data presented in this report indicates replacement may occur much more rapidly.

PROCEDURES

Collection for Electrophoretic Analysis

Collection of fish from streams was accomplished by electrofishing, angling or explosives (M-80 firecrackers) while fish from lakes were caught by angling or gill netting. Fish caught were retained whole, packed in wet ice or dry ice shortly after capture and frozen within 48 hours after capture. The samples were then transported to University of Montana Wild Trout and Salmon Genetics Laboratory, stored in -80° C freezers and analyzed using starch gel electrophoresis by laboratory personnel. Scales for age growth analysis were collected from most fish.

RESULTS AND DISCUSSION

Inland Rainbow Trout - Salmonids from 31 streams and 2 high mountain lakes in the Kootenai River drainage were collected and genetically analyzed. These data are presented and discussed in a report submitted to the U.S. Fish and Wildlife Service entitled, "A Report on Kootenai River Drainage Native Species Search, 1994" by Joe E. Huston, June 1995. Copies of this report are available from Montana Fish, Wildlife & Parks, 490 N. Meridian Rd., Kalispell, MT 59901.

Westslope Cutthroat Trout - Suspected westslope cutthroat trout were collected from six streams tributary to Noxon Rapids Reservoir for genetic analysis. All fish were determined to be genetically pure westslope and included 25 fish samples from Prospect Creek at Twenty-three Mile Creek, Evans Gulch and the outlet of Blossom lakes; the latter two sites also in the Prospect Creek drainage. Other streams found to contain pure westslope included Little Beaver Creek, East Fork Trout Creek and Swamp Creek near the Cabinet Wilderness boundary.

Results of native species surveys and genetic analysis of almost all waters within the lower Clark Fork River drainage from the city of Thompson Falls to the Montana-Idaho border will be presented in next year's report. This report will include work done on westslope cutthroat trout and bull trout. Genetic analysis of suspected westslope cutthroat trout was started in 1983, and with the exception of a few high mountain lakes, was finished in 1994. Analysis of DNA in bull trout from the Bull River drainage should be completed in FY96.

Swamp-Out Evaluation - Simply stated, the swamp-out effort is based on the theory that the native species, westslope cutthroat trout, is better adapted to local environments, and if planted in large numbers on top of non-native or hybridized fish, will eventually replace or introgress to the point that the non-native genes become very insignificant. Initial estimates of the time needed to achieve replacement of non-native genes with native genes to at least 98 percent level was between 20 and 40 years if pure westslope cutthroat trout were available for breeding with non-native or hybridized individuals. Fisheries surveys of high mountain lakes in the South Fork Flathead River drainage done in 1985-1987 showed that many lakes contained non-native salmonids (rainbow trout or Yellowstone cutthroat trout (*O. c. bouveri*) or westslope cutthroat hybridized with either or both the above non-native fish.

Eleven lakes in the northern portion of the South Fork Flathead River drainage that contained either non-native fish or hybridized westslope cutthroat trout populations were planted with young-of-the-year westslope cutthroat annually from 1985 through 1989. Initial genetic surveys were made of these lakes in 1986 and follow-up surveys have been done in four lakes thereafter. Table 1 shows the genetic makeup of fish samples collected from these four lakes.

Table 1. Percent composition of fish samples collected and analyzed from Black, Blackfoot, Tom Tom and Clayton lakes, 1986-1994.

			Percent Composition		
Lake	Year	Number Analyzed	Westslope Cutthroat Trout	Yellowstone Cutthroat Trout	Rainbow Trout
Blackfoot	1986	24	25.0		75.0
	1990	34	67.6		32.4
	1991	30	81.3		18.7
	1994	30	65.0		35.0
Black	1986	42	85.7	2.1	12.2
	1991	44	98.6		1.6
	1994	50	95.2		4.8
Tom Tom	1986	12		100.0	
	1994	62	67.1	32.9	
Clayton	1986	29	73.0	27.0	
	1989	32	92.7	7.3	
	1994	30	72.1	27.9	

Table 2 shows the number of fish analyzed to species or hybrids from the four lakes but only for the initial 1986 and the 1994 surveys. Also shown is the stocking rate expressed as number of young-of-the-year Wct per surface acre.

The data shown in tables 1 and 2 show that changes in the genetic structure of the fish populations inhabiting Blackfoot, Black and Tom Tom lakes has undergone noticeable changes from 1986 to 1994. Percent contribution of Wct genetic material (Table 1) and number of Wct (Table 2) has increased, while contribution of non-native genetic material and non-native fish has declined. Numbers of hybrids in Blackfoot and Tom Tom lakes has markedly increased as predicted. Number of hybrids in Black Lake has decreased from 1986 to 1994, while numbers of Wct increased.

Table 2. Number of fish analyzed as Wct, Rb, Rb or hybrids in Black, Blackfoot, Clayton and Tom Tom lakes, 1986 and 1994.

			Number Analyzed				
Lake	Year	Sample Size	Westslope Cutthroat Trout	Yellowstone Cutthroat Trout	Rainbow Trout	Hybrid	Plant Rate No./Acre
Blackfoot (16 acres)	1986	21	5		14	2	156
	1994	30	11		2	17	
Black (50 acres)	1986	38	28		0	10	178
	1994	50	43		1	6	
Tom Tom (10 acres)	1986	12		12			150
	1994	62	31	10		21	
Clayton (62 acres)	1986	38	18			20	81
	1994	30	12	2		16	

Percent composition (Table 1) of Black and Blackfoot lakes samples appear to show a backward slide toward more non-native genetic material if the 1991 samples are compared to the 1994 data. This increase in non-native material is thought to be an artifact of planted fish availability in the 1991 samples compared to the 1994 samples. Aging of fish from Black Lake in 1991 showed that 40 of the 42 Wct could have been from hatchery sources, while in 1994 only 3 of 50 fish would have been of hatchery origin. The 1991 Blackfoot Lake sample of 20 Wct could have contained 15 fish of hatchery origin compared to only 1 of 11 Wct in 1994. A sample of fish collected from Tom Tom Lake in 1990 included a few 0+ and I+ fish that were first generation hybrids, while all the fish II+ or older were either pure Wct or Yct.

Percent composition of the Clayton Lake sample collected in 1989 was markedly higher than the 1994 sample, and the latter sample was very similar to the 1986 sample. These data indicate that no change was effected by planting Wct in Clayton Lake. A major difference between Clayton Lake and the other lakes was that the Clayton Lake planting rate was only about one-half that of other lakes. Of the 26 Wct caught in 1989, all could have been of hatchery origin compared to only 4 of 12 in 1994.

Why hatchery reared young-of-the-year Wct appear to be successful in replacing non-native population well established in Black, Blackfoot and Tom Tom lakes has not been fully determined. Part of the success may well be the planting rate. Another major factor may be size of the hatchery fish when planted compared to size of naturally spawned fish. Generally hatchery fish are planted in mid-August at a size of about 35 mm. Young-of-the-year fish collected from Tom Tom Lake tributaries on September 1, 1994 averaged 30 mm and ranged from 23 to 43 mm. Genetic analysis identified 28 fry as 16 Wct, 1 Yct and 11 hybrids. Young-of-the-year collected from two tributaries of Blackfoot Lake on September 27, 1995 averaged 29 mm and ranged from 26 to 31 mm. Of the 31 fry genetically identified 11 were Wct, 7 were Rb and 13 hybrids. Another factor may be the broad genetic makeup of the hatchery broodstock which is derived from about 6,000 Wct collected from 13 different streams in 1984 and 1985.

Effects of planting fish on top of established populations on population age structure and growth rates was of some concern, especially in Clayton Lake. Clayton Lake is one of the most heavily fished lakes in the north half of the South Fork Flathead River drainage. Table 3 lists the age and growth data for fish collected from the four lakes in 1986 and 1994. The small sample size, especially when divided into species and hybrids, from each lake precludes valid statistical analysis. Perusal of the data indicate no significant changes in growth rates, size range or longevity. However, it does appear that Clayton Lake growth rates were slightly lower for the 1994 sample compared to the 1986 sample.

Table 3. Growth rates and size range of fish collected from Blackfoot, Black, Tom Tom and Clayton lakes, 1986 and 1994.

			Length in Inches at Annulus						
Lake	Year	Species	I	II	III	IV	V	VI	Size Range
Blackfoot	1986	Rb	2.2	4.1	6.9	9.5	11.7	13.1	5.6 - 14.2
		Wct	2.2	4.6	7.9	10.3			3.7 - 11.8
		WctxRb	3.2	6.1	9.1	10.4			5.2 - 11.4
	1994	Rb	2.1	5.4	10.3	12.6	14.5		10.6 - 15.5
		Wct	2.7	5.5	9.1	9.8	12.6		8.8 - 14.8
		WctxRb	23	5.4	9.5	12.6			9.5 - 15.2
Black	1986	Wct	2.4	5.1	7.0				4.8 - 10.0
		WctxRb	2.5	5.4	8.3	10.1			8.2 - 11.6
		WctxRbxYct	2.4	4.7	7.4	9.9	12.0		5.8 - 13.7
	1994	Wct	2.4	4.5	6.9	8.9	10.3	12.2	6.3 - 15.3
		WctxRb	2.5	4.5	7.2	10.5	11.8	12.2	8.5 - 16.6
Tom Tom	1986	Yct	2.9	5.3	7.2	8.7	10.0		6.3 - 11.2
	1994	Yct	2.3	4.1	5.9	7.5	8.0		7.1 - 9.1
		Wct	2.4	4.7	7.3	9.4			4.7 - 11.3
		WctxRb	2.7	5.0	7.1	8.3			3.5 - 11.3
Clayton	1986	Wct	2.5	5.6	8.2	10.9			7.5 - 12.2
		WctxYct	2.4	5.2	7.9	10.5	12.5	13.8	7.3 - 16.2
	1994	Wct	2.5	4.8	7.6	9.8	11.2		6.8 - 12.8
		Yct	2.5	4.7	6.8	8.8	10.3		8.6 - 11.2
		WctxYct	2.4	4.7	7.7	9.9	11.6	14.6	7.0 - 15.6

The species composition changes in the lakes' populations strongly suggest that the purification process is occurring by two methods and include displacement and hybridization. Displacement of non-native or hybridized fish into downstream waters has been examined in Wheeler Creek of which Tom Tom Lake is the headwater lake. Wheeler Creek is divided into two separate reaches by a barrier falls located in the vicinity of the Bigelow Creek Bridge. The downstream reach, about 5-6 miles long, is a spawning and rearing area for Wct and bull trout from Hungry Horse Reservoir. The upper reach, about 4-5 miles long, was largely barren of fish through the mid-1980s. About 1,500 feet was electrofished in 1984 and three fish, all Yct, were caught.

Fish samples for genetic analysis were collected from lower Wheeler Creek in 1983, 1991 and 1994. Percent Wct genetic material in these samples was 98.7 in 1983, 94.1 percent in 1991 and 98.5 in 1994. Genetic makeup of fish collected in 1984 from above the falls was essentially 100 percent Yct. Thirty fish were electrofished in 1990 from the same areas sampled in 1984 and this sample was 53.3 percent Yct and 46.7 percent Wct. Most of these fish were first generation hybrids or Yct. The 1994 sample of 19 fish came from only 500 feet of stream and genetic makeup was 42.8 percent Wct and 57.2 percent Yct. This sample included some first generation hybrids and some back crosses.

The genetic data show that Yct and hybrids have invaded upper Wheeler Creek from Tom Tom Lake but, as yet, have not made inroads into the fish population of Wheeler Creek below the falls. The mechanism preventing or deterring upper Wheeler Creek or Tom Tom fish from establishing a population in lower Wheeler Creek is not known at this time. It is suspected that the Tom Tom Lake Yct planted in 1941 were from Yellowstone Lake and genetically a lake fish not geared for survival in streams and this may account in part the lack of colonization in lower Wheeler Creek.

Correct visual identification of related fish species or subspecies such as the Wct, Yct and Rb and their hybrids has been a problem for this project's personnel and is likely a major problem for many other biologists. Fish collected from the four lakes in 1994 were sight identified (Wct, Yct, Rb or hybrids), tagged with individual tags and then analyzed by the University of Montana Wild Trout and Salmon Genetics Laboratory. Results of the field (visual) identification done only by the author versus the genetic identification is presented in Table 4 and 5. Both tables include one lake where fish were caught by hook and line and one lake where fish were caught by gill net. The column headed by genetic analysis shows the number analyzed by species or hybrids followed by the number visually identified by species or hybrids and the number visually misidentified.

Table 4. Visual identification versus genetic identification for lakes containing Yellowstone cutthroat, westslope cutthroat and hybrids thereof.

Lake	Species	Genetic Analysis	Visual Identification	Number Correct	Number Incorrect[1/]
Tom Tom (hook and line caught)	Wct	31	31	26	5 (hybrids)
	Yct	10	12	9	3 (hybrids)
	Hybrids	21	19	13	5 (Wct), 1 (Yct)
Clayton (gill net caught)	Wct	12	15	9	6 (hybrids)
	Yct	2	3	2	1 (hybrid)
	Hybrids	16	12	9	3 (Wct)

[1/]Number of fish incorrectly identified and (correct ID).

Table 5. Visual identification versus genetic identification for lakes containing westslope cutthroat trout, rainbow trout and hybrids thereof.

Lake	Species	Genetic Analysis	Visual Identification	Number Correct	Number Incorrect[1/]
Blackfoot (hook and line caught	Wct	11	14	11	3 (hybrids
	Rb	2	7	1	6 (hybrids)
	Hybrids	17	9	8	1 (Rb)
Black (gill net caught)	Wct	43	19	19	
	Rb	1	1	1	
	Hybrids	6	30	6	24 (Wct

[1/]Number of fish incorrectly identified and (correct ID).

The author's identification score on Tom Tom was 77 percent correct and on Clayton Lake 67 percent. His score on Blackfoot Lake was 67 percent versus only 52 percent on Black Lake. Several factors affecting the scores are discernable. First, hook and line caught fish were more often correctly identified probably related to the fact that the fish were seen not more than 3-4 hours after being caught. Conversely, gill-netted fish were misidentified often and partially related to the fact that the fish may have been in the nets for up to 16 hours before being examined. It also appeared that Yct hybrids were easier to identify than Rb hybrids. Correct identification of Black Lake WctxRb hybrids is made most difficult by the small amount of rainbow genetic material in each fish.

RECOMMENDATIONS

1. Bull trout redd counts were not made in Fishtrap Creek, a Thompson River tributary as recommended in 1994, but should be done in fall 1995.

2. Fish from Lower Bighawk Lake and Graves Creek at least three miles above Handkerchief Lake should be collected for genetic analysis and continued evaluation of the "swamp-out" effort and its effects upon downstream waters.

3. Fish from almost all or all of the lakes within the Cabinet Wilderness Area should be collected for genetic analysis. This survey is intended to find those lakes inhabited by native species including westslope cutthroat trout and inland rainbow trout.

4. Native species searches should be continued on other waters within the region as time and personnel permits.

Prepared by: Joe E. Huston
Date: August 9, 1995

Key Words: *Oncorhynchus* genetic identification, native species restoration.

Waters Referred to:

Black Lake	08-8160
Blackfoot Lake	08-8180
Clayton Lake	08-8340
E.F. Trout Creek	05-2448
Evan Gulch	05-2656
Little Beaver Creek	05-4016
Prospect Creek	05-5648
Swamp Creek	05-7114
Tom Tom Lake	08-9860
Wheeler Creek	08-7720