A GENETIC SURVEY OF LAKES IN THE CABINET WILDERNESS AREA AND PROPOSED INLAND RAINBOW TROUT RECOVERY

A Report to the U.S. Fish & Wildlife Service

by

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July 1996

ACKNOWLEDGEMENTS

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INTRODUCTION

In April 1994, the Biodiversity Legal Foundation, Boulder, Colorado, filed a petition with the U.S. Fish and Wildlife Service (USFWS) to list the inland redband rainbow trout (*Oncorhynchus mykiss*) under the Endangered Species Act. The area included in the petition included the Kootenai River Drainage in Idaho and Montana. This petition was rejected by the USFWS. However, it did accelerate an effort by the Montana Fish, Wildlife & Parks and USFWS to determine the range of inland rainbow trout in Montana.

MacCrimmon (1971) and Behnke (1992) proposed that rainbow trout were native to Montana in the Kootenai River Drainage downstream from Kootenai Falls. Genetic surveys of fish from Kootenai River drainages from 1980 through 1995 (Allendorf 1980, Sage et al. 1992, Phelps and Allendorf 1980, Huston 1995) showed that inland rainbow trout were present in certain waters in the drainage below and above Kootenai River Falls. These genetic surveys concentrated on stream-living fish and two lakes in the Yaak River Drainage.

The USFWS contracted with MFWP to make genetic surveys of lakes within the Cabinet Wilderness in summer 1995 and to explore potential inland rainbow restoration measures. The U.S. Forest Service was to collect fish from the lakes' outlet streams near the wilderness boundary, concentrating on the West Fork Fisher River and Granite Creek drainages. This was not done.

METHODS

People including MFWP, USFS and USFWS employees, Libby area anglers, fishing guides and packers were interviewed to compile a list of lakes that contained fish, those thought to be fishless and those unknown. Montana Fish, Wildlife & Parks fishing planting records were reviewed for all lakes in the wilderness. Lakes known to contain fish were the highest priority for sampling, those unknown the next and those reported barren of fish last.

A one- or two-person survey crew walked or were horse-packed into the lakes between July 23, 1995 and September 5, 1995. Fish were caught either by hook and line, gill nets or a combination of the two methods. The targeted number from each lake was 25 fish unless the project leader felt that the lake was populated by cutthroat trout (*O. clarki*). In the latter case, fewer fish would be an appropriate sample, especially if the lake had been planted with westslope cutthroat trout (*O. clarki lewisi*) in the last 20+ years.

Fish selected for genetic analysis represented the size range caught from the lake to ensure that several year classes were analyzed. Fish selected were kept cool, either packed in ice or local snow, packed out to the trailhead, weighed, measured and scale samples taken and then frozen. Frozen samples were taken to the University of Montana Wild Trout and Salmon Genetics Laboratory in Missoula, Montana, where genetic analysis was done in winter 1995-1996.

RESULTS OF GENETIC SURVEYS

Lakes Outside Cabinet Wilderness

Wee Lake

Nine fish were collected from Wee Lake in 1994 and analyzed as inland rainbow trout. In 1995, 17 more were collected, analyzed and found to be inland rainbow trout. Conclusion is that Wee Lake is populated by genetically pure inland rainbow trout suitable as a source of broodstock.

Smith Lake

Smith Lake, a headwater lake in North Fork Callahan Creek, is the only lake in the Callahan Creek Drainage. Inland rainbow trout is the only trout found in Callahan Creek. However, 25 fish from Smith Lake were determined to be a hybrid swarm containing 96 percent westslope cutthroat trout and 4 percent rainbow trout genetic material. Origin of the westslope cutthroat and westslope by rainbow trout hybrids present in Smith Lake is most likely from Idaho Fish and Game's hatchery system. Idaho planting records show this lake was planted with cutthroat in 1971, 1973 and 1976, with Henry Lake cutthroat in 1978, 1980 and 1983, and with westslope cutthroat in 1984, 87, 88, 92, 93 and 1995.

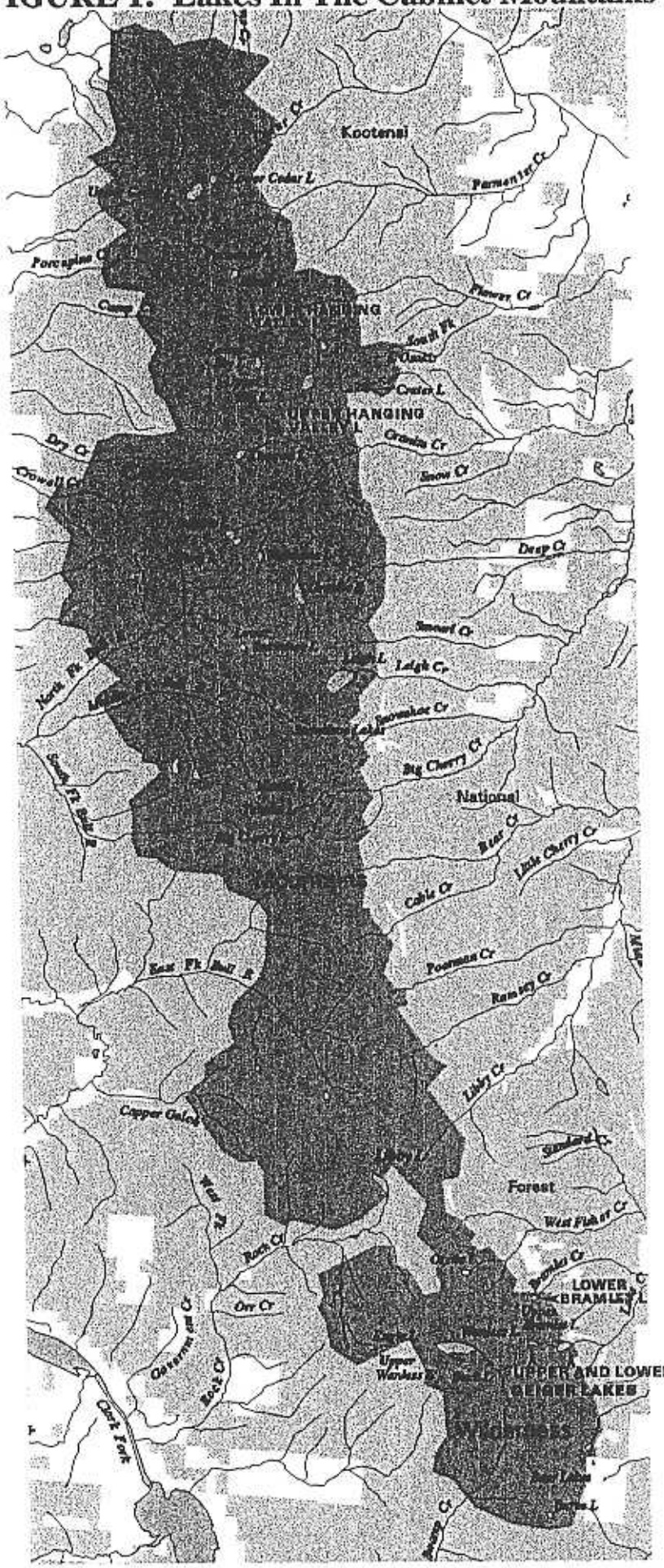
Montana's survey crew was helicoptered into Smith Lake August 30, 1995 and collected the fish sample in about three hours. A very cursory examination of the lake basin indicated no inlets or spring areas suitable for reproduction. The outlet, dry when examined, contained gravels that may be suitable for spawning. The Smith Lake fish must be considered a major threat to the genetic integrity of the Callahan Creek inland rainbow trout.

Lakes Within Cabinet Wilderness

Location of lakes within the Cabinet Wilderness are shown in Figure 1. Fishery survey results are presented below by fishless lakes, lakes with brook trout (*Salvelinus fontinalis*) and lakes containing *Oncorhynchus* species.

Fishless Lakes: Lakes found to be barren of fish or reported to be barren are listed in Table 1 by drainage. All the fishless lakes surveyed were too shallow to support fish. Lakes reported to be fishless were also shallow. Three of these lakes surveyed had been planted with fish in past years and included Snowshoe, Upper Sky and Parmenter lakes.

FIGURE 1: Lakes In The Cabinet Mountains Wilderness



Map produced by:
Angie Schmidt
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Kalispell Office

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Montana Fish, Wildlife & Parks

Table 1. Fishless lakes in the Cabinet Wilderness area.

Drainage	Lake	Surveyed in 1995
West Fork Fisher River	Upper Bramlett	Yes
	Ozatte	No
Libby Creek	Libby Lakes (2)	No
	Ramsey	No
Big Cherry Creek	Big Cherry	No
	Takoka	No
	Martin	No
	Snowshoe (2)	Yes
Granite	Vimy	Yes
	Klatawa	Yes
Flower Creek	Osakis	No
	Upper Sky	Yes
Parmenter Creek	Parmenter	Yes

Lakes with brook trout: Leigh Lake in the Big Cherry Creek Drainage and Wishbone and Double lakes in the Granite Creek Drainage (Figure 1) contained brook trout.

Leigh Lake was planted with Yellowstone cutthroat trout (*O. clarki bouveri*) in 1953. Correspondence dated 1954 between the Montana Fish and Game Department and the Libby Rod and Gun Club expressed concern about the declining "blackspotted natives" in Leigh Lake. Libby area anglers, including a retired MFWP person, remember catching mostly rainbow trout and a few brook trout in Leigh Lake in the mid 1970s. The 1995 survey crew caught only brook trout both by hook and line and gill nets. It is postulated that brook trout were planted or invaded Leigh Lake in the 1940s and 1950s, and have replaced rainbow trout. Whether this replacement is total is not known at this time.

The Libby Rod and Gun Club correspondence seems to indicate "black-spotted natives" to be the native fish of Leigh Lake. Usage from the 1910s to 1960s of the term "black-spotted" generally referred to cutthroat trout regardless whether westslope or Yellowstone cutthroat. It is suspected "black-spotted" could also apply to native rainbow trout. If Leigh Lake was populated by "black-spotted" rainbow, the Yellowstone cutthroat planted in 1953 undoubtedly comprised them and brook trout essentially eliminated this native fish.

Wishbone and Double lakes are extreme headwater lakes in the Granite Creek Drainage. No marked trails exist leading into the lakes and access is by bushwhacking several miles either from Granite Lake trail or from North Fork Bull River trail. Neither of these lakes have been

planted with fish by government agencies. The survey crew met several people while hiking into Wishbone-Double lakes and one person from Troy, Montana, stated he knew the person who packed brook trout into the lakes and that it occurred in 1948. This person's name is known and MFWP personnel should contact this person to ascertain whether he did or did not move brook trout into the lakes.

Wilderness Lakes Containing *Oncorhynchus*: Table 2 lists the lakes in the Cabinet Wilderness by drainage, genetic analysis and recorded fish planting history. Location of lakes is shown on Figure 1.

Table 2. Lakes in Cabinet Wilderness Area containing *Oncorhynchus*.

Drainage	Lake	Planting History[1/] and Year	Genetic Analysis[2/]
Silver Butte/Fisher River	Baree	Wct 75, 80, 84, 89	Wct x Rb x Yct
	Little Bear	Wct 80, 85, 90	Wct
West Fork Fisher River	Big Bear	Yct 52, Wct 75, 80, 85, 90	Wct
	Lower Geiger		Irb x Crb
	Upper Geiger		Irb x Crb
	Bramlett		Irb x Yct
Granite Creek	Lower Sky	G 60, Wct 69, 75, 80, 89, 90	Wct x Yct
	Lower Hanging Valley		Irb x Crb
	Upper Hanging Valley		Irb x Crb
Cedar Creek	Upper Cedar	Rb 40	Crb
	Lower Cedar		Crb

[1/]Species abbreviations are: Yct - Yellowstone cutthroat trout; Wct - westslope cutthroat trout; Rb - rainbow trout; G - golden trout (*O. aguabonita*).

[2/]Species abbreviations are the same as listed above except rainbow (Rb) is divided into Irb - inland rainbow and Crb - coastal rainbow trout. The most common genetic material is shown first in hybridized fish.

The author suspects that lakes in the Silver Butte Fisher River Drainage were originally fishless or contained Wct. Previous genetic surveys (Huston 1995) showed that main stem Silver Butte Fisher River contained inland rainbow, but that two of its headwater tributaries were populated by pure Wct. Outlet streams of Baree Lake (Baree Creek) and Little Bear Lake (Iron Meadow Creek) should be sampled and tested to determine taxonomic status. Genetic composition of the fish from Baree Lake also show MFWP's planting records to be incomplete. No records exist for planting either rainbow trout or Yellowstone cutthroat trout. The analysis of fish from Baree was 88 percent Wct, 7 percent Rb and 5 percent Yct.

Big Bear Lake, headwater of Trail Creek tributary to West Fork Fisher River, was planted with Yct in 1952. A MFWP survey in 1973 indicated fish were Yct while the 1995 genetic analysis showed fish were pure Wct. Between 1973 and 1995 this lake was planted four times with 2,500 one-inch long Wct. Either the planted Wct completely replaced the Yct or the 1973 identification was incorrect; the latter scenario is probably correct and Wct were native to the lake.

Fish from Lower Bramlett Lake, headwater of Bramlett Creek tributary to West Fork Fisher River, were analyzed as inland rainbow by Yellowstone cutthroat trout. Inland rainbow trout contributed 86 percent and Yellowstone cutthroat 14 percent and the genetic material was randomly distributed throughout the sample. The randomness suggests Yellowstone cutthroat were planted into the lake several generations ago.

Fish from Upper and Lower Geiger lakes, headwaters of Lake Creek tributary to West Fork Fisher River, were classified as inland rainbow by coastal rainbow hybrids (Table 3). In general, coastal rainbow trout usually possess the LDH-B2*100 allele at frequencies greater than 0.90 and the sSOD-1*152 allele at frequencies greater than 0.15. Interior rainbow trout, however, usually possess the LDH-B2*100 allele at frequencies less than 0.80, and usually lack the sSOD-1*152 allele or possess it at a very low frequency. The Upper and Lower Geiger lakes populations appear to be coastal rainbow by inland rainbow trout populations.

Table 3. Allele frequencies for the two loci that are used to separate coastal and inland rainbow trout and their frequencies in the Geiger Lake fish.

Locus	Alleles	Lower Geiger	Upper Geiger
LDH-B2*	100	0.375	0.471
	76	0.625	0.529
SOD-1*	100	0.725	0.853
	152	0.275	0.147

Determining the native fish in the West Fisher River Drainage cannot be done at this time. Additional fish samples from streams within the area should be collected and analyzed. Historical records should be researched. The West Fork and Silver Butte areas are old mining districts with numerous claims dating back to the late 1800s to early 1900s. The Geiger lakes, Bramlett Lake, Bear lakes and Baree Lake are the most accessible of the many lakes in the Cabinet Wilderness. An old wagon trail exists leading almost into Bramlett Lake. Early activity could have resulted in unrecorded fish planting. It is the author's opinion that it's a reasonable assumption the aboriginal fish in Bramlett and the Geiger lakes was inland rainbow trout.

Granite Lake in the Granite Creek Drainage contained a slightly hybridized population of westslope cutthroat trout (99.2 percent) and rainbow trout (0.08 percent). Granite Lake was planted with Yct in 1938 and a 1967 survey classified the fish as westslope cutthroat by Yellowstone cutthroat hybrids. It is the author's opinion that the aboriginal fish species was Wct. At present, the fish should be considered pure Wct for management purposes, but unsuitable for broodstock purposes.

Lakes in the Flower Creek Drainage containing fish included Lower Sky Lake and Upper and Lower Hanging Valley lakes. A survey of the Sky lakes in 1967 showed that both Upper and Lower were fishless, although Lower Sky had been planted with golden trout in 1960. Both lakes were planted with Wct in 1969 and Lower Sky has been planted with Wct once every five years starting in 1975. The 1995 survey determined that Upper Sky Lake was barren and that Lower Sky contained Wct (98 percent) slightly hybridized with Yct (2 percent). The most likely source of Yct genes was the fish plant of 1969. Sky Lake should be considered pure Wct for management, but as an introduced population.

Fish from the two Hanging Valley lakes were determined to be coastal by inland rainbow trout hybrids. As with Geiger Lake, the frequency of the LDH-B2* 100 allele was well within the criteria for inland rainbow being 0.42 for the upper lake and 0.54 for the lower lake. However, the frequency of SOD-1* 152 allele was marginal for either coastal or inland rainbow being 0.12 for the upper lake and 0.16 for the lower lake.

The Hanging Valley lakes may be the most difficult lakes in the wilderness to access. At present, it takes about three to four hours of hiking up an unmaintained trail from the Sky Lake trail, a distance of only two to three miles. Total distance into Lower Hanging Valley Lake is about seven miles from the present trailhead. Getting into these lakes before the modern road and trail system would have been very difficult on foot and impossible using pack stock. It is considered unlikely that man moved fish into the Hanging Valley lakes prior to trail and road construction which took place in the 1930s.

The authors believe there is a reasonable possibility that rainbow trout are native to the Hanging Valley lakes. Still, the author realizes that fish could have been planted in the lakes by government packers, most likely during the 1925-1935 period. It is known that several lakes in the South Fork Flathead River Drainage were planted, and not recorded, with rainbow trout around 1930. The author was informed by a U.S. Forest Service packer named Lee Razor, now deceased, that he packed in and planted Yct into Snowshoe and Wanless lakes located in the Clark Fork River side of the Cabinet Wilderness in the early 1930s. Both these lakes have been genetically tested and are populated by Wct by Yct hybrid swarms. Neither of the two above fish plantings are recorded.

Genetic analysis of the two Cedar lakes, Upper and Lower, determined both contained coastal rainbow trout. Upper Cedar Lake was stocked with 800 four-inch long rainbow trout in 1940. Prior to this, these lakes were probably fishless.

Genetic analysis of fish from lakes in the Cabinet Wilderness has done little toward determining the original range of inland rainbow trout in Montana. Unrecorded fish plants and past fish planting practices have severely clouded the issue. The knowledge that Montana's first known genetically pure Wct hatchery broodstock was producing production fish no earlier than 1969-1970 does ease some identification problems.

Lack of genetic knowledge of fish populations in Cabinet Wilderness lakes' outlet streams is also a major stumbling block to classifying lake populations. The Kootenai National Forest had agreed to collect fish from streams below lakes in summer 1995 but did not do so. This should be done as soon as possible.

Stream populations to be collected and analyzed include Baree, Iron Meadow and Porcupine creeks and East Fisher River tributary to Silver Butte Fisher River. Streams in the West Fork Fisher River include the West Fork two to three miles above its mouth and about two miles below the wilderness, Trail Creek, Lake Creek, Fourth of July Creek, Bramlett Creek, Mill Creek and Standard Creek. Streams in the Libby Creek Drainage include Midas, Poorman, Cable Bear and Crazyman creeks. Streams in the Cherry Creek Drainage include Big Cherry, Leigh, Smearl, Deep and No creeks. Streams in the Granite Creek Drainage include Granite, Snow, Horse and Prospect creeks. In addition, fish should be collected from Flower and Parmenter creeks near the wilderness boundary and from the Pleasant Valley Fisher River Drainage above and below Loon Lake.

At the present time, the author concludes that Wct and Irb were the native trout species in the Montana portion of the Kootenai River Drainage. Inland rainbow trout were confined to parts of the system downstream from the Fisher River Drainage. In this part of the drainage they occupied some streams and lakes in allopatry. Westslope cutthroat occupied many streams and lakes in allopatry while in others, Irb and Wct occupied stream systems sympatrically.

Age and growth-scale samples were collected from fish from 11 lakes surveyed in 1995. These data are presented in Table 4 below by species or by dominant gene type.

Table 4. Age and growth of fish from ten Cabinet Wilderness lakes and Wee Lake.

		Length in Inches at Annulus						
Lake	Genetic Analysis	I	II	III	IV	V	VI	VII
Wishbone	Brook	2.6(12)*	5.5(12)	7.4(12)	8.5(5)			
Granite	Wct x Rb	2.3(21)	4.8(21)	6.6(16)	8.6(3)			
Baree	Wct x Yct x Rb	2.5(13)	6.2(13)	9.4(9)	10.8(1)			
Lower Sky	Wct x Yct	2.6(22)	5.8(22)	8.8(18)	10.4(7)	11.9(1)		
Lower Cedar	Crb	2.1(14)	4.8(14)	7.2(13)	9.1(7)	10.3(2)	11.1(1)	
Upper Cedar	Crb	2.0(22)	4.3(22)	6.1(22)	7.2(17)	8.3(7)	9.5(2)	
Lower Hanging Valley	Irb x Crb	1.9(23)	4.0(23)	5.9(21)	7.5(20)	8.6(17)	9.2(6)	10.6(1)
Lower Geiger	Irb x Crb	2.1(19)	4.7(19)	6.5(12)	7.9(10)	8.6(4)	9.6(1)	
Upper Geiger	Irb x Crb	2.4(16)	4.8(16)	7.1(14)	8.8(10)			
Lower Bramlet	Irb x Yct	2.2(25)	4.9(25)	7.2(10)	8.5(4)	10.4(1)	11.7(1)	
Wee	Irb	2.3(15)	4.8(14)	8.6(9)	11.2(3)	12.0(1)		

The age data show that natural reproduction is occurring in all lakes surveyed. Growth rates are slow in all lakes, but particularly in the rainbow trout lakes. This is probably not a function of the species involved, but of lake elevation, basic fertility and fish densities.

INLAND RAINBOW TROUT CONSERVATION AND RECOVERY

Conservation of identified inland rainbow trout populations is essentially a two-part problem; maintenance of existing habitats and genetic integrity. Maintenance of habitat quality is primarily the responsibility of landowners such as the U.S. Forest Service and corporate entities. Inland rainbow trout, westslope cutthroat trout and bull trout are considered species of special concern or sensitive species by Montana and the USFS and, as such, should be given special consideration on land management projects such as timber harvest, livestock grazing or mining. Land management entities should be appraised of inland rainbow trout stocks and their cooperation sought on habitat protection and enhancement.

Habitat deterioration seldom leads to extirpation of a fish population, while introduction of other fish species often results in extinction or loss of genetic integrity, especially when coupled with habitat degradation. Planting of fish in streams and lakes is the responsibility of state fishery agencies. Maintenance of inland rainbow trout genetic integrity for streams in Montana will also require the assistance of two exterior jurisdictions, the state of Idaho and the province of British Columbia.

Much of the Callahan Creek Drainage joining the Kootenai River near Troy, Montana lies within the state of Idaho. As stated earlier in this report, Idaho Fish and Game Department has been planting Smith Lake in the North Fork Callahan Creek Drainage with cutthroat trout periodically since at least 1971. Two fish samples, one in 1979 and the other in 1994, taken from Callahan Creek below the Smith Lake outlet stream, were pure inland rainbow. Still, a very high threat is posed by the Smith Lake cutthroat to the genetic integrity of Callahan Creek rainbow trout. Idaho Fish and Game must be appraised of this potential problem and steps taken to eliminate the cutthroat in Smith Lake. Fish for genetic analysis should be collected from Smith Creek proper and from North Fork Callahan Creek downstream of Smith Creek to determine if rainbow trout genetics have been compromised. If hybridization has occurred, steps should be initiated to eliminate fish from affected stream reaches.

Most of the North Fork Yaak River Drainage is in British Columbia. Fish for genetic analysis were collected by B.C. fisheries personnel and they were informed that analysis was pure inland rainbow trout. The provincial government should be asked to refrain from planting the North Fork Drainage waters with non-inland rainbow trout species. British Columbia does have at least three rainbow trout broodstock lakes that have been genetically identified as pure inland rainbow trout.

Montana Fish, Wildlife & Parks planting program for drainages with identified or suspected inland rainbow trout populations should be thoroughly examined for possible conflicts. Montana Fish, Wildlife & Parks already ceased planting westslope cutthroat trout in Mt. Henry Lake in the East Fork Yaak River Drainage. Westslope cutthroat trout planted in this lake were identified as the most likely source for a small amount of hybridization with inland rainbow trout in East Fork Yaak River below the lakes outlet stream.

A no-plant policy should be incorporated in those waters identified as containing genetically pure inland rainbow trout. These waters are: North Fork and East Fork Yaak River drainages; Yaak River below Yaak Falls; Wee Lake in the Yaak River Drainage; the Callahan Creek Drainage; Wolf Creek Drainage (tributary to Fisher River); Silver Butte Fisher River; and Big Cherry Creek. At the present time, MFWP plants only two waters in the above listed areas. These waters are Baree and Little Bear lakes in the Silver Butte Fisher River Drainage. Westslope cutthroat trout was likely the native species in these two lakes and are currently being planted.

Restoration of inland rainbow trout into waters considered to have historically been populated by this sub-species will be a long-range project. First, waters historically populated by inland rainbow trout, primarily in the Fisher River and Libby Creek drainages have to be better defined. This definition will require considerably more genetic analysis as earlier proposed. Secondly, a source of acceptable fish for reintroductions will have to be established. Thirdly, restoration waters will have to be selected, methods to achieve restoration determined, restoration criteria established and public acceptance of restoration methods and goals achieved.

BROODSTOCK DEVELOPMENT

The MFWP is examining two methods to develop an inland rainbow broodstock capable of producing 100,000 eggs per year. These are a hatchery-held broodstock or a wild broodstock maintained in a lake. Selection of either or both is largely dependent upon long-term needs, monies available, cost/benefit ratios and available places to hold a broodstock and rearing space.

It is anticipated that numbers of fish needed for a successful reintroduction program will be small on an annual basis but substantial over the long run. It is doubtful that the present state hatchery system has the capacity to commit space for an inland rainbow trout broodstock without compromising other planting programs. Also, it is imperative that any inland rainbow brood effort be confined to the Kootenai River Drainage. This hatchery location criteria limits broodstock to MFWP's Murray Springs Fish Hatchery or to a new or reconstructed facility.

The authors know of no location with a suitable water source, preferably of spring origin, in the Kootenai River area for new hatchery construction. However, the Libby Field Station is located on the grounds of the old Libby Fish Hatchery that was abandoned in 1971. It would be possible, but expensive, to reconstruct this hatchery into a inland rainbow trout brood-rearing station. The old hatchery was closed for several reasons including an open water supply, brook trout being present in the water supply, endemic furunculosis and cold water temperatures restricting production. The cutthroat trout broodstock moved to Libby Hatchery from the Hamilton Hatchery in the early 1960s averaged about 8-9 inches long at four years and produced about 200 eggs per female. Summer water temperatures were in the upper 40° F. Hatchery reconstruction could account for the brook trout, open water source and endemic furunculosis problems. The cold water problem is solvable, but extremely expensive.

We believe that the most feasible method to produce eggs for restoration would be conversion of an area lake into a broodfish lake. Four lakes have been identified as potential and include Kilbrennen Lake in the lower Yaak River Drainage, Mt. Henry Lake in the East Fork Yaak River, Howard Lake in the upper Libby Creek Drainage and a privately-owned lake in the Big Cherry Creek Drainage. It is thought that three of these lakes have the capability of producing enough adult fish and eggs to supply demands for an inland rainbow restoration effort. Mt. Henry Lake's capacity to hold enough adults to supply 100,000 eggs is questionable. Each lake is briefly described below.

Kilbrennan Lake: Kilbrennan Lake has a surface area of about 60 acres and is the headwater source of Kilbrennen Creek which drains into the Yaak River below Yaak Falls. Correspondence dating back to the 1910s indicate the native fish were inland rainbow trout (Huston 1995). Brook trout were introduced in 1934, rainbow trout in 1945, Yellowstone cutthroat in 1955 and westslope cutthroat in 1988. Black bullheads were illegally stocked in the mid-1970s and yellow perch in the 1990s. Catch in order of declining abundance in gill net sampling in 1995 was bullheads, brook trout, rainbow trout and perch. Genetic analysis of rainbow trout showed they were a mix of inland, coastal and westslope cutthroat.

The MFWP has started the research needed to chemically remove the existing fish population and replant with acceptable trout. Kilbrennan Creek, the outlet stream, is populated by mostly brook trout and a few rainbow trout and will have to be treated also, possibly to its junction with Yaak River. Feeder Creek, the inlet stream will also have to be chemically treated and may be mechanically enhanced to provide more adequate spawning habitat.

Public meetings to measure support for the Kilbrennan Lake treatment were held in the Libby-Troy area in 1995 and 1996. Some opposition was expressed about the project. Considerable opposition was expressed about complete removal of brook trout and this public opposition could sink the proposal. Fortunately, it is believed Kilbrennen Lake can support a brook trout-inland rainbow trout population sufficiently strong to provide both public angling and inland rainbow brood fish.

Howard Lake: Howard Lake, about 45 surface acres, lies in the headwaters of Libby Creek and historically was probably fishless. This lake was first planted with rainbow trout in 1928, with Yellowstone cutthroat trout one time in 1951 and with grayling (*Thymallus arcticus*) in 1943 and 1946. Since 1951, it has been planted with yearling coastal rainbow trout on an almost yearly basis. Howard Lake is accessible by road, has a USFS campground and handicap access and does support considerable angling by the local population.

Fishery information about Howard Lake is scant but does indicate that natural reproduction by planted fish is nil to non-existent. If reproduction does not occur, the fish population could easily be changed from coastal rainbow trout to inland rainbow trout by manipulation of the planting program.

Mt. Henry Lake: Mt. Henry Lake is a small (10± surface acre) lake in the Basin Creek Drainage of the East Fork Yaak River area. This lake is about three miles from the road end and is easily accessible by foot or pack stock.

Planting records indicate this lake was stocked with cutthroat trout in 1938 and with westslope cutthroat in 1971, 1978, 1983 and 1987. Genetic survey of the East Fork Yaak River streams in the early 1990s indicated a low level of hybridization of inland rainbow trout with westslope cutthroat. The likely source of the westslope cutthroat trout genes was downstream drift from Mt. Henry Lake. Survey of this lake in 1992 indicated a one age-class population of westslope cutthroat trout and no visible spawning areas. It is highly possible this lake is now fishless.

Double N Lake: This private lake is located on Getner Creek, a very small tributary of Libby Creek, about ten miles east of Libby, Montana. Origin and history of this lake is largely unknown at this time but it is thought that it is wholly or partially manmade. Water sources are from Getner Creek and a diversion from Big Cherry Creek.

Robert Mitchell, a retired MFWP person and ex-manager of the Libby Fish Hatchery in the mid to late 1960s set up a spawning station and spawned fish for the lake's owners in the mid-1960s. Fish were 10-12 inches long. The only trout species present in the lake at that time were rainbow trout. He does not know the origin of these rainbow trout. Genetic analysis of rainbow trout from Big Cherry Creek collected in the vicinity of the diversion into Double N Lake (Huston 1995) indicated they were pure inland rainbow trout.

It is a reasonable theory that Double N Lake is populated by inland rainbow trout and that they are endemic to the Libby Creek Drainage. This theory should be tested, however, the potential for cooperation with the current lake manager is unknown.

Broodstock Selection

In recent years MFWP has had considerable experience, both good and bad, establishing broodstocks of westslope cutthroat and coastal rainbow trout in hatcheries or lakes. The major difference between a failure and a success has been the number of fish used to establish the broodstock. Numbers of fish have direct implications on long-term maintenance of genetic health of a broodstock.

Major differences exist in genetic structure of westslope cutthroat and coastal rainbow trout. Genetic variation in westslope occurs between populations, while individuals in a population are very similar to each other. Genetic variables in coastal rainbow trout occur within a given population and different populations are generally genetically similar. Genetic patterns of inland rainbow trout have not been completely established throughout its native habitats in Montana. Therefore, selection of fish for establishment of a Montana inland rainbow trout broodstock should follow the westslope experience more than the coastal rainbow experience. Montana's present westslope broodstock was established from about 6,000 individuals from 13 streams and Hungry Horse Reservoir.

The University of Montana Wild Trout and Salmon Genetics Laboratory has suggested an inland rainbow broodstock be established from about 150 fish collected from at least five different sources. Available sources include the East Fork Yaak River system above Basin Creek, the North Fork Yaak River, North Fork Callahan Creek at least two miles above Smith Creek, South Fork Callahan Creek, Wolf Creek above the Fairview Work Center, Silver Butte Fisher River and Wee Lake. Targeting adult fish for broodstock development would result in a shorter time span needed for the first egg collection. However, some of the above areas may not readily provide 150 individuals without considerable damage to the population.

It is thought that 150 adult fish could easily be removed from each of the Callahan Creek forks. Since most of the forks are in Idaho, Idaho's cooperation will be required. East Fork Yaak River system above Basin Creek should also provide 150 fish without complications. The North Fork Yaak River could supply fish but only if the British Columbia section is included. If no fish can be obtained from British Columbia, then collection inside Montana should be combined as a very minor part of the East Fork Yaak River. Wolf Creek and one tributary, Weigel Creek, could easily provide 150 fish.

It will be near impossible to collect 150 fish from Silver Butte Fisher River. About a mile of stream was electrofished in 1991 and 1994 to collect a total of 20 fish for genetics. Also, much of Silver Butte Fisher River flows through private property and access into the water is scarce without trespassing.

Collection of 150 fish from Wee Lake will also be difficult. The small lake size limits fish numbers and transportation may be a problem. Wee Lake is about three miles from the nearest road making transport of live fish difficult. It is proposed that Wee Lake fish be spawned on site, moved to a hatchery and hatched. Eggs from each pair should be reared to fingerling stage and about 500-600 fingerlings added to the broodstock. Remaining fish should be replanted back into Wee Lake.

Fish from Big Cherry Creek could also be considered for addition to a broodstock, but only after additional genetic analysis is completed in the drainage. It is anticipated that if fish from Double N Lake are pure inland rainbow trout, fish from Big Cherry Creek would be of the same genetic characteristics.

Fish used for the broodstock have to be disease-free and if transported across state or international borders may have to meet further restrictions. Disease testing will require sacrificing 60-120 fish from each steam. Adults from Wee Lake should be spawned as individual pairs and the pairs sacrificed for disease tests.

The ideal scenario for establishment of an inland rainbow trout is listed below by step.

1. Collect needed information to chemically treat Kilbrennen Lake, its inlet and outlet, determine if natural reproduction is occurring in Howard Lake, determine if Mt. Henry Lake is barren, successfully negotiate with owner of Double N Lake and collect and do genetic analysis as presented earlier in the report concentrating on Big Cherry Creek Drainage (1996 through June 1997).

2. Select brood lake(s) and chemically treat Kilbrennen Lake, collect fish for disease analysis; if Mt. Henry Lake found to be fishless, collect about 200 fish and plant in lake (summer and fall, 1997).

3. Collect remaining fish from streams, spawn Wee Lake fish, plant in brood lake(s) including another 200 in Mt. Henry Lake (1998).

4. Sample brood lakes and collect eggs if available for restoration efforts (spring 1998 →).

Two alternatives to creation of an inland rainbow trout Kootenai River Drainage broodstock should be considered. These are: (1) obtaining eggs from British Columbia's rainbow trout brood lakes that were genetically tested as inland rainbow in 1980 (Phelps and Allendorf 1980). It is not known if any genetic changes have taken place since 1980, so it would be imperative that genetic analysis be done again. Origin of fish in these lakes was from lakes in the upper Columbia River system.

The second alternative would be to use fish originating from Kootenay Lake, British Columbia. These rainbow trout, commonly called kamloops, Girrards or Duncan strains are inland rainbow, but may not be adapted to living in small lakes or streams. Potential egg sources include British Columbia's Kootenay Trout Hatchery near Wardner, B.C. and the U.S. Fish and Wildlife Service hatchery at Ennis, Montana.

Starting a wild broodstock from hatchery fish would delay collection of eggs from brood lakes until about year 2001.

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PROPOSED RESTORATION PROJECTS

Described below briefly are three proposed projects that should increase inland rainbow trout populations. The projects are Wolf Creek, Arbo Creek and Pleasant Valley Fisher River.

Wolf Creek: Wolf Creek is a small tributary of Fisher River, joining the latter about 12 miles upstream from Kootenai River. Wolf Creek, from its mouth to its source near the Flathead Tunnel, can be divided into three distinct reaches over its length of about 39 miles.

Over the last 50 years, Wolf Creek and its fish population has been impacted by timber harvest, railroad construction and forest fires. A report entitled, "Evaluation of Mitigation Measures in Fisher River, Wolf Creek and Fortine Creek - 1969-1972" (May 1972) summarizes effects of relocation of the Burlington Northern railroad from Kootenai River up Wolf Creek in the late 1960s. In brief, railroad construction up Wolf Creek resulted in replacement of 29,650 feet of natural stream channel with 24,800 feet of man-made channel. Salmonid (rainbow trout, brook trout, mountain whitefish) numbers declined in sampling sections located in channel changes and natural channels from 1969 to 1971. Reasons for this decline was attributed to the nature of man-made channels and increased channel siltation.

The three reaches of Wolf Creek are divided by valley shape and stream gradient. The upper reach from Wolf Creek headwater to the U.S. Forest Service Fairview Work Center, a distance of 15 miles, has an average gradient of 40 feet per mile and flows through a U-shaped valley. The middle reach, about eight miles in length is a meandering meadow-type channel with an average gradient of ten feet per mile. The lower reach flows through a V-shaped canyon 16 miles to the Fisher River. Average gradient is 24 feet per mile. Fish populations varied by reach. The most common trout species found above the Fairview Work Center was rainbow trout, followed by brook trout. The most abundant species in the meadow section and the upper 5-6 miles of the lower reach was brook trout followed by rainbow trout, while the most abundant species in the lowest 10 miles was rainbow trout followed by brook trout. Largescale suckers (*Catastomus macrocheilus*) were very abundant in the lower reach while long-nosed dace (*Rhinichthys cataractae*), redside shiners (*Richardsonius balteatus*) and sculpins (*Cottus spp.*) were common. Resident mountain whitefish (*Prosopium williamsoni*) were occasionally caught in the two lower stream reaches.

Genetic analysis of rainbow trout captured in 1993 and 1994 from Wolf Creek near Fairview and from two tributaries, Weigel and Little Wolf Creek, showed they were pure inland rainbow trout. It is assumed that rainbow trout throughout the drainage are also of the inland type. However, genetic status of rainbow trout in the lower area of Wolf Creek should be determined as part of this restoration proposal.

The elements of this proposal are:

1. Evaluate changes that have occurred in habitat quality and quantity since 1971.

2. Determine fish population characteristics throughout the length of Wolf Creek by doing extensive survey electrofishing and population estimation in these sections estimated in 1969-1971.

3. Determine feasibility of eradicating existing fish populations in selected stream reaches and replacing with inland rainbow trout. The author anticipates that Wolf Creek, from Fairview down to about Richards Creek, may be an excellent area to rehabilitate.

Arbo Creek: Arbo Creek, about 5-6 miles long, is a tributary of Yaak River entering the latter below Yaak Falls. Genetic analysis of rainbow trout from Yaak River in the vicinity of Arbo Creek showed they were inland rainbow. Analysis of fish from Wee Lake, headwater source of Arbo Creek, showed they were inland rainbow trout. Fish from Arbo Creek, about midway between Wee Lake and the Yaak River, were a mix of coastal and inland rainbow trout and westslope cutthroat trout. Arbo Creek was planted with westslope cutthroat in 1976 in the same area from which fish for genetic analysis were collected. This stream section is about two miles below Wee Lake.

The genetic data indicates that westslope cutthroat genes have not flowed upstream to Wee Lake yet. It is very likely that a barrier preventing upstream fish movement exists between the planting site and Wee Lake. Stream surveys must be done to locate this barrier if it exists. Arbo Creek downstream from this barrier, or from Wee Lake if no barrier, should be chemically treated to remove the existing fish and then replanted with inland rainbow trout. This action will protect the Wee Lake and Yaak River rainbow from hybridization and restore the creek back to its native state.

Pleasant Valley Fisher River: Pleasant Valley above Loon Lake is in mostly corporate or smaller private ownership. Present-day land use includes timber harvest and livestock operations. Much of the Pleasant Valley Fisher River has been channelized to facilitate agricultural development. In past years, the river has been planted with Yellowstone cutthroat trout, rainbow trout and brook trout, but no fish have been stocked since 1952. This stream feeds Loon Lake, which contains brook trout, rainbow trout and an assortment of warmwater fish species. Spawning runs of rainbow and/or brook trout from Loon Lake into the river may exist, but upstream movement would be blocked by extensive beaver dams about 3-4 miles above Loon Lake.

Fish were collected for genetic analysis from Barnum Creek, Marl Creek and main stem Pleasant Valley, all within four miles of Loon Lake. Analysis indicated they were a mix of coastal rainbow trout, westslope cutthroat trout, but mostly inland rainbow trout. It was concluded that inland rainbow trout and westslope cutthroat trout were likely the native trouts of the Pleasant Valley Fisher River Drainage above Loon Lake.

No fishery survey work has ever been done on any of the Pleasant Valley Fisher River streams. Fish population surveys should be done on Island Creek, outlet of Island Lake, Pleasant Valley Creek, outlet of Dahl Lake and Pleasant Valley Fisher River sometimes referred to as South Fork Pleasant Valley Fisher River. Island Creek and Pleasant Valley Fisher River are reported to flow year round while Pleasant Valley Creek is reported to be intermittent. Surveys may indicate projects with potential to increase inland rainbow trout numbers.

At the present time a U.S. government agency is negotiating with a landowner on Pleasant Valley Fisher River to recover wetlands. A major part of this proposed action will be rerouting of the stream back into its natural channel. If this project becomes a reality, about three miles of channelized stream could be restored. Recovery of inland rainbow trout may also be a viable part of the project. The agency involved has requested that a minimum of information be presented here as negotiations are of a delicate nature.

Successful Projects

Residents of in Lincoln County, Montana, are considered more disconcerted by the federal Endangered Species Act than most other populations. The success of recovery of inland rainbow trout must have public support. The authors strongly suggest that the program, from building a broodstock to actual recovery projects, be sold as a program to keep the inland rainbow from being listed. Recovery projects should not affect fishing opportunities.

Definition of a successful project will vary, but have commonality between projects. The common goal will be the establishment of a self-sustaining population capable of sustaining fishing opportunity and harvest equal to that present before recovery efforts. The specific goal for Arbo Creek should be complete removal of the non-native hybridized fish and replacement with pure inland rainbow trout. The specific goal for Wolf Creek and Pleasant Valley Fisher River should be a marked increase in numbers of inland rainbow trout. A more definitive goal will have to be established after determination of present fish population structures.

COST/BENEFITS

Costs and benefits were not calculated since the actions from broodstock development to the three recovery projects extend from 1996 through possibly 2005. It is estimated that costs could be in the $500,000 to $1,000,000 range.

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