A REPORT ON KOOTENAI RIVER DRAINAGE NATIVE SPECIES SEARCH, 1994

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

by

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INTRODUCTION

Salmonid trout and char species native to the Montana portion of the Kootenai River include the interior redband rainbow trout (*Oncorhynchus mykiss subsp.*), westslope cutthroat trout (*O. clarki lewisi*), and bull trout (*Salvelinus confluentus*). All three fish species are considered species of special concern by Montana Fish, Wildlife & Parks (FWP) and sensitive by the U.S. Forest Service (USFS). Two species, the inland redband rainbow and bull trout, have been proposed for listing under the federal Endangered Species Act.

Rainbow trout are divided into two major groups called coastal rainbow trout and inland rainbow trout. Coastal rainbow trout are those fish that occurred naturally in waters that originate on the western slopes of the Cascade Mountains in Washington, Oregon and California. Inland rainbow trout are those fish that inhabit waters east of the Cascade Mountain Divide and included waters in the Columbia River System. In Montana, waters thought to contain native inland rainbow trout are limited to the Kootenai River drainage below Kootenai Falls (Behnke, 1979). Various people have called inland rainbow trout interior rainbow, redband rainbow, redband or Columbia Basin redband trout. Throughout this report they will be named inland rainbow trout.

Determining whether a particular rainbow population is coastal or interior cannot be done using visual characteristics or meristic counts, but may be done through genetic analysis using starch gel electrophoresis. Of the proteins electrophoretically examined, only two (LDH-4 and SOD) are useful in distinguishing if a particular fish sample represents coastal or inland rainbow trout. The number of diagnostic loci used to differentiate between rainbow and westslope cutthroat is 6, between westslope and Yellowstone cutthroat trout (*O. bouvieri*) 12, and between Yellowstone cutthroat and rainbow trout 9 loci (Allendorf and Leary, 1988).

Frequency of LDH-4 100 allele in coastal rainbow trout is generally 90 percent or more, but 80 percent or less in inland rainbow trout. Frequency of SOD 152 in coastal rainbow trout is 15 percent or more but often absent in inland rainbow trout (Robb Leary, pers. comm.). However, there are still unanswered questions about differences between coastal and inland rainbow trout and how to separate the two strains accurately. These questions will only be answered after extensive genetic studies of inland rainbow trout from throughout their entire native range.

Three groups of inland rainbow trout may exist and include steelhead rainbow trout, Girrard (Kamloops) rainbow trout and the redband rainbow trout. Steelhead are anadromous and do not occur in Montana. The Girrard rainbow trout may be genetically geared to reach a large size when feeding on kokanee (*O. nerka*). These fish are native to the Kootenai River drainage (Kootenai Lake in British Columbia) and reportedly use Kootenai River tributaries below Kootenai Falls in Montana for spawning. Montana Fish, Wildlife & Parks has adopted the name inland redband for other native rainbow trout to delineate these fish from steelhead or Girrard rainbows. Inland rainbow trout are thought to be mostly stream or small lake dwellers that seldom weigh more than 4-5 pounds. Differentiation between these three strains of rainbow trout can not be done by coloration patterns, meristic counts, or by starch gel electrophoresis. Essentially, identification is done by life cycle and geographic distribution.

HISTORIC BACKGROUND AND PRE 1994 GENETIC ANALYSIS

In April 1994, the Biodiversity Legal Foundation, Boulder, Colorado, filed a petition with the U.S. Fish and Wildlife Service to list the inland redband rainbow trout as a threatened or endangered species under the Endangered Species Act. The area included for listing encompassed the Kootenai River drainage in Montana and Idaho. However, MacCrimmon (1971) and Behnke (1979) did not consider inland rainbow trout native to the Kootenai River drainage above the Montana-Idaho border (MacCrimmon) or Kootenai Falls (Behnke). Kootenai Falls has been considered a block to upstream fish passage by FWP. If, in fact, Kootenai Falls is the upstream limit of inland rainbow trout in the Kootenai River drainage then most of the drainage in Montana should be excluded from potential listing as native rainbow trout habitat.

Game warden creel census information for Kootenai River in Montana from some years between 1949 and 1964 is presented by May and Huston (1983). These creel data clearly show that cutthroat trout were much more common in the fisherman's creel than rainbow trout. During the summer, cutthroat trout outnumbered rainbow trout 7 to 1 and in the winter 15 to 1. Pre-Libby Dam sampling in the late 1960s showed that cutthroat trout were the most abundant trout in the Kootenai upstream from the Libby dam site, but rainbow trout were the most numerous downstream. May and Huston (1983) also state that industrial pollution from British Columbia and Montana sources may have been a leading factor leading to a change from a cutthroat trout, burbot, whitefish complex to a whitefish, rainbow trout dominated fish population in Kootenai River. These changes were thought to have started in the 1950s.

Origin of rainbow trout in the Kootenai River above Kootenai Falls was most likely Montana's hatchery system. By the early 1940s, 10 of the 20 perennial streams tributary to Kootenai River above Kootenai Falls and the Kootenai River itself had been planted with rainbow trout. Most of the remaining streams had also been planted with other trout species such as brook (*Salvelinus fontinalis*) and Yellowstone cutthroat trout. Genetic analysis of cutthroat from Kootenai River collected at Young Creek prior to Libby Reservoir filling showed these fish to be mostly westslope cutthroat trout with some Yellowstone cutthroat influence.

Genetic testing of fish populations in the Kootenai River drainage has been an ongoing effort. Allendorf (1980) examined the genetic characteristics of rainbow trout from six streams below Kootenai Falls and concluded that two, Callahan Creek and South Fork Callahan Creek, were populated by inland rainbow trout. Raymond, Star, and Arbo creeks contained coastal rainbow trout while Yaak River below Yaak Falls contained a mix of coastal and inland rainbow trout.

In retrospect, the results of these early genetic tests are what might be expected. The Yaak River sample was taken from the area reportedly used for spawning by large Girrard rainbow trout, while hatchery plants of rainbow trout into the Yaak River started in 1934 and continued through 1969. Star Creek, and its tributary Raymond Creek, had been planted with rainbow trout in 1949 and Yellowstone cutthroat trout in 1931 and 1948. A barrier falls isolates most of Star Creek from Kootenai River fish. Of special interest is Arbo Creek. Analysis of the 1979 sample indicated that fish were coastal rainbow trout. Wee Lake, the source of Arbo

Creek, had been planted with rainbow trout in 1931 and Yellowstone cutthroat trout in 1939 and 1941, while the creek itself had been planted with young-of-the-year westslope cutthroat trout in 1976. Fish were collected from the same locality in 1987, as the 1979 sample and analysis indicated that they were a mix of coastal and inland rainbow trout and westslope cutthroat trout.

The Callahan Creek drainage samples first analyzed in 1980 were repeated in 1994. These samples were classified as inland rainbow trout in both 1980 and 1994. It must be noted that all samples were collected above a falls-chute structure thought to be a fish barrier located about two miles above the Callahan Creek-Kootenai River junction.

Rainbow trout collected from two Kootenai River rainbow trout spawning streams in 1980 near Libby, Montana, were genetically analyzed and determined to be mostly coastal rainbow trout, but carrying some inland rainbow trout genetic material as well.

Extensive genetic analysis was done on trout populations in Lake Koocanusa (Libby Reservoir) in the late 1970s through the mid-1980s. This work was directed toward explaining a marked increase in rainbow trout numbers in the reservoir. Leary et al. (1988) summarizes this genetic work and the report's abstract states:

> "The genetic composition of the Lake Koocanusa trout fishery has changed dramatically between 1979 and 1983. In 1979, the fishery was composed mainly, if not entirely, of coastal rainbow trout. Electrophoretic analysis of fish collected from the reservoir in 1983 and 1986 and four of its tributaries in 1987 indicates that the reservoir fishery now represents an introgressed fishery containing coastal rainbow, inland rainbow, and westslope cutthroat trout genes. We postulate that this change is largely due to the invasion of Lake Koocanusa by inland rainbow trout during the mid-1970s. Subsequently, these fish have hybridized extensively with the trout in the reservoir and its tributaries."

Source of the inland rainbow trout contributing genes to the Lake Koocanusa trout population is thought to have been from a British Columbia fish hatchery located on Bull River immediately upstream from the headwaters of Lake Koocanusa. This hatchery was rearing inland rainbow trout as determined by electrophoresis (Phelps and Allendorf, 1980) in the 1970s and early 1980s. Escapement from this facility of anywhere from 25,000 to 100,000 fish was reported to the author by Canadian fisheries personnel. In later years, from 1988 to the present, both British Columbia and Montana have been planting Lake Koocanusa with a total of 15,000-20,000 Girrard strain rainbow trout on an annual basis.

Genetic analysis was also done on fish collected from two tributaries of Lake Koocanusa. Fish were collected from the stream above barrier falls that prevent fish from the reservoir moving into the streams. Fish from Dodge Creek were determined to be pure westslope cutthroat while fish from Boulder Creek were mostly westslope hybridized with Yellowstone cutthroat trout (Huston 1988). Dodge Creek had been planted with Yellowstone cutthroat trout and brook trout while Boulder Creek and its two headwater lakes were planted with Yellowstone cutthroat trout and rainbow trout.

Genetic analysis of Kootenai River rainbow trout collected near Libby, Montana, in 1982 showed these fish carried some inland rainbow trout genes. Rainbow trout in the river in 1994 should have considerably more inland genes. This increase undoubtedly is related to fish from Lake Koocanusa escaping downstream into Kootenai River and spawning with "resident" river fish. Examination of rainbow trout immediately below Libby Dam in recent years has disclosed several with badly eroded fins indicative they were Girrard strain fish planted in Lake Koocanusa and pure inland rainbow trout. Both Montana and British Columbia plant five- to ten-inch fish raised in concrete raceways.

Following impoundment of Kootenai River in 1972, spawning runs of trout developed into almost all accessible tributaries of both Lake Koocanusa and Kootenai River from the Montana-British Columbia border to the Idaho-Montana border (May and Huston 1983)(Huston, Hamlin and May 1984). Genetic testing of rainbow trout from the upper Libby Creek drainage indicated that one population appeared to be pure inland rainbow while others carried inland rainbow trout genes, as well as coastal rainbow trout material. It is postulated that these genes probably both inland and coastal, were from two sources including as one source spawning runs of hybrid rainbow trout from Kootenai River.

The other potential source of rainbow trout carrying inland and/or coastal genetic material was Montana's hatchery system. Prior to the mid-1950s Montana's rainbow trout egg sources were many and included taking wild eggs from several lakes in western Montana. These lakes included Lake Mary Ronan near Proctor, Little Bitterroot Lake near Kalispell, Georgetown Lake near Anaconda and Kilbrennen Lake near Troy. Genetic testing of rainbow trout collected from spawning tributaries of Little Bitterroot Lake and Lake Mary Ronan in 1987 showed that most fish were coastal and inland rainbow hybrids. Genetic testing of ten rainbow trout from Kilbrennen Creek in 1994 indicated they were mostly inland redband rainbow trout coupled with coastal rainbow trout.

Unfortunately, fish hatchery records of egg sources and especially where fish were planted are almost non-existent for the years of 1907 through about 1930. During these years, western Montana had two major hatcheries including Anaconda, started in 1907, and Somers, started in 1912. The Flathead Lake Salmon Hatchery (Somers hatchery) does have files for the years of 1912-1915 which includes much correspondence between the state's Anaconda and Somers hatchery and the federal hatchery located at Bozeman, Montana. The latter facility began operation in 1897. Alvord (1975) relates some of the early history of Montana Department of Fish and Game during the years of 1900-1975. These sources indicate that Little Bitterroot Lake near Kalispell had been planted by the Bozeman hatchery prior to 1912 and that the Bozeman hatchery had planted "steelhead trout" and rainbow trout at least as early as 1903. There is some indication that Little Bitterroot Lake was also a source of trout eggs for Bozeman before spawning was taken over by the state.

Of special interest is Kilbrennen Lake which is located on a tributary of the Yaak River northwest of Troy, Montana, and is presently assumed to be within the aboriginal range of redband rainbow trout. Correspondence between a Mr. H.D. Dean, Superintendent of State Fish

Hatcheries, Anaconda, Montana, and the U.S. Commission, Bureau of Fisheries, Washington D.C., indicates that the Kilbrennen Lake trout were rainbow trout and that they were numerous, and that the lake was used as a spawning station. This correspondence was dated April 16, 1913, and May 2, 1913.

Alvord (1975) states that the Libby hatchery put into operation in about 1931, was preceded by temporary spawning stations near Libby. Robert Mitchell, a retired Montana hatchery worker who started working in about 1946, recalls stories from old-time employees about satellite spawning stations on Alvord Lake, Savage Lake, and Kilbrennen Lake. All these lakes are in the Kootenai River drainage below Kootenai Falls near the town of Troy, Montana. At the present time, all three of these lakes contain brook trout and various species of warmwater fish, except Kilbrennen Lake which still has a small population of rainbow trout. It is likely that Kilbrennen Lake rainbow trout were similar genetically to those tested from Kilbrennen Creek since the creek is the outlet of the lake. A fish sample for analysis was collected from the lake in May 1995.

Alvord (1975) also states that the Bozeman hatchery planted several streams around the state with "steelhead trout" in April, 1916. These eggs were secured from Clackamas, Oregon. In the 1923-1924 biennium, Montana secured two million steelhead and rainbow trout eggs from Oregon. A million rainbow eggs went to the Great Falls hatchery and the fry were planted in the Missouri River (Alvord, 1975). Nothing was stated about the other million eggs.

Montana also obtained rainbow trout eggs from several out-of-state sources including a facility located at Murray, Utah, from the state of Michigan, and a commercial operation located at Hudson, Wisconsin. "Rainbow Trout in the Great Lakes" (MacCrimmon and Goti 1972) indicates that almost all or all of the original plants of rainbow trout in the Great Lake areas were from McCloud River stock, and therefore, coastal rainbow trout.

The Flathead Lake Salmon Hatchery files at Somers also include egg cards dating back to the early 1930s. These egg cards show information on when and from where eggs were received, but no information on where the eggs or resultant fish were planted. The Somers station received eggs from Utah's Springville Hatchery, from Wisconsin Conservation Commission, from a Newell Cook state fish hatchery (state unknown), and from a Rainbow Ranch located near Troy, Montana. This latter source was a private hatchery located on Slee Lake operated by a Kenneth G. Drew; Mr. Drew was also connected with private hatcheries located at Arlee and Woodworth, Montana. The "Drewbow" trout farm apparently no longer exists and the whereabouts of Mr. Drew is unknown and he is likely deceased since his approximate age now would be at least 80 years.

One of the major ways of shipping eggs to hatcheries or distributing fish from the 1910s to 1930s was by railroad car. Both the federal hatchery at Bozeman and Montana had railroad cars fitted with aeration systems so that fish held in ten gallon milk cans could be transported long distances. These cans were delivered to individuals or groups requesting fish or were planted by car attendants in streams close to railroad tracks. One early day railroad track ran from

Somers to Libby, and points west via Ashley Creek, Pleasant Valley Fisher River area, down Little Wolf Creek, Wolf Creek, lower Fisher River and Kootenai River to Libby and Troy. It is considered likely that the aforementioned streams were planted in this manner. Another railroad line ran from Kalispell to Eureka, and down the Kootenai River to Libby and Troy. Old hatchery correspondence maintains fish planting occurred along this route. The present U.S. Highway 2 existed in the 1920s and hatchery records of that era indicate that plantings were made in streams along this route. Streams would have included Fisher River and Libby Creek. The latter records were checked during a search for old bull trout history information and are stored at the Montana Historical Society in Helena, Montana.

Another method was to have individuals or groups pick up fish at hatcheries for planting. In either case, no records were kept of where fish were finally planted. It is likely that the latter method was used to plant Lena Lake in the Bob Marshal Wilderness Area in the mid to late 1920s with rainbow trout probably reared at the Somers hatchery. Genetic testing of fish from this lake done in 1987 indicated they were a mix of inland and coastal rainbow trout. Origin of the original fish is unknown, but likely from Lake Mary Ronan, Little Bitterroot Lake or a Troy area lake as these were likely the Somers hatchery egg sources.

In 1990 and 1991, FWP personnel collected fish from selected streams in the Lake Creek and Yaak River drainages for genetic analysis. Two streams in the Lake Creek drainage, North Fork Keeler and Camp creeks, were found to contain genetically pure westslope cutthroat trout and North Fork Keeler Creek contained bull trout-brook trout hybrids. Several streams in the Yaak River drainage were found to be populated with pure or slightly hybridized with westslope cutthroat inland rainbow trout. In 1992 and 1993, the Kootenai National Forest and FWP collected fish samples from most streams and several lakes in the Yaak River drainage for genetic analysis. A report entitled, "Genetic Analysis of 45 Trout Populations in the Yaak River Drainage, Montana," by Kevin Sage, et al. (1992) describing the results of most of the genetic analysis is available from the Wild Trout and Salmon Genetics Laboratory, Biological Division, University of Montana, Missoula, Montana.

The summary of this report is reprinted below as a brief description of the results of the Yaak River genetic survey:

SUMMARY

> "We used protein electrophoresis to determine the genetic composition of 45 trout populations in the Yaak River drainage, Montana. In the North Fork Yaak drainage, all three populations sampled appear to be genetically pure interior rainbow trout. In the East Fork Yaak drainage, six populations sampled appear to be genetically pure interior rainbow trout, four populations are slightly hybridized with westslope cutthroat trout and one population, established from hatchery introductions, appears to be genetically pure westslope cutthroat trout. In the West Fork drainage, all six populations sampled appear to be genetically pure westslope cutthroat. In tributaries to the middle and lower Yaak River, 10

populations appear to be genetically pure westslope cutthroat, 11 populations are westslope cutthroat by rainbow trout hybrid swarms, and 1 population is a westslope cutthroat by Yellowstone cutthroat trout hybrid swarm."

"The available evidence indicates that interior rainbow and westslope cutthroat trout coexisted in tributaries to the lower Yaak River. The rainbow trout appears to have occupied the lower portions of these streams and the cutthroat trout the headwaters. In contrast, westslope cutthroat trout appear to have been the predominant fish in the West Fork and middle Yaak drainage, while interior rainbow trout appear to have been the predominant fish in the North and East forks of the Yaak River drainage. In addition, as one proceeds northwards up the drainage the genetic impact of introduced coastal rainbow trout on native populations diminishes."

Huston (1993) reported on genetic survey of fish from four lakes in the Yaak River drainage done in summer 1992. Mt. Henry Lake in the East Fork Yaak River drainage contained a population of pure westslope cutthroat trout totally dependent upon continual planting with hatchery fish. Planting of this lake has been terminated until an acceptable source of inland rainbow trout can be obtained. Survey of North Fish Lake showed all fish as pure westslope cutthroat trout, but that the lake had no outlet into the East Fork Yaak River or into Middle and South Fish lakes. Middle and South Fish lakes connected to the Yaak River via Vinal Creek contained pure westslope cutthroat trout and coastal rainbow trout. Data presented by Sage (1992) suggests that westslope cutthroat trout were probably the native fish in the Vinal Creek drainage.

In summary, the limited historic information and pre-1994 genetic analysis data lead to the following conclusions.

1. Inland rainbow trout and westslope cutthroat trout were native to the Yaak River drainage above Yaak Falls and probably to the Yaak River drainage below Yaak Falls.

2. Inland rainbow trout were native to Callahan Creek which is also below Kootenai Falls.

3. Inland rainbow trout have invaded waters of the Kootenai River drainage above Kootenai Falls in recent years.

4. There is a good likelihood that inland rainbow trout were present in Montana's hatchery system prior to the 1950s and that these fish, either as pure strain or mixed with coastal rainbow trout, were indiscriminately planted throughout Western Montana or maybe the entire state.

5. The Libby Creek drainage above Kootenai Falls contains pure inland rainbow as well as mixed inland-coastal rainbow trout.

RESULTS OF 1994 SAMPLING, CONCLUSIONS, AND RECOMMENDATIONS

In July, 1994 the U.S. Fish and Wildlife Service, Montana Fish, Wildlife & Parks and Kootenai National Forest agreed on a plan to collect fish from selected waters within the Montana portion of the Kootenai River drainage. Purpose of this sampling was to determine genetic makeup of fish populations within the selected waters with emphasis on westslope cutthroat trout and inland rainbow trout. Presence or absence of bull trout, tailed frogs, sculpins and other biota of interest was to be recorded. Scale samples from collected fish were to be taken and age-growth analysis performed. Crews from the Kootenai National Forest and FWP were to collect the fish while genetic analysis was to be done by the University of Montana's Wild Trout and Salmon Genetics Laboratory. Age-growth determinations were to be made by FWP personnel. Genetic analysis of fish from individual waters was to be compared to fish planting history; planting records are fairly accurate from about 1935 to the present, but very unreliable or non-existent prior to 1935.

The original sampling schedule listed 23 streams and 8 lakes from which fish were to be collected. An unusually intense forest fire season in the Kootenai River drainage delayed sampling of many streams and caused cancellation of most lake sampling. In total 37 fish samples for genetic analysis were collected from 31 streams and 2 lakes. No fish were found in another three streams. Normal sample size for genetic analysis is 25 fish but in some waters this target was not reached. Genetic analysis, age and growth data and other data are presented by stream or sub-drainage in the pages that follow starting with the lowermost stream in the Kootenai River drainage in Montana. Also included is genetic analysis of other populations from previous years' work when appropriate. The areas where fish were collected are shown on Figure 1, map of Kootenai River drainage.

Standard fish species abbreviations used for the remainder of this paper include: WCT - westslope cutthroat trout; YCT - Yellowstone cutthroat trout; RB - rainbow trout; CRB - coastal rainbow trout; IRB - inland redband rainbow trout; EB - eastern brook trout; ?X? - hybrid between two of the above; ?X?X? - hybrid between three of the above. The first species in a hybrid is the most common genetic material.

Genetic Analysis

Yaak River - Four samples were collected from the Yaak River area and included two from the main stem, one above and one below Yaak Falls, one from Wee Lake, and one from Kilbrennen Creek. Wee Lake is the headwater source of Arbo Creek mentioned earlier in this report. Genetic analysis, sample size, and planting history are presented below.

Table 1a. Genetic analysis of fish, sample size, and planting history, Yaak River drainage, 1994.

Waterbody	Genetic Analysis	Sample Size	Planting History
Yaak River above Falls	IRBX, CRT x WCT	28	YCT (1933-70) RB (1934-69) EB (1946-47)
Yaak River below Falls	IRB	25	RB (1954-66)
Wee Lake	IRB	9	RB (1931)
Kilbrennen Creek	IRX x CRB	10	YCT (1939, 1941, 1946) EB (1944, 1949)

Genetic analysis presented by Sage, et.al (1992) indicates that inland rainbow and westslope cutthroat trout were likely the native salmonids in the Yaak River drainage above Yaak Falls. The analysis of fish from the Yaak above the falls seems to fortify Mr. Sages opinion. The coastal rainbow trout genes would have been the result of planting Yaak River with hatchery rainbow trout on an almost yearly schedule from 1934 to 1969. Planted fish ranged from young of the year to catchable size. Considerable numbers of Yellowstone cutthroat were also planted in Yaak River. However, no trace of this species has been found by electrophoresis except in the headwaters of one Yaak River tributary (Sage 1992). Brook trout have become well established, but are most abundant upstream from the Pete Creek campground. Bull trout have not been captured in any of the sampling done in the Yaak River drainage above Yaak Falls.

Fish from Yaak River taken from below the falls tested to be pure inland rainbow trout. Rainbow trout were planted in five years during the 1954-1966 period and it is likely that most were planted near its mouth due to very poor road access further upstream. Yaak River below the falls has long been considered a spawning area for Girrard strain inland rainbow trout from Kootenai Lake, British Columbia. The age structure of the fish caught might indicate a rearing population of an adfluvial adult population; see age-growth section presented later in this paper.

The sample from Wee Lake, headwater of Arbo Creek, included only nine fish, but all were classified as inland rainbow trout. Wee Lake had been planted one time with rainbow trout in 1931 and with Yellowstone cutthroat in 1939, 1941 and 1946. There is some possibility that Wee Lake was barren before being planted in 1931, and, if so, the fish planted were inland trout. If fish were present in Wee Lake before the first planting and the planted fish were coastal-type rainbow then either the coastal rainbows did not survive, were not sampled or genetic material may have already been bred out of the population. Yellowstone cutthroat genetic material were not present in any of the nine fish analyzed. Additional fish from Wee Lake will have to be collected and analyzed to clarify the genetic makeup.

The sample from Kilbrennen Creek numbered only 10 fish and were classified inland rainbow by coastal rainbow hybrids. Additional fish should be analyzed from this stream to ascertain genetic makeup to at least a 95 percent confidence level. Kilbrennen Creek is the outlet of Kilbrennen Lake, the latter which was used for an egg source of rainbow trout in the 1910s to maybe early 1930s.

Table 1b. Lake Creek drainage sample analysis, sample sites and planting history

Waterbody	Genetic Analysis	Sample Size	Planting History
Lake Creek	CRB	25	RB (1938-1962) YCT (1931-1959) EB (1938, 1942, 1943, 1948)
Lower Keeler Creek	~~IRB x WCT~~ CRB x WCT	13	RB (1951) YCT (1924-58, 11X)
Upper Keeler Creek	WCT x CRB	29	
Ross Creek above falls	WCT	28	None, see text
Camp Creek[1/]	WCT	25	None
Dry Creek[1/]	WCT	1	None
Porcupine Creek[1/]	WCT	10	None
N. Fork Keeler Creek[1/]	WCT	25	WCT (1976-77)

[1/]These samples analyzed prior to 1994.

The native fish fauna of the Lake Creek drainage has probably been greatly affected by two man-made events. These are construction of a small hydroelectric impoundment near Lake Creek's mouth about 1915, which stopped all upstream fish movements from Kootenai River and the long term planting of Bull Lake which should be considered a headwater lake. Fish, Wildlife & Park's planting records show that Bull Lake has been planted with over three million fish since 1924 and species planted included rainbow, Yellowstone cutthroat, westslope cutthroat trout, brook trout, lake trout, kokanee, grayling and largemouth bass. Yellow perch and pumpkinseeds are also in the lake. Some of the lakes tributaries including Ross Creek below its falls have also been planted with rainbow and cutthroat trout. The Ross Creek Falls located about two miles above Bull Lake is a definite barrier and Ross Creek below this falls generally goes dry by mid-summer.

Bull Lake does contain a small population of bull trout. The only known spawning and rearing area for these fish is lower Keeler Creek and lower North Fork Keeler Creek. Sampling for

rainbow trout in 1994 in the lowest half mile of Keeler Creek yielded about three times as many small bull trout as rainbow trout and one large adult bull trout was observed. Yet, sampling in upper Keeler Creek about five miles upstream yielded only westslope cutthroat slightly hybridized with coastal rainbow trout. A confirmed brook trout-bull trout hybrid was caught in the lower part of North Fork Keeler Creek in previous years sampling.

The author suspects that the native salmonids in the Lake Creek drainage were bull trout, westslope cutthroat trout, and inland rainbow trout. The bull trout would have been confined to Bull Lake, Keeler Creek and main stem Lake Creek below Bull Lake. Westslope cutthroat trout would have been limited to Lake Creek tributaries while rainbow trout would have been limited to main stem Lake Creek and the lower portions of some of the larger tributaries such as Keeler Creek and possibly Stanley Creek. The dam located near the stream mouth eliminated spawning runs of Girrard rainbow trout and bull trout from Kootenai River and other downstream waters. The 1994 sampling in Lake Creek also caught two brown trout (*Salmo trutta*). Likely these fish were the result of an illegal transplant from Bull River in the Clark Fork drainage which is only a few miles to the south.

Table 1c. Genetic analysis of fish from other streams below Kootenai Falls, sample size and planting history

Waterbody	Genetic Analysis	Sample Size	Planting History
Callahan Creek	IRB	25	RB (1953), see text; YCT (1933-69, 11X)
S.F. Callahan Creek	IRB	25	None
N.F. Callahan Creek (in Idaho)	IRB	25	None
Upper O'Brien Creek	WCT x YCT	19	YCT (1924-25)
Lower O'Brien Creek	WCT x CRB x YCT	25	RB (1978), see text

Planting records show that Callahan Creek was planted with rainbow and Yellowstone cutthroat trout. The author believes that these fish were planted in lower Callahan Creek downstream from a falls thought to be a barrier. This falls is located about two miles upstream from the Kootenai River, and according to local rumor may be wearing down but still concentrates large spawning rainbow from the river creating a good snagging/poaching locale.

The analysis of the three samples from Callahan Creek showed all were inland trout. However, differences between the North Fork sample and the combined South Fork and Callahan Creek samples were notable. Frequency of one of the marker proteins was 60 percent in the North Fork fish and only 30 percent in the other samples.

O'Brien Creek was planted with Yellowstone cutthroat in 1924 and 1925 and evidently these fish readily introgressed with the native westslope cutthroat trout. Rainbow trout green eggs taken from fish spawning in Bobtail Creek, a Kootenai River tributary above Kootenai Falls, were planted in lower O'Brien Creek in 1978. Purpose of this 1978 planting was to establish a spawning run of Kootenai River rainbow into O'Brien Creek. O'Brien Creek also supports a spawning run of bull trout from Kootenai River. Redd counts have averaged about 15-20 for the last three years.

The available data strongly suggest that westslope cutthroat trout and bull trout were the native trout in O'Brien Creek.

Seven streams and one headwater lake located in the Kootenai River drainage above Kootenai Falls but below the city of Libby, Montana were sampled and fish analyzed. The findings of these efforts are presented in Table 1d.

Table 1d. Planting history and genetic analysis of fish collected from waterbodies located between Kootenai Falls and Libby, Montana.

Waterbody	Genetic Analysis	Sample Size	Planting History
Koot Creek	This stream fishless		
Williams Creek	No fish caught, see text		
China Creek	IRB x CRB x WCT	26	None
East Fork Pipe Creek	WCT x YCT	25	YCT (1939, 43, 52)
Flower Creek	WCT x CRB	20	RB (1941) YCT (1925) EB (1936, 38)
Lower Hanging Valley Lake	IRB x CRB	25	None, see text
Parmenter Creek	IRB x CRB x WCT	26	RB (1943) YCT (1925, 38)
Cedar Creek	IRB x CRB	29	None,see text
Bobtail Creek	WCT x CRB	14	YCT (1939, 40, 43, 51) EB (1926, 32, 46, 48, 53, 54)

Williams Creek is a very small stream tributary to Kootenai River about two miles above Kootenai Falls. About 300 feet of stream immediately upstream from U.S. Highway 2 was

sampled in late July, 1994, and no fish were caught or seen. However, this stream section was dry later in the year which may account for no fish. It is recommended that this stream be sampled a couple of miles further up in fall 1995 to ascertain if the creek is in fact fishless.

China Creek is a very small tributary of Kootenai River entering the river about one mile above Kootenai Falls. The fish collected from this creek were taken within a short distance of Kootenai River, were mostly four inches long or less and may represent progeny of river spawners. After leaving the valley floor, the creek has a very steep gradient that should limit access by river spawners and the upper reaches should be sampled to determine what, if anything, is present.

East Fork Pipe Creek is a headwater tributary of Pipe Creek joining with Pipe Creek about 18 miles upstream from Pipe Creek's confluence with Kootenai River. It is known that main stem Pipe Creek is a spawning and rearing area for rainbow trout, mountain whitefish, and bull trout from Kootenai River. Rainbow trout collected from Pipe Creek would very likely mimic the genetic make-up of rainbow in Kootenai River. However, spawning runs of rainbow trout from Kootenai River have never been observed in East Fork Pipe Creek. The genetic analysis shows that the native species, westslope cutthroat trout, has been interbred with the introduced Yellowstone cutthroat trout and that the genetic make-up is about 80 percent westslope cutthroat and 20 percent Yellowstone cutthroat.

The Flower Creek drainage has been all or part of the city of Libby's water supply system for years, and the creeks within the drainage closed to fishing but the lakes open to fishing. A small impoundment without fish passage facilities built prior to 1920 is part of this water system. This impoundment has stopped upstream fish passage eliminating the influence of downstream fish populations. The author first sampled Flower Creek above the city water works in 1960 and identified the fish as westslope cutthroat trout. Since westslope cutthroat trout were not planted in the drainage's lakes until 1969, it is very likely that the westslope cutthroat trout is the native fish species in Flower Creek. No explanation can be given for the occurrence of IRB x CRB in Lower Hanging Valley Lake at this time except to suspect they originated from a hatchery planting in past years or that IRB were native to the lake and CRB were planted on top of the IRB. Additional genetic analysis is required from waters within the Flower Creek drainage to make a logical conclusion about what fish species or strains were native to this stream-lake system.

Lower Hanging Valley Lake is a headwater lake in the Flower Creek drainage. Other headwater lakes within the Flower Creek drainage are listed as being planted with rainbow trout, golden trout, and westslope cutthroat trout. One of these listings is titled Flower Creek Lakes which could be the two Hanging Valley lakes, upper and lower.

Parmenter Creek is a small tributary of Kootenai River originating in the Cabinet Wilderness and joining the Kootenai River near the town of Libby. As far as is known, rainbow trout from Kootenai River could reproduce in this creek as far upstream as the point of fish collection for genetic analysis. One small bull trout was also caught during the fish collection.

Cedar Creek is a small tributary of Kootenai River west of Libby that originates in the Cabinet Wilderness. Planting records indicate this stream has never been planted although Upper Cedar Lake, the source of Cedar Creek was planted with rainbow trout one time in 1940. The stream length sampled should be accessible to fish from Kootenai River.

Bobtail Creek enters Kootenai River a short distance downstream from Pipe Creek and, like Pipe Creek, it supports a sizable spawning run of rainbow trout from Kootenai River. Spawning rainbow trout have been reportedly caught almost as far upstream as where the genetics sample was collected. The dominant gene in the fish tested was westslope cutthroat trout and since this species has never been planted in Bobtail Creek, it is logical to assume that westslope cutthroat is the native species.

The limited data presented in Table 1d indicates to the author that westslope cutthroat trout is the native species in at least Bobtail Creek, Pipe Creek, and Flower Creek. Hybrids found in lower Parmenter Creek and China Creek may be the result of spawning runs of fish from Kootenai River, while species native to Lower Hanging Valley Lake and Cedar Creek can not be speculated on at this time.

Table 1e. Genetic analysis, sample size and planting history of Big Cherry Creek tributary to Libby Creek and three of its tributaries.

Waterbody	Genetic Analysis	Sample Size	Planting History
Lower Big Cherry Creek	IRB x WCT	25	RB (1936) YCT (1939, 43, 46, 49, 51)
Middle Big Cherry Creek	IRB	25	Same as above
Granite Creek	IRB x WCT	25	RB (1944) YCT (1925-51, 7X)
Deep Creek	WCT x RB	25	YCT (1931, 48) EB (1939-45, 6X)
Leigh Creek	WCT x RB	25	None

Genetic analysis of several fish populations in the upper Libby Creek drainage collected in the mid 1980s showed that rainbow trout in that drainage varied from mostly coastal rainbow trout to inland rainbow trout. Planting records show that Libby Creek and one headwater lake, Howard Lake, had been or are still being planted with rainbow trout. Rainbow trout from the Kootenai also spawn in the Libby Creek portion of the drainage, although it is not know whether river spawners travel into the headwater areas. Kootenai River bull trout are also thought to spawn in upper Libby Creek and resident populations of bull trout do occur.

Spawning runs of rainbow or bull trout have never been documented in the Big Cherry Creek portion of the Libby Creek drainage. One factor thought to have limited use by migratory populations was mine pollution originating from Snowshoe Creek. Another major difference between Libby and Big Cherry creeks is that cutthroat are found in only one Libby Creek tributary (Swamp Creek) while genetic results in the above table show that cutthroat occurs in at least two of the three tributaries sampled.

The data presented in Table 1e would seem to indicate that inland rainbow trout is the native salmonid in part of the drainage, while westslope cutthroat is the native species in other parts. Inland rainbow trout sampled here were found mostly in valley floor, low gradient areas while the westslope was found in higher stream gradient sites. Valley floor streams in the Libby Creek drainage at the present time, and probably historically, have very poor fish habitat and contain low fish numbers. The Libby Creek drainage is subject to very severe rain on snow events at a frequency of about once every ten years. Land management activities since the turn of the century have probably increased the severity of flood events.

Considerably more testing has to be done in all of the Big Cherry Creek drainage including high mountain lakes within the Cabinet Wilderness to ascertain native and current salmonid distribution.

Table 1f. Genetic analysis, sample size and planting history of certain streams in the Fisher River drainage

Waterbody	Genetic Analysis	Sample Size	Planting History
Fisher River @ MP14	IRB x CRB x WCT	25	RB (1934-82, 32X) YCT (1925-68, 21X) EB (1950,52)
Wolf Creek	IRB	27	RB (1943-44) EB (1932-54, 16X)
Silver Butte Fisher River	IRB	9	YCT (1932, 33, 48, 49, 51) EB (1946)
Silver Butte Creek	WCT	16	YCT (1932, 33)
Silver Bow Creek	WCT	25	None
Himes Creek	WCT x IRB x CRB	7	None, see text
Crystal Creek	WCT	11	None
Pleasant Valley Fisher River	IRB x CRB x WCT	26	RB (1942, 43, 44, 49) YCT (1940) EB (1932-59, 10X)

The Fisher River drainage is the largest tributary of Kootenai River in Montana above Kootenai Falls in both drainage area and water yield. Major tributaries to Fisher River from mouth to source include Wolf Creek, West Fork Fisher River, Silver Butte Fisher River, East Fork Fisher River and Pleasant Valley Fisher River. All the above named steams except the West Fork could be classified as valley floor streams having low gradients. In addition the tributaries of Wolf Creek and Pleasant Valley Fisher River are not typical of higher gradient mountain streams. The West Fork Fisher River, its tributaries and tributaries of Silver Butte Fisher River arise in the Cabinet Mountain Range and have physical characteristics of the "typical" mountain stream.

Salmonids including mountain whitefish, bull trout, and rainbow trout from Kootenai River do use portions of the Fisher River drainage for spawning and rearing. Whitefish spawning is limited to main stem Fisher River and fish may go at least 25-30 miles upstream. Extent of rainbow trout spawning areas is largely unknown, but they should migrate as far upstream as whitefish. It is known that neither whitefish or rainbow trout enter the Wolf Creek drainage. Where bull trout spawn is also unknown at this time but it is suspected that reproduction may occur in the West Fisher River drainage.

Genetic analysis indicate that fish in Wolf Creek are inland rainbow trout. These data support sampling done by a U. S. Forest Service crew in 1993 that collected small numbers of rainbow trout for genetic analysis. The analysis for fish taken from Little Wolf and Weigel creeks, tributaries of Wolf Creek and Wolf Creek itself upstream from the 1994 sample indicated that all were inland rainbow trout. Rainbow trout from Silver Butte Fisher River collected in 1994 were also analyzed as inland rainbow trout as was a small sample collected in 1987 from a location in Silver Butte Fisher River about three miles further upstream.

Fish from headwater tributaries of Silver Butte Fisher River, Silver Butte Creek and Silver Bow Creek were analyzed as pure westslope cutthroat trout. A Plum Creel Timber Company crew collected seven fish from Himes Creek, tributary to East Fork Fisher River which is tributary to Silver Butte Fisher River and these fish tested as mostly westslope cutthroat with some rainbow trout influence.

Crystal Creek is a very small tributary to the Pleasant Valley Fisher River about mid-point between Loon Lake and junction of Silver Butte and Pleasant Valley Fisher rivers. Fish from this creek were analyzed as westslope cutthroat trout.

In 1993 the U. S. Forest Service collected six fish from the lower part of Marl Creek and these were analyzed as inland rainbow trout. Marl Creek is a small tributary of Pleasant Valley Fisher River about five miles above Loon Like. In 1994 another 16 fish were collected from Marl Creek and 10 from Pleasant Valley Fisher River near Barnum Creek which is about 2 miles downstream from Marl Creek. These 26 fish were mostly inland rainbow trout combined with coastal rainbow trout and westslope cutthroat. It is suspected that the coastal genes originated with rainbow trout planted in Pleasant Valley Fisher River or Loon Lake and that the westslope originated from some native population within the drainage.

The author considers it a good possibility that inland redband rainbow trout were the native trout of some portion of the Fisher River drainage while westslope cutthroat trout were native to the remainder of the drainage. Bull trout residing in Kootenai River spawned and reared in parts of the drainage. The genetic data does point toward the westslope cutthroat as being native to mountain side streams and inland rainbow trout to valley floor stream.

Determination of definitive boundaries of native trout(s) in the Fisher River drainage cannot be determined without more intensive genetic testing. Additional streams and lakes within the Wolf Creek, Silver Butte and Pleasant Valley Fisher drainages will have to be tested. No water bodies within the West Fish drainage have been examined and several streams and lakes should be included in any sampling scheme.

Table 1g. Genetic analysis, sample size and planting history of certain streams tributary to Lake Koocanusa and one stream below Libby Dam.

Waterbody	Genetic Analysis	Sample Size	Planting History
Alexander Creek	CRB x WCT	9	None
Rainey Creek		No Fish Found	
Ten Mile Creek	CRB x WCT	12	None
Sutton Creek	CRB	26	YCT (1931, 39)
Pinkham Creek	CRB	26	RB (1934) YCT (1931-1950, 13X) EB (1946) WCT (1973, 74, 75, 80)

Fish from Pinkham Creek above Pinkham Falls were genetically tested and found to be coastal rainbow trout. The other species found above this falls is brook trout but no westslope cutthroat trout are present. The species found in Pinkham Creek above the falls leads the author to believe that this section of stream was barren of fish life before being planted with hatchery fish. Pinkham Creek below the falls currently is used for spawning by Lake Koocanusa trout, some resident fish probably rainbow trout, and by large numbers of brook trout. Westslope cutthroat trout were planted in the 1970's to establish spawning runs of fish from Lake Koocanusa.

The area of Sutton Creek from which fish were collected for genetic analysis is open to fish inhabiting Lake Koocanusa. This stream was not imprint planted with westslope cutthroat to establish spawning runs from the reservoir and the genetic analysis of only coastal rainbow trout seems to indicate that spawning runs did not develop on their own. Origin of the coastal rainbow population is not know but probably was derived from an unrecorded hatchery plant.

The area in Tenmile Creek sampled was within a half mile of Lake Koocanusa and the genetic analysis of hybrid coastal rainbow and westslope cutthroat trout is similar to that found in the reservoir. Tenmile Creek above Tenmile Falls should be sampled to determine status of these isolated fish.

Alexander Creek is a very small tributary of Kootenai River entering the river about half mile below Libby Dam. It is suspected that rainbow trout from Kootenai River have interbred with the native westslope cutthroat resulting in a hybridized population.

TENTATIVE INTERPRETATION OF GENETIC DATA

Information presented by Phelps and Allendorf (1980), by Sage (1992) and from other genetic data stored at University of Montana Wild Trout and Salmon Genetics Laboratory indicates that both the redband and westslope cutthroat trout are native to the Kootenai River drainage below Kootenai Falls. Genetic analysis of fish samples collected from various waters in the Kootenai River drainage above Kootenai Falls indicates that both the inland rainbow and westslope cutthroat were native fish species. Species found in tributary stream may have been determined by stream morphology. Creel census data from Kootenai River suggests that Kootenai River above the falls prior to construction of Libby Dam was primarily populated by westslope cutthroat trout.

Definite delineation of those territories occupied by the inland redband and westslope cutthroat will require additional testing of trout populations throughout their suspected range. Analysis should be concentrated on Cabinet Wilderness lakes, on streams within the Libby Creek drainage and on streams in the Fisher River drainage.

Age and Growth

Scale samples for age-growth analysis were collected from fish taken in 22 sampling sites from 20 individual waters. All scales were read and monographed assuming a straight line relationship between scale length and fish length and a zero intercept. Sample sizes were all small precluding any detailed comparisons between species or streams. These age-growth data are presented in Table 2, proceeding up the Kootenai River drainage, similar to Table 1a-f.

Table 2. Age-growth of fish collected for genetic analysis.

Water	Species	Length in Inches at Annulus I	II	III	IV	V
Yaak River above falls	IRB x CRB x WCT	2.5(45)*	4.5(42)	6.7(15)	10.2(3)	12.3(1)
Yaak River above falls	IRB	2.9(25)	6.0(4)			
Wee Lake	IRB	2.79(9)	7.3(9)	10.3(8)	12.0(5)	13.1(2)
Ross Creek	WCT	2.4(18)	4.39(1)	6.9(3)		
Keeler Creek, lower	IRB x WCT	2.7(8)	4.6(3)	6.4(2)	11.0(1)	13.8(1)
Lake Creek	CRB	2.9(17)	5.5(4)	6.9(1)		
N.F. Callahan Creek	IRB	2.0(23)	3.7(21)	5.1(8)	6.4(1)	
O'Brien Creek, upper	WCT x YCT	2.7(13)	5.0(10)	6.4(1)		
O'Brien Creek, lower	WCT x YCT x CBB	2.5(25)	5.1(8)	7.9(3)		
East Fork Pipe Creek	WCT x YCT	2.9(23)	5.0(14)	7.2(3)		
Flower Creek	WCT x CRB	2.7(11)	4.3(6)	5.9(1)		
Parmenter Creek	IRB x CRB x WCT	2.2(22)	4.2(19)	5.9(7)	7.4(3)	
Bobtail Creek	WCT x CRB	3.0(12)	4.9(5)			
Cedar Creek	IRB x CRB	2.6(11)	4.1(6)	5.5(1)		
Wolf Creek	IRB	2.7(21)	4.9(7)	6.9(1)		
Silver Butte/Fisher R.	IRB	2.3(7)	4.2(5)			
Silver Butte Creek	WCT	2.5(13)	4.1(8)	5.6(5)	8.2(1)	
Silver Bow Creek	WCT	2.8(10)	4.8(10)	6.4(5)		
Crystal Creek	WCT	2.4(9)	3.8(2)	5.8(10)		
Pleasant Valley/Fisher River	IRB x CRB x WCT	2.3(19)	4.0(2)			
Sutton Creek	CRB	3.0(18)	4.7(8)	6.0(1)		
Pinkham Creek	CRB	2.8(25)	5.6(12)	7.2(7)		

*Number in parenthesis is sample size

Occurrence of bull trout, tailed frogs, and sculpins was noted when each sample site was electrofished to collect fish for genetic analysis. Sculpins were not keyed to specific species or collected and preserved for future identification. Presence of tailed frogs was determined by capturing the larval stage during electrofishing. Presence of bull trout was noted and one specimen thought to be a bull trout-brook trout hybrid sent in for genetic confirmation. This specimen from Lake Creek was determined to be a bull trout. Present-Absent information on occurrence of sculpins, bull trout, and tailed frogs is listed in Table 3. It must be noted that a No answer does not necessarily mean that organism does not occur in that water; just that it was not captured in the stream section sampled.

Table 3. Occurrence of bull trout, tailed frogs and sculpins.

Stream	Bull Trout	Tailed Frogs	Sculpins
Yaak above	No	No	No
Yaak below	Yes	No	No
Kilbrennen Cr.	No	Unknown	Unknown
Lake Cr.	Yes	No	Yes
Keeler Cr.	Yes	No	No
Ross Cr.	No	No	No
Callahan Cr.	No	No	No
S.F. Callahan	Yes	No	No
N.F. Callahan	No	No	No
O'Brien, upper	No	No	No
O'Brien, lower	Yes	No	No
Chino Cr.	No	Yes	No
E.F. Pipe Cr.	No	No	No
Flower Cr.	No	No	Yes
Parmenter Cr.	Yes	No	No
Cedar Cr.	No	Yes	No
Bobtail	No	No	No
Big Cherry Cr.	No	No	Yes
Granite Cr.	No	No	Yes
Deep Cr.	No	No	Yes
Leigh Cr.	No	No	Yes
Fisher River	Yes	No	Yes
Wolf Cr.	No	No	No
S.B. Fisher River	No	No	Yes
Silver Butte Cr	No	No	Yes
Silver Bow Cr.	No	No	No
Hines	Unknown	Unknown	Unknown
Crystal Cr.	No	No	No
P.B. Fisher	No	No	No
Alexander Cr.	No	No	No
Ten Mile Cr.	No	No	No
Sutton Cr.	No	No	No
Pinkham Cr.	No	No	No

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