STATUS AND MANAGEMENT OF YELLOWSTONE CUTTHROAT TROUT

Oncorhynchus clarki bouvieri

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Captains Meriwether Lewis and William Clark were the first white explorers to scientifically document some of the indigenous strains of cutthroat trout found in what is now the State of Wyoming. Cutthroat trout (*Oncorhynchus* ssp.) are native to the major drainages of Northwestern America. Indigenous trout found in Wyoming included the Bonneville (*O. clarki utah),* Westslope (*O. clarki lewisi*), Colorado River (*O. clarki pleuriticus*), Greenback (*O. clarki stomias*), and Yellowstone (*O. clarki bouvieri*; includes Snake River) cutthroat trout (Baxter and Stone 1995). This document deals only with the management status of the Yellowstone cutthroat trout (YSC).

In the last decade research authorities and fishery biologists have noted the decline of YSC due to genetic introgression and habitat loss (Duff 1996; Varley and Gresswell 1988). Varley and Gresswell (1988) provided data indicating genetically pure YSC occupy 85% of historic lake habitat, but only 10% of the estimated stream habitat. The United States Department of Interior has recently indicated they are considering the listing of YSC as a Threatened subspecies under the Endangered Species Act. The petition for listing of YSC was initiated by the Biodiversity Legal Foundation, the Alliance for the Wild Rockies, Montana Ecosystems Defense Council, and George Wuerthner. The document specifically indicates the threats to YSC as stocking, angling pressure, habitat loss, whirling disease, and the New Zealand mud snail. Genetic purity is an overriding question that enters into the document in several instances (stocking not acceptable, etc.). Historically, this trout was found in the states of Idaho, Montana, Nevada, Utah, and Wyoming (Figure 1).

The decline of genetically pure YSC stocks has led to the current petition for listing. The overall assessment and quantification of the actual loss for historic range is largely predicated upon information relative to large-spotted YSC, and not the fine-spotted SRC. Kruse (1998) was correct in stating that the classification of SRC has major implications in the quantification of YSC historic range. He also notes the addition of SRC range will depict a lesser degree of decline in the presence of YSC subspecies. However, for the purpose of petitioning the U. S. Fish and Wildlife Service (USFWS) consider SRC and YSC are the same species.

In 1988, the American Society of Icthyologists and Herpetologists prevailed upon the American Fisheries Society to change the generic names of western North American trout species from *Salmo* to *Oncorhynchus*. Taxonomists agreed the native *Salmo* trouts of northern Pacific Ocean drainages were more closely allied with Pacific salmon *Oncorhynchus* spp. than other salmonid species of the Atlantic and Eurasian species

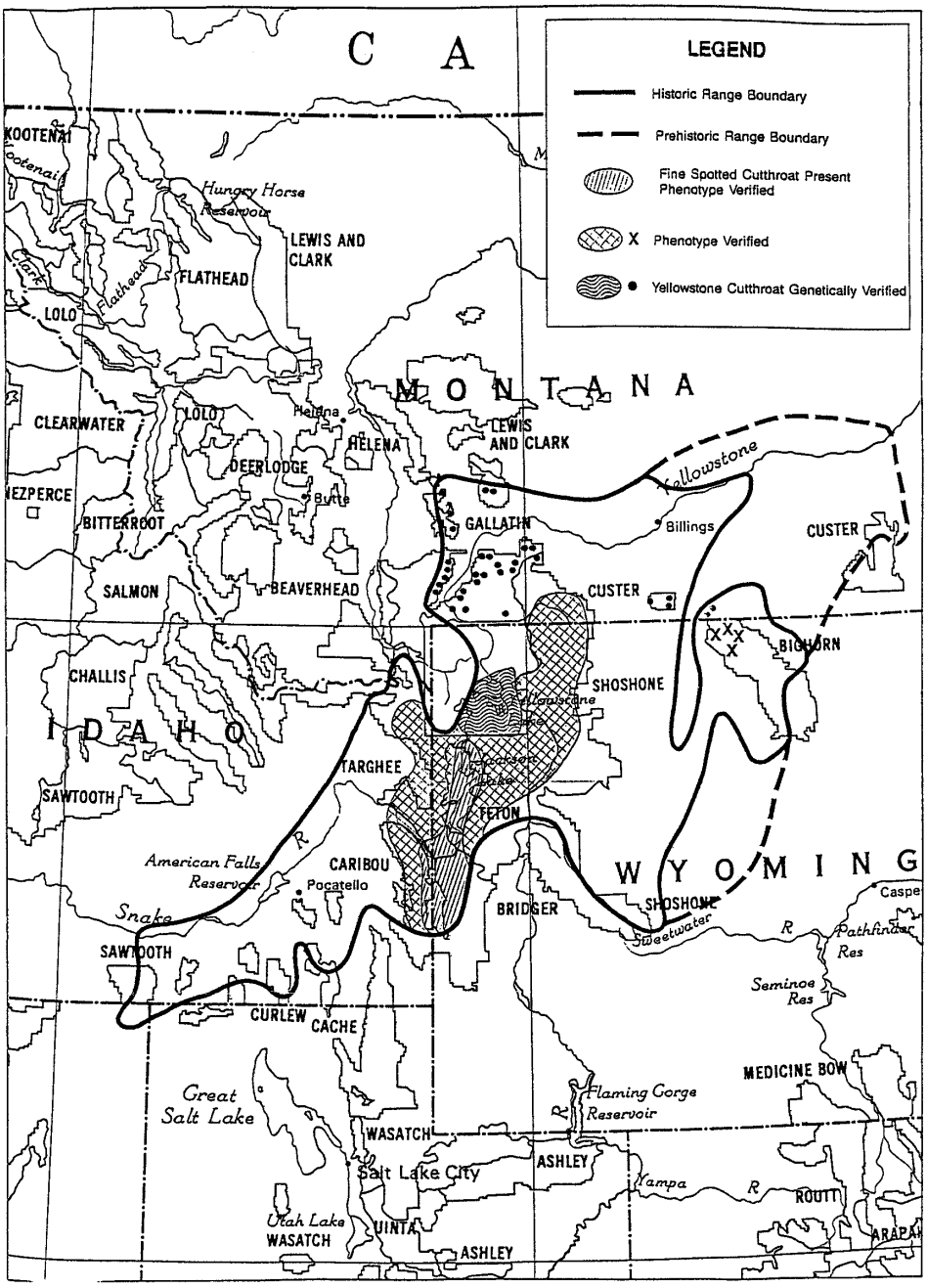


Figure 1. Yellowstone cutthroat. Historic ranges and present occupied habitats. (Reproduced from May 1996)

(Kendall 1988). Thus, one of the North American species that changed generic names was the cutthroat trout. Hence, reference to the generic name of native cutthroat in this document will reflect the nomenclature used during the period of investigation.

Review of early journals by Evermann and Cox (1894) turned up citations by Coues (1893) of the Lewis and Clark journals (1805). These explorers indicated YSC were found near Crooked Falls of the Missouri below Great Falls, MT, Missouri River East of Helena, Jefferson Fork of the Missouri South of Helena, MT, Beaverhead River near Grasshopper Creek South of Dillon, MT, and in the Gardner River below falls near Livingston, MT. More thorough documentation was to be undertaken nearly ninety years later.

Evermann's "Reconnaissance Of The Streams And Lakes Of Western Montana And Northwestern Wyoming" (1891), indicates there were no fish whatever in waters of Yellowstone National Park (YNP) and the adjoining area excepting the following: Yellowstone Lake and its tributary streams; mouth of the upper Yellowstone River; Meadow Creek; E. Fork Gardiner River below falls; McClellan Creek; Falls of Missouri River; Yellow Creek; Gallatin Fork; St. Mary River; Yellowstone River at Livingston; Solution Creek; Riddle Lake; Canyon Creek; Madison River; and Atlantic Creek (Two Ocean Pass and below). He found the many falls were effective barriers preventing fish movement into many waters and that very few fish existed above these barriers.

Evermann and Cox (1894) also related the presence of mountain trout (*Salmo mykiss lewisii*) in waters other than Yellowstone National Park. During their investigation of fishes of the Missouri River Basin, their field notes indicate YSC were abundant in the Tongue River Basin of the Big Horn Mountains which flows NE into the Yellowstone River in Montana. Mountain trout, YSC, were also found in the South Fork of Tongue River and Big Goose Creek. These scholars take scientific license and indicate YSC were undoubtedly in the Clark Fork of the Yellowstone and Big Horn River although no specimens were obtained. In addition, they believed mountain trout were present in the headwaters of the Powder River, even though no records were found. In truth, the actual regional presence of YSC will never be known.

All fisheries scientists have agreed on one distinct parameter, the outward appearance of this trout is widely varied at best. Whether it is called Rocky Mountain, mountain, black-spotted, Snake River, or Yellowstone trout, everyone had a tendency to attach a different specific name to it. Early notations of Lewis and Clark (1805), Evermann (1891), Jordan (1891), and Kendall (1914) reference the wide variety of coloration and spotting. Gilbert and Evermann (1894) found YSC when taken in larger river channels were lighter colored, had finer spots, and the red mark on the lower jaw was a fainter red. Everyone had an opinion on this matter. "With every additional collection of black-spotted trout it becomes increasingly difficult to recognize any of the distinctions, specific or subspecific, which have been set up. We are now convinced that the greater number of subspecies of *S. mykiss* have no sufficient foundation" (Evermann 1891). David Starr Jordan (1891) indicated that even though mountain trout from the Upper Missouri had received the name of *Salmo lewisi* (Girard), he could not recognize it as being distinctly different from *Salmo mykiss*. The difference in the many races of mountain trout is further compounded by imperfect geographic anomalies. As those before him, he also believed Yellowstone

Lake may have been naturally stocked from the Snake River by way of Two-Ocean Pass (Atlantic Creek). Evermann (1891) indicates there is a free waterway through Two-Ocean Pass that permits fish to pass easily from the Snake River into Yellowstone, or in the opposite direction. He further states it would be possible (barring certain falls) for a fish to start at the mouth of the Columbia, go to the crest of the great Continental Divide, and eventually enter the Mississippi and Gulf of Mexico.

The desire to create more recreational fishing in YNP led to the present management concerns that now face regional fisheries managers. The few fish species present in the park were abundant in the few waters where they were found. Increased numbers of anglers made it desirable to stock barren waters with game fish beginning in 1889 (Kendall 1914). The species that were either transplanted or introduced included native whitefish, native trout, rainbow trout, Loch Leven trout, landlocked salmon, European brown trout, lake trout, Eastern brook trout, and largemouth black bass. These different fish species were all stocked by 1914.

Some of the concerns in the proposed listing of YSC are predicated upon their genetic purity. The purity of those YSC inhabiting the Greater Yellowstone Ecosystem is clouded, at best. The exchange of both fish and eggs from Yellowstone National Park and sites out of the Park are noted in YNP stocking records. These records indicate the stocking of black-spotted, or cutthroat, or native trout as early as 1903 from the Park hatchery at West Thumb (Varley 1981). Other hatchery sources listed are as follows: Lake (YNP); YSL - Yellowstone Lake (YNP); Mammoth Pools (YNP); Sedge Creek (YNP); Emigrant (YNP); Ashton (ID); Ennis (MT); Bozeman (MT); Big Timber (MT); McAllister (MT); Cody (WY); Jackson (WY); Auburn (WY); Game Ranch Pond (WY); and the Soda Butte/Trout Lake complex (YNP).

In addition, YSC were taken from Howard's Creek, Idaho (near the headwaters of Henry's Lake) and planted in the E. Fork of the Gardiner River (Lava Creek) above the falls (Kendall 1914). The spawn of YSC were shipped from Yellowstone to the Jackson Hatchery on Spring Creek where they were hatched and distributed as advanced fry in the waters of what is now Grand Teton National Park (GTNP).

Inadvertent stocking has also occurred, much of which has not been documented. In 1945, nearly 23,000 YSC were brought into the old Jackson Hatchery, located immediately SW of Jackson, from Yellowstone Park and escaped into Spring Creek (Richan 1946). At that time the Jackson Hatchery site was less than two miles from the Snake River proper.

The wide exchange of eggs and advanced fingerlings throughout the region from such a wide variety of sources leaves the genetic purity of YSC somewhat in question. While there are certainly enclaves of pure YSC in the region, the impact of wide distribution of various races of YSC between 1903 and the late 1970s has already had its impact. The determination of the well being of YSC stocks relative to genetic purity may be too complex to warrant blanket judgment as to the future management of YSC stocks in many cases.

The genetic purity of Wyoming cutthroat stocks in the past has largely been judged using meristic characters, and some limited DNA analysis. There is now a need to determine the purity of select stocks and degree of intercrossing of populations and species by using DNA methodology. DNA analysis completed by the Wyoming Game and Fish Department Laboratory with the protocol established by Shiozawa and Evans of Brigham Young University will be utilized in the future. Colorado and Wyoming have developed a classification system that provides a method to assess the consistent interpretation of genetic purity (Interagency Agreement 1999). The parameters for this classification is as follows:

A+: A pure population with unique phenotypic, genetic or historical qualities that suggest special management consideration.

A: A pure population with no evidence of non-native salmonid hybridization.

A-: A population may be phenotypically representative, but has differences from the norm as a result of natural variation or movement of differing cutthroat populations from other regions by man.

B+: A population where 5% or less of the genetic markers indicate hybridization with non-native stocks.

B: A population where 5% or more but less than 10% of the genetic markers indicate hybridization with non-native stocks.

B-: A population where 10% or more but less than 15% of genetic markers indicate hybridization with non-native stocks.

C: A population where 15% or more but less than 20% of genetic markers indicate hybridization with non-native stocks.

D: A population where 20% or more of the genetic markers indicate hybridization with non-native stocks.

This classification system provides managers with alternatives necessary for the management and well being of native YSC populations in a very definitive and finite manner.

The management of YSC trout in Wyoming encompasses several management regions. The Wyoming Game and Fish Department fish management crews located in Cody, Lander, Jackson, and Sheridan are responsible for the management of the YSC stocks in Wyoming (Figure 2).

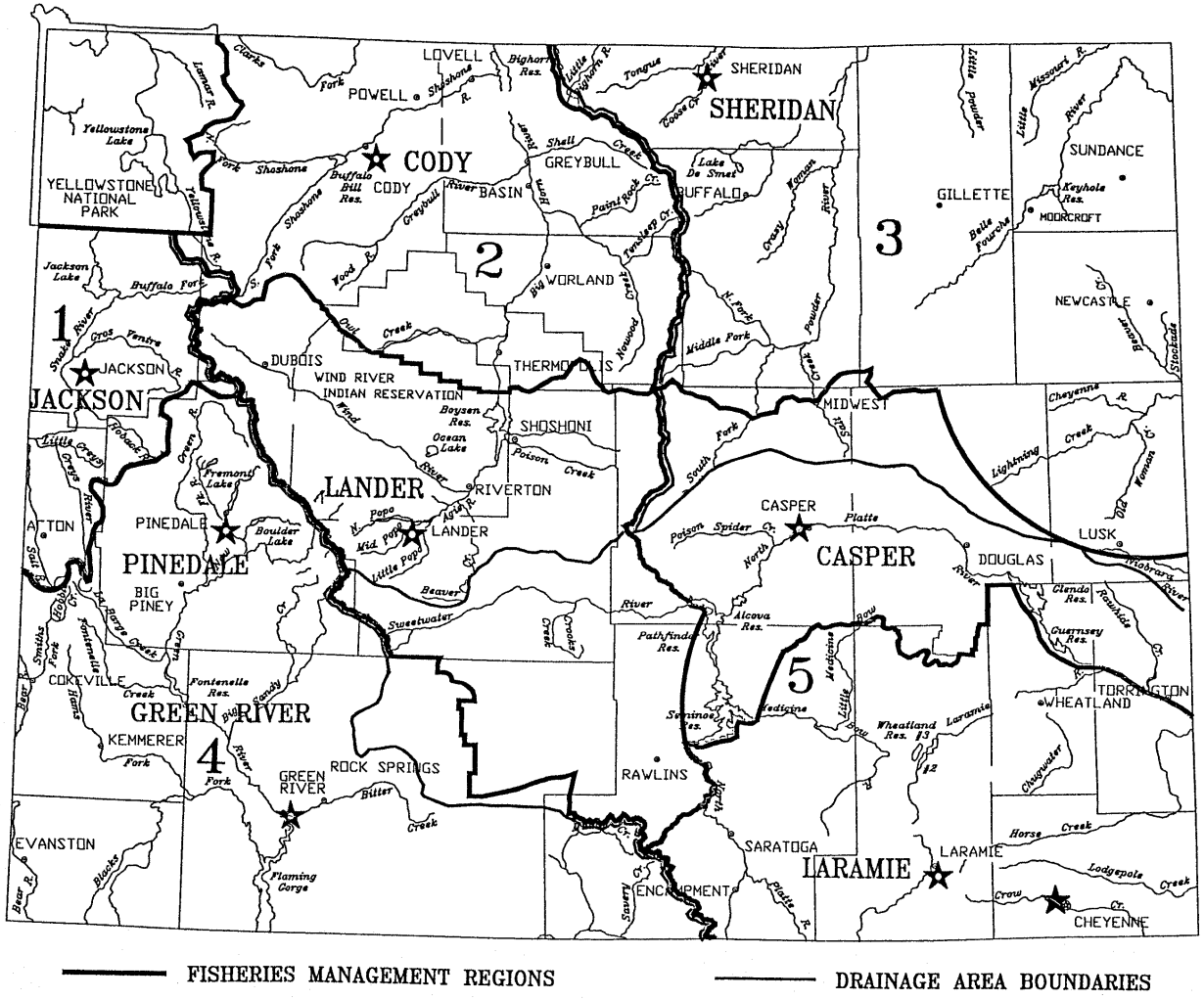


Figure 2. Wyoming Game and Fish Department regional fish management areas.

The presence of YSC in the differing management areas is quite variable (Table 1). Management practices are guided by individual basin management plans developed within the respective regions. The fish management crews are charged with the responsibility for the management, maintenance, and well being of the fishery resource. Their primary goal has been to maintain or increase the supply and diversity of sport fishing opportunities in their respective drainages. Management tools used in these endeavors include habitat manipulation, stocking, and regulations.

Table 1. Percent occupancy of YSC in historical waters in regional management areas, 1999.

Fisheries Management Region	Percent of Historical Waters Occupied
Cody	30
Jackson	98
Lander	10
Sheridan	24

Adding to the task of maintaining native YSC stocks is the presence of extensive SRC stocks in the state. Behnke (1979) notes that Snake River cutthroat trout are worthy of subspecies recognition. The widespread stocking of SRC throughout the state has contributed to widening and enhancing the distribution of YSC in many regions. However, stocking SRC has also made it difficult for managers to identify endemic stocks of YSC in their respective management areas. This and past distribution of YSC in and out of YNP puts an added burden on state managers to ascertain the current status of native stocks in general. New management efforts on behalf of YSC stocks will be developed on the basis of their specific geographic location, and the historical influence and bias of those waters in question.

Cody Fish Management Region.

The Cody fish management crew was established in the Big Horn River drainage in 1955. The management area encompasses roughly 13,000 square miles (Figure 2). This area, collectively called the "Big Horn Basin", extends from the Montana state line on the north, to Yellowstone National Park on the west, dropping along the hydrologic divide between the Snake River and Big Horn River drainages to the Wind River Indian Reservation and Copper Mountain hydrologic divide in the south. The eastern boundary includes all waters on the west slope of the Big Horn Mountains that drain to the Big Horn River. Three national forests (Shoshone, Bridger-Teton, and Big Horn) are within the region. Fish populations are generally limited by harsh environmental conditions from volcanic watersheds with steep channel slope, varied water temperatures, and low biological productivity (Kruse 1997). Management of native game and non-game fish is of primary importance in the Cody Region.

Historic Distribution in the Cody Region.

Historic accounts suggest the majority of the Cody Region was inhabited by YSC. Much of the literature was summarized by May (1996). Exceptions were noted in the Clarks Fork of the Yellowstone River drainage with Jordan (1891) indicating the upper portion

to be fishless above barrier falls. This would reduce the historic range by approximately 930 miles of perennial streams in this drainage (Kruse 1998). Portions of the Big Horn River were probably devoid of trout owing to warmer water temperatures. An expedition in 1864 led by Major John Owen and Jim Bridger traveled down the Big Horn River from the south and did not mention an encounter with trout until reaching the Greybull and Shoshone Rivers (May 1996). However, this does not preclude the existence of YSC in headwater areas of tributaries that drain into this reach such as Owl and Cottonwood Creeks where habitat and biotic conditions would be more favorable. Existing estimations of historic range do not account for stream reaches that could not support fish because of barriers, and other limiting abiotic geomorphic influences such as steep channel slopes, high elevation, and stream size (Kruse 1997). Consequently, actual historic range in the Cody Region was less than determined by May (1996).

Present distribution in the Cody Region**.**

From current Game and Fish Department stream-lake inventory data, the Cody Region manages a total of 1,452 waters (streams and standing waters). Of these, 917 are suitable public waters. A total of 78 waters contain only YSC populations (Appendix 1 and 2). An additional 93 waters contain pure YSC that exist sympatrically with non-native salmonids (BNT, BKT) or with RBT or hybrid swarms. Another 47 waters contain unidentified cutthroat (CUT or SRC) living alone or sympatrically with other salmonids. Information is lacking for these waters.

Non-native species introgression has been the number one threat to YSC populations within the Cody Region. Earliest regional exotic introductions were recorded in 1915 (Kruse 1998) and predate active fish management by forty years. Stocking was based mostly upon availability, public desire and emphasized sport fishing. When plants of cutthroat were made, the origin was sketchy. The general scenario from management records suggest that YSC, from a Yellowstone National Park source, were originally stocked until the late 1950's when cutthroat of the Snake River variety were then utilized (Satake 1977). For the purpose of this paper, SRC are not considered separate from YSC. However, use of this strain can be traced genetically using protein electrophoretic analysis which detects the presence of one allele (AK-1*333) that is common to the finespotted SRC and rare in YSC outside of the Snake River drainage (Robb Leary, personal communication). Then in 1972, an effort to establish a genetically pure brood stock of YSC was undertaken by the Wyoming Game and Fish Department. The first source was from South Paintrock Creek, a tributary off the west slope of the Big Horn Mountains. This population was small and isolated between barriers with BKT above and BNT and RBT populations below. An increase in genetic deformities forced a change to the McBride strain YSC from a Montana source during the early 1990's. Although there is little genetic basis to suggest this lake strain would not do favorably in stream situations, managers requested a change back to a strain with lotic origin. The LeHardy Rapids strain that inhabits the Yellowstone River is presently in use.

YSC distribution has also been reduced within the Cody Region by other anthropogenic influences (Kruse 1997) most notably logging, mining, agriculture, and irrigation. These actions have blocked fish migration (for example; the construction of Buffalo Bill

Reservoir on the Shoshone River in 1906), caused entrapment and entrainment, increased sedimentation, and altered stream channel morphology.

Detailed studies to determine the status of YSC and other fish species within the Cody Region began in the mid 1970's and centered primarily around three major drainages; the Shoshone, Greybull and Clarks Fork (Kent 1984, Yekel 1980). YSC were thought to exist in these areas, but little was known of genetic purity, population dynamics and habitat suitability. Our knowledge of YSC in the other three major drainages within the Big Horn Basin (Paintrock, Nowood and Shell Creeks) was limited to historic accounts of stocking by Superintendent S.E. Land of the Wolf Creek Hatchery at Decker Springs, Sheridan County, Wyoming (Report of State Fish Commissioner and Game Warden, 1895). He was reported to have planted 30,000 fry into Shell Creek above the falls and noted no evidence of fish in the creek at the time of stocking. No historic accounts are available regarding known YSC populations in Cedar, Deer, Trout and South Paintrock Creeks (all west slope tributaries of the Big Horn mountains) prior to cutthroat plants beginning in 1933.

To determine YSC genetic purity, abundance, distribution, and habitat features within the Cody Region, the Cody fish management crew, in cooperation with the Forest Service and University of Wyoming Cooperative Fish Unit, initiated an extensive study in 1993. The study was under the direction of Carter Kruse and included the drainages of the Greybull River and North and South Fork Shoshone River (Kruse 1995, 1998). These drainages represented a major portion of what was considered present YSC range. Results indicated that only 26% of the 104 streams containing trout still support YSC that are genetically pure. This represents 152 stream miles and a 70% loss of native trout from historic ranges within these watersheds. The Greybull River drainage contained genetically pure YSC, but with a high degree of introgression with the SRC variety from past stocking within the drainage. Should SRC be separated into a unique subspecies of cutthroat, the present range of what we currently consider YSC would be further reduced. While individuals of genetic purity were noted in the North Fork Shoshone River, most coexist with rainbow and hybrid swarms. Only Marquette Creek (some SRC influence) and four other tributaries within the upper portion of the South Fork Shoshone River contained pure YSC (living in sympatry with BKT).

Security of these populations from risk factors of hybridization and competition with non-native trout will be a constant concern. At present all four groups (Greybull River, Wood River, Marquette Creek and the upper South Fork Shoshone River enclaves) have estimated breeding populations in excess of 500 individuals and are large enough to withstand demographic and genetic pressures (Kruse 1998).

The initial study plan also called for sample collections for genetic purity on known YSC populations within the Upper Yellowstone, Clarks Fork, Porcupine and Shell Creek drainages. The Upper Yellowstone contained genetically pure populations at all sites, while purity was also substantiated at Cedar (Shell Creek drainage), Deer (Porcupine Creek drainage) and Muddy Creeks (Clarks Fork drainage). The South Paintrock Creek enclave continues to maintain a population of pure YSC.

Some extension of historic range has occurred in the Cody Region. As previously mentioned, the upper Clarks Fork drainage was thought to be fishless. YSC stocking has created populations in the Crandall and Dead Indian Creek drainages. However, RBT introgression has compromised these populations to some extent. The Muddy Creek population is also introduced but barrier falls protect it from similar risk factors.

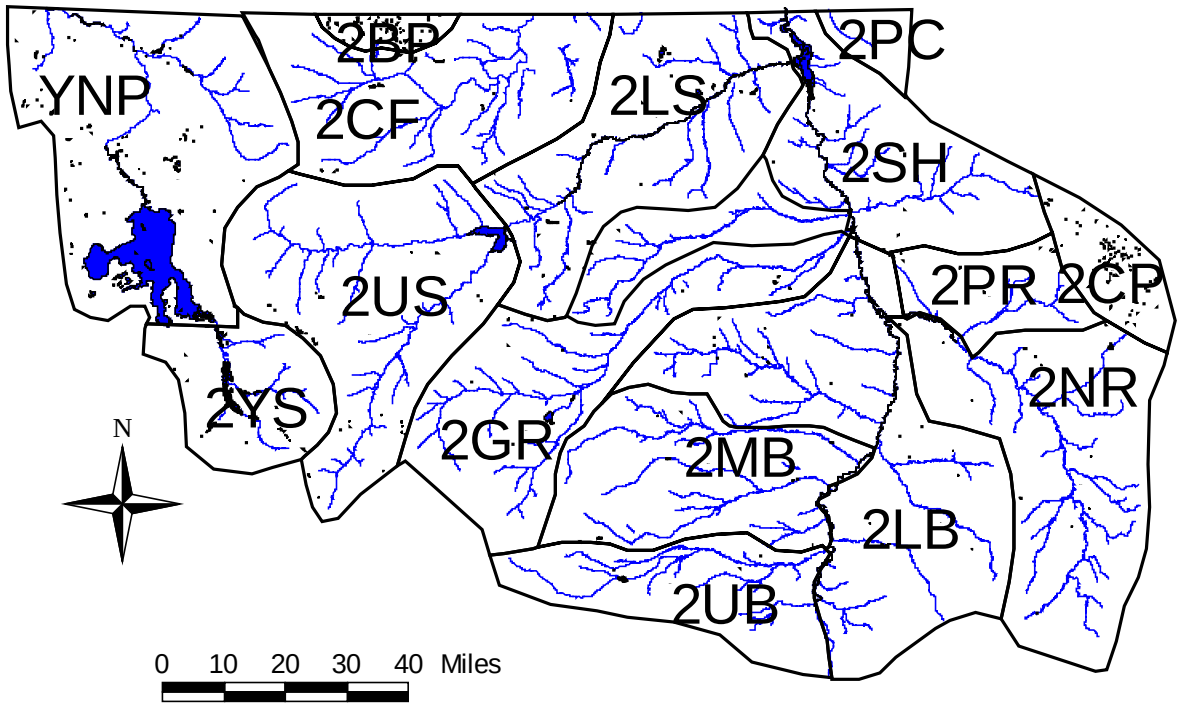
There were no known lakes in the Cody Region that contained indigenous YSC. Standing waters were stocked. A total of 12 lakes, ponds, or reservoirs contain only pure YSC while another 25 waters contain YSC along with other salmonids (Appendix 1).

Present management in the Cody Region.

Sub-basin management plans guide management strategies for all waters within the Cody Region (Figure 3). Present management continues to emphases protection and enhancement of wild trout fisheries of which identifying habitat degradation and developing improvement plans are an integral part. Stocking of lotic environments are limited to those that are impacted by manmade barriers, severe environmental conditions, inadequate spawning habitat or high public use.

Cultured YSC have been used to re-establish YSC above barriers in the Greybull River drainage with limited success. Kruse (1998) suggested that failure of these populations may be attributed to environmental perturbations; in this case high flows through relatively short distances of harsh environment. Further investigations will be directed towards habitat suitability and re-introduction strategies.

In the North Fork Shoshone River drainage, much of the fishery is driven by conditions within Buffalo Bill Reservoir. This highly migratory population spawns in numerous North Fork Shoshone River tributaries with the young returning to the reservoir in one to two years to rear and reach sexual maturity. Both the river and reservoir were stocked with YSC, but return to the creel and contribution to the overall YSC population was limited. Stocking was discontinued in 1989 in the river and in 1995 in Buffalo Bill Reservoir (Kent 1995, Yekel 1997). Presently, YSC represent approximately 10% of that population (Fish Division 1998, 1999). This drainage has been under a restrictive regulation to protect spawners since the late 1960's. The North Fork Shoshone River drainage from Gibbs Bridge upstream to Newton Creek (about 30 miles with a portion of the river closed to fishing from April 1 to July 1 while the North Fork Arm of Buffalo Bill Reservoir is closed from April 1 to July 15. Attempts to conserve YSC in the North Fork Shoshone River lead to restrictive YSC harvest regulations that were established in 1986. This did little to boost YSC numbers and was dropped at the end of year 1995. In 1996, we implemented regulations to decrease creel limits from six fish overall to three fish in the river and four in the reservoir to protect populations from over harvest.



Code	Basin Name	Code	Basin Name
YNP	Yellowstone National Park	2MB	Middle Big Horn River and tributaries
2YS	Upper Yellowstone drainage	2UB	Upper Big Horn River and tributaries
2BP	Beartooth Plateau	2PC	Porcupine Creek and tributaries
2CF	Clark's Fork River drainage	2SH	Shell Creek drainage
2US	Upper Shoshone River	2CP	Cloud Peak Mountain Lakes
2GR	Greybull River drainage	2PR	Paintrock Creek drainage
2LS	Lower Shoshone River drainage	2NR	Nowood River and tributaries
2LB	Lower Big Horn River and tribs		

Figure 3. Cody region sub-basin delineation, 1999.

The lower reaches of the Shoshone River below Buffalo Bill Reservoir are stocked with SRC, RBT, and BRC to met public demand and utilize available habitats. YSC are found in this reach but only incidental to high outflow from Buffalo Bill Reservoir. Natural reproduction is limited and favors BNT populations that have become established in small numbers from plants made in 1953 and 1954.

Efforts to re-establish YSC populations in the lower South Fork Shoshone River were initiated in 1981 through 1989. However, habitat degradation coupled with periodic dewatering limited success of this effort. This river is currently managed as a wild fishery. In addition, the drainage is dominated by small BNT populations (Fish Division 1997).

In the Clarks Fork watershed, recent stocking of YSC in the upper portion has been limited to the Dead Indian Creek drainage. These stocks continue to maintain a small population of YSC in the headwaters and also meet high public demand at campgrounds in the area off-wilderness. Hybridization with RBT is possible. YSC are also stocked along with RBT and GRL in the lower most reaches of the Clarks Fork, but these are managed mostly for yield as spawning and winter habitat is limited.

The Upper Yellowstone River above Yellowstone Lake is the last major drainage that does not appear to have an eminent threat to genetic purity maintenance. Little is known about the abundance and distribution of YSC in the drainage. Several range expansion efforts have been attempted. In 1977, the South Fork Yellowstone River received YSC transplants from Sedge Creek (A YNP water) attempting to establish a viable resident population above Woodard Canyon (Yekel 1996). Natural recruitment was limited by barrier falls. A small population has been established, but is limited by extensive angler use and harsh headwater conditions. Then in 1981 and 1982, Senecio Creek, a tributary to Atlantic Creek, also received a transplant from Sedge Creek. The fish were reported to have survived, but current status is unknown. Efforts to protect the Upper Yellowstone populations from overharvest have lead to a restrictive two fish limit. Harvest is limited by a short use season. Deep snow usually does not recede until late June in normal years and access is limited by winter storms by mid-October, allowing only a little over three months of back country angler use. This area is also remote and rugged with access limited to mostly horseback. However, outfitter use has increased in recent years. Future management direction will concentrate on protection of this valuable YSC drainage.

Prior to Kruse's work, the Cody Management Crew had hopes that YSC were isolated from introgression in the headwater areas of all of these drainages. Benke (1992) suggested that the resilience of cutthroat in headwater habitats may be a result of competitive advantage possibly due to physiological adaptations over other fishes in these habitats. Bozek and Hubert (1992) found that cutthroat were the most likely to be found in small streams at high elevation. This too suggested an ecological advantage. However, in Cody Regional watersheds, Kruse's (1998) results demonstrated that non-native salmonids can displace YSC in high elevation habitats and YSC are not able to withstand exotic invasion. These findings greatly reduce YSC management options.

The parasite that causes Whirling Disease was first noted in the Cody Region in 1996 and could be a threat to YSC and other salmonid persistence (Fish Division 1997). This malady was discovered in a small private pond system adjacent to the South Fork Shoshone River and has subsequently spread to the river proper (Fish Division 1999). While the extent of the disease is presently small, its spread is probably imminent and will complicate trout management in the future. In addition, Whirling Disease was found in late 1998 in Yellowstone Lake and could have profound effects on the Upper Yellowstone River fishery as most of the YSC populations that frequent this area are thought to be lake migrants.

The New Zealand mudsnail, an exotic mollusk, has been found in the Upper Snake River drainage and other streams within the confines of Yellowstone National Park. This invertebrate has amazing reproductive potential under degraded stream conditions and could compete spatially with other aquatic invertebrates that are essential trout food. Monitoring for the presence of this organism and other intrusive exotics in Cody Regional waters is ongoing.

Future Management Efforts in the Cody Region.

Efforts to maintain and enhance YSC populations will be difficult in light of the degree to which non-native species introgression has reduced genetic purity and anthropogenic influences have reduced habitat. Conservation of existing populations in the Upper Yellowstone drainage will be a high priority. Data on distribution, abundance and habitat are lacking and were included as a study proposal under the FWS YSC initiative.

To determine the exact extent of historic and present YSC ranges, GIS technology will be employed and will utilize updated stream-lake inventory data coupled with current knowledge regarding barrier locations, historic accounts of fish presence or absence, and geomorphic influence on YSC distributions as outlined by Kruse et al. (1997). Through cooperation with the US Forest Service and Bureau of Land Management, this effort will be completed for all management regions of Wyoming containing YSC populations.

The Cody management crew will continue to survey drainages (outside of Kruse's study area) where YSC are thought to exist using methodologies outlined by Kruse (1998). A preliminary listing of these waters that need addition sampling are shown in Appendix 1 and 2. Conservation and recovery options will be developed for these drainages if habitat and other environmental factors are favorable for YSC.

Kruse (1998) advocated a proactive approach to conserve YSC within areas he studied. He suggested strategies that had been tried by others (Varley and Gresswell 1988; Thurow et al. 1988; Young 1995; Dunham et al. 1997; Guffey et al. 1998), but stated that not all will work within the Cody Region. Some options include: (a) restrictions on terminal fishing tackle or encourage increased harvest of non-native salmonids within native YSC streams, (b) habitat enhancement, (c) reclamation by poisoning, (d) stocking of genetically pure hatchery fish (continue to maintain genetically viable brood stocks), (e) intra- or inter-basin transfers of natural populations, and (f) protect extant stocks with artificial barriers or stock genetically pure fish in barren habitats above natural barriers.

Future efforts will further investigate each of these options to determine possible protection, enhancement, and/or reintroduction strategies. A short synopsis of preliminary plans for those with the highest potential for success are listed below:

1) Conservation of existing YSC populations.

Four populations within the Greybull and Shoshone River drainages have effective population sizes greater than 500 individuals and appear genetically and demographically viable. However, due to the potential of hybridization and competition by non-native trout, these populations may not be secure (Kruse 1998). Within the Greybull drainage, two populations exist (Greybull and Wood Rivers). These are separated by a segment of river containing exotic populations and impacted by irrigation withdrawals and diversion dams that have effectively isolated each population of YSC. In addition, Sunshine Reservoirs located within this area of concern are managed for YSC, SRC, BNT, and SPK and increase the potential hybridization risk to these drainages should water supply canals allow any fish movement. These structures should be investigated to determine degree of risk. If the risk is high, a move to single species (YSC) management in the reservoirs will be closely examined. An effort to maintain genetic isolation for these two viable populations is a priority. A similar situation (irrigation diversion) occurs on Marquette Creek, a YSC tributary to the South Fork Shoshone River. This water terminates at South Fork Dike Pond that is presently managed for YSC, SRC, and BNT. Future investigations of the diversion structure should be completed to determine potential for failure. Consequences, of multi-species management in the dike pond, on maintenance of genetic purity in Marquette Creek should be investigated further. Of the four upper South Fork Shoshone River tributaries found to contain YSC of acceptable effective population size (>500), all are not considered secure because of competition from BKT. Conservation efforts in this wilderness area will be difficult, but options should be explored.

2) Re-introduction above natural barriers.

Thirty-three natural barriers to fish movement were identified by research conducted by Kruse (1998). Of these, six had a high probability of supporting a YSC population based up watershed and stream characteristics. Two were in the Greybull River drainage (SF Wood River and Wood River headwaters) and four in the South Fork Shoshone River drainage (Boulder, Deer, Ishawooa and Needle Creeks). Reintroduction of YSC into these drainages should be investigated further. These efforts would most likely take a long term stocking effort to establish viable populations. The decision to proceed in a specific drainage should place strong emphases on length of drainage above the barrier and suitability of that habitat for YSC. These factors were considered in Kruse's analyses to some degree but not in detail.

3) Determine extinction risk factors on known pure YSC streams.

Genetically pure YSC populations were found at Muddy Creek (Clark Fork drainage), Deer Creek (Porcupine Creek drainage), and South Paintrock Creek (Paintrock Creek drainage). However, sampling was at one site and non-native trout and anthropogenic

threats were not evaluated in Kruse's study. These enclaves should be sampled to determine population size, habitat conditions, and external threats to their existence.

4) Habitat enhancement.

Since the majority of YSC are located on public lands (primarily US Forest Service), a coordinated effort to maintain and enhance occupied habitat should be a high priority for all agencies. Most of these habitats are remote and give an added measure of protection for YSC populations. Where anthropogenic impacts can be identified, agencies should develop a plan to minimize those impacts. Habitat inventories should note fishless reaches that would support YSC and should be considered for YSC expansion.

5) Educate the public about the status of YSC.

The current status of native trout in Wyoming needs greater emphasis in educational programs and publications. Workshops and other education and information efforts may be necessary to educate the public regarding identification of YSC, historic and present range, habitat requirements, conservation strategies, other possible options, threats to YSC long term existence, present management, and possible management limitations should the species be listed as threatened or endangered.

6) Disease and exotic species introduction.

Continue to monitor the Cody Region for the parasite that causes Whirling Disease on a two to three year basis. Keep the public informed about the disease's status and current prevention measures. Monitor area waters for the presence of the New Zealand mudsnail. Coordinate with Yellowstone National Park to develop standardized monitoring criteria and an active public education program to reduce expansion of this organism by humans. In summary, the Cody Region will engage in an active program of protection and enhancement of its remaining YSC populations. Expansion of present range may be difficult due to extensive non-native introgression and other anthropogenic influences, coupled with the fact that most unoccupied habitats exist in harsh environments that would have low potential for YSC. Any major attempt at restoration that would include chemical treatment to eliminate non-native species would take considerable effort to obtain public informed consent.

Jackson Fish Management Region.

The Jackson fish management crew was established in the Snake River drainage in 1955. The management area encompassed roughly 6,000 square miles (Figure 2). The boundaries extended from Yellowstone National Park south to Salt Creek Pass and the Rim Station in the Hoback River System. The eastern boundary is the Continental Divide, while the western boundary is the Wyoming-Idaho state line. This area included waters within Grand Teton National Park, and the Bridger Teton and Targhee National Forests. Many of the waters in this region are subject to extreme winter conditions that limit many populations.

The Jackson region's responsibilities are deeply ingrained in the management of native cutthroat stocks. The continued enhancement of the wild trout fishery and preservation of the Snake River cutthroat trout is paramount in the management of Jackson fisheries.

There are a total of 987 waters (streams and lakes) in the Jackson region. Of the 701 suitable waters, 653 contain native cutthroat trout populations. Jackson fisheries personnel note that nearly all of these populations are the more distinct Snake River cutthroat trout. Stream-lake inventory data indicates only three waters have distinct populations of Yellowstone cutthroat (Hidden and Trail Lakes in 4PC; Grassy Creek in 4TR).

Historic Distribution In The Jackson Region.

Crew personnel tend to agree with the comments of noted fishery scientists that there are distinct differences that can be attributed to the native cutthroat which inhabit this region. Evermann and Cox (1894) noted subjectively there should be the separation of subspecies based upon their geographic locations. The forms found in the upper Missouri Basin and in the Snake River above Shoshone Falls should be referred to as *Salmo mykiss lewisi*. Those found in the Snake River basin below Shoshone Falls as *Salmo mykiss gibbsii*. David Starr Jordon (1891), found Yellowstone Lake cutthroat had black spots that were larger and more distinct, and were less numerous than those found in Heart and Henry's Lake cutthroat. YSC have significantly larger and less profuse spots than SRC (Kruse 1998). Jackson fish management crew biologists and Kruse (1998) also consider YSC having most of their spotting posterior to the dorsal fin and above the lateral line.

Behnke (1979) has found there is wide distribution of these seemingly distinct subspecies in the region that have amazingly resisted the effects of hybridization. He further indicates SRC represent an evolutionary and ecological reality that should be regarded as a distinct subspecies. However, DNA evidence presently does not support differentiation at this time. Geneticists from Montana State and Brigham Young Universities indicate there is a single allele found more commonly in SRC that can possibly used to differentiate between races of YSC.

The fine-spotted Snake River cutthroat is the only subspecies of cutthroat trout more abundant now than it was historically (Behnke 1979). Behnke notes; "There has probably been no marked reduction in abundance within its known historical range, and wide-spread propagation and introduction outside that range have increased its numbers."

As previously noted, the areas of concern expressed by the petition included stocking, angling pressure, habitat loss, whirling disease, and the presence of the New Zealand mud snail. These concerns are certainly valid and noteworthy of fishery concerns everywhere, and have been addressed by Jackson fish managers for a number of years.

There are few waters in the region, if any, in which there is concern for its survival. In addition to the major spawning habitat projects which have been conducted in the region since the 1970s (Kiefling 1997), fish managers have also recognized the potential for increased angling pressure and have employed a variety of special regulations on waters of the area to protect the integrity of the present wild trout fishery. For example, the waters that may provide habitat for the purest strains of native trout lie within wilderness

waters. A limit of 2 trout per day or in possession from all waters in designated wilderness areas has been in effect for over 25 years. In addition, a bonus brook trout regulation was also initiated at the same time to further reduce the impact of exotic species on native populations. In addition to wilderness regulations, special regulations (spawning season closures, slot limits, and trophy regulations) have been applied to 12 major waters to reduce harvest levels and protect spawning size classes.

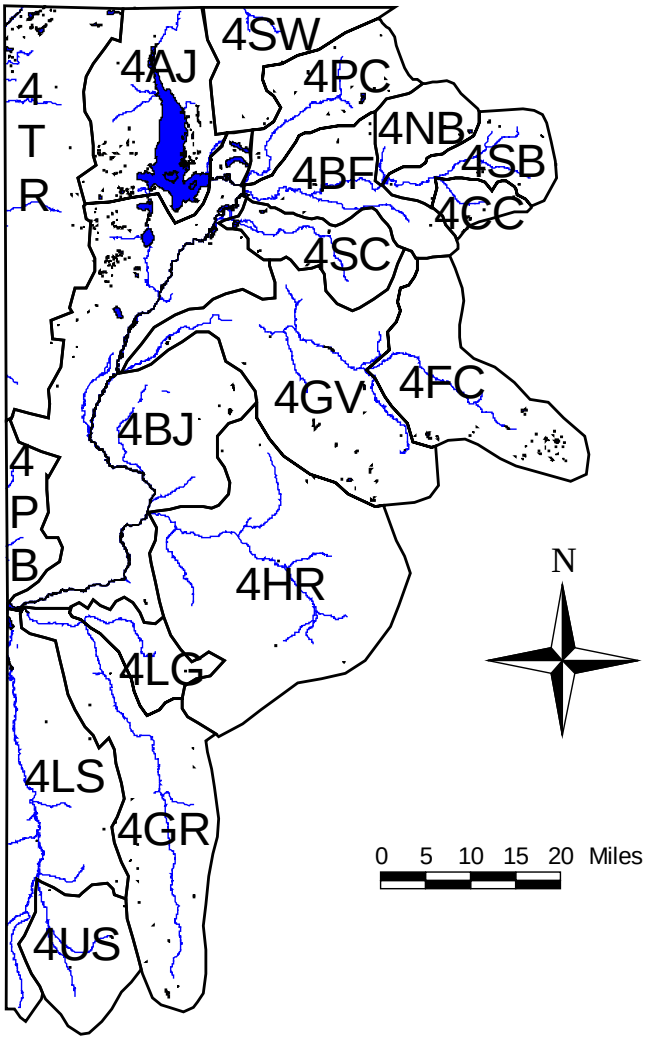
Present Management In The Jackson Region.

Sub-basin management plans guide management strategies for all waters within the Jackson Region (Figure 4). Jackson area waters have been primarily managed as wild trout fisheries since the inception of the fish management crew. Stocking is required in select waters where temperature, icing, reduced winter flows, inadequate spawning habitat, etc. limit fisheries. Cutthroat utilized for regional stocking have been obtained from brood stocks located at the Auburn fish hatchery. The Auburn broodstock was initiated in 1953 from fish taken from Flat Creek. The Jackson National Fish Hatchery also utilized fish from the same source. Another cutthroat broodstock was develop in 1987 from fish collected from Lower Bar BC Spring Creek and are kept at the Wigwam state hatchery. The genetic analysis of the Auburn stocks indicate they are genetically less variable than wild fish, and that they are not suitable to establish/re-establish wild populations. Wyoming Game and Fish Department genetic specialists indicate the Auburn brood stock is rated as a B- in the WY/CO rating system. The Bar BC brood stock has an A rating. Current stocking programs are continually being evaluated, and several waters are scheduled for deletion within the next two years. Crew personnel also recognize it is logistically and economically impossible to maintain multiple hatchery broodstocks for the needs of each drainage basin. Even though the USFWS has indicated there is no recognized difference between the seemly two distinct forms of Yellowstone cutthroat trout, management of cutthroat stocks in the Jackson Region will continue to address the different races according to their distinct needs.

As part of the state wide DNA investigation, and in regard for the integrity of native stocks, several regional waters have been selected from Jackson Basin Management Plans for further examination (Figure 4). A total of 51 waters have been selected from 17 of 18 sub-basin management areas for DNA analysis (Appendix 3).

This information will be instrumental in fine-tuning future management of native stocks in the Jackson management area. There may be a limited number of sites in which upstream barriers and other management options are viable means to maintain/manage current populations. Major changes in current management direction of native fishes in the Jackson area are not anticipated.

Major spawning habitat projects have been employed on nearly all spring creek systems that provide spawning runs relative to the Snake River proper where necessary. Such projects have entailed the maintenance of spawning venues through the placement of commercially washed gravels, development and/or maintenance of spawning riffles,



Code	Basin Name	Code	Basin Name
4BJ	Snake River Basin (below Jackson Lake Dam	4NB	North Buffalo Fork Basin
		4SB	South Buffalo Fork Basin
4AJ	Snake River Basin (above Jackson Lake Dam	4CC	Cub Creek Basin
		4PC	Pacific Creek Basin
4SW	Snake River Basin (wilderness waters)	4PB	Palisades Basin
4HR	Hoback River Basin	4TR	Teton River Basin
4GV	Gros Ventre River Basin	4LS	Lower Salt River Basin
4FC	Fish Creek Basin	4US	Upper Salt River Basin
4SC	Spread Creek Basin	4GR	Greys River Basin
4BF	Buffalo Fork Basin	4LG	Little Greys River Basin

Figure 4. Jackson region sub-basin delineation, 1999.

removal of silts in resting areas, and rehabilitation of adjoining riparian lands with native grasses and shrubs. Crew personnel have worked closely with conservation groups in watershed and aquatic habitat projects that are vital to and compliment cutthroat populations in general.

Future Management In The Jackson Region.

The presence of whirling disease in the Yellowstone Ecosystem is an ongoing concern to all fishery managers and has and is being addressed by Fish Division Protocol for prevention and protection of the fishery resource. This includes one of the most rigid fish health programs in the western states. State regulations require all imported fish be certified specific pathogen free. Protocol requires any fisheries equipment used by WGFD and any cooperators to be disinfected with chlorine-based wash on site and also before being used in other drainages. All WGFD fish culture facilities are inspected annually and have always been certified by blue book analysis as pathogen free. Fish samples in waters up and downstream of all state hatcheries are obtained annually. Select waters where *Myxobolus cerebralis* (MC) have been found (Salt River - tributaries) is sampled every two years. Drainage waters in which MC has not been found are sampled during surveys each 4 years (Flat Creek, Snake River, Greys River, etc.). There have been no recorded losses or salmonids populations recorded in Wyoming waters.

The WGFD has developed informational brochures and signs for MC positive water to inform the public of this problem and suggest methods to avoid spreading MC into adjacent waters. Several programs dealing with MC have been given in the Afton-Jackson area and as a result, several outfitters have provided disinfectant sites for the general public, customers, and guides to utilize in a further effort to thwart the spread of MC.

The recent findings of New Zealand mud snails (*Potamopyrgus antipodarium*) in Yellowstone Park boundary waters (Snake River) by Yellowstone Park biologists was noted in November of 1998. Prior to these findings, Jackson fisheries personnel had also provided information relative to regional presence of mud snails at whirling disease meetings. Additional information relative to NZ mud snails will be provided to the public at a variety of meetings in an effort to prevent further movement in area waters. Crew personnel will be working with Yellowstone Park biologists to set up protocol necessary to monitor the movement of mud snails into the Snake River drainage below Yellowstone Park. Many waters in New Zealand, Australia and Europe have noted the presence of this mollusk with little adverse effects on fishery populations.

Management/research efforts in regard to native salmonids have been conducted on a variety of waters and facets of those fisheries. Although not cited in this document, these references are included in the literature cited and significant references section of this document.

Lander Fish Management Region.

Fisheries management activities began in the Lander area in 1951. At that time a fish management crew was established in Cokeville to cover the western portion of the state.

In 1953 this crew was moved to Lander but they still had management responsibilities for approximately the western half of the state. In 1955 the state was divided up into several regions and the Lander Region was established at approximately its present size (Charles Viox, personal communication).

The Lander Region covers about 11,000 square miles in west central portion of the state. This region includes the Wind River drainage, the Sweetwater drainage and a portion of the North Platte River drainage as well as a large portion of the Great Divide Basin (Figure 4). The Wind River Indian Reservation lies within the Wind River Drainage and reservation waters that are managed by the tribal government.

It is the responsibility of the Lander fish management crew to maintain and /or increase the supply and diversity of sport fishing opportunity and to maintain native non-game species to satisfy recreational, aesthetic and educational needs. Native game and non-game species are playing an increasing important role in the management of the region's fisheries. In recent years a greater emphasis has been focused on the management of Yellowstone cutthroat trout. Stocking has been used to reestablish this species within its historic range as well as the cessation of stocking in some areas to protect wild stocks. Harvest regulations have been implemented to help protect wild stocks. Surveys are proposed to determine the distribution and abundance of Yellowstone cutthroat within the region.

Historic distribution in the Lander Region.

Actual historic range of the YSC in this region is not well documented. Duff (1996) indicates that in prehistoric times there were probably times when the entire Bighorn drainage contained conditions suitable for YSC.

One of the earliest accounts of trout in the Wind River drainage comes from the 1877 accounts by J. M. Endlich of the expeditions to explore the Wind River country under Dr. Ferdinand V. Hayden, director of the U.S. Geological Survey (Hayden 1879). When moving down the Popo Agie above Lander it was note that "A few hours fishing in some small pools, caused by a partial damming of the water furnished us with a good mess of trout." It was also commented that "In the head-drainage of the Sweetwater not a trout can be found, while in that of Green River, as well as the Wind River they occur in large quantities."

Another reference to trout in the Wind River drainage can be found in the letters to family from Caroline Winne (Buecker 1981). Caroline was the wife of Assistant Surgeon Charles Winne who was stationed at Camp Brown or the present day Fort Washakie from May 13, 1879 to May of 1880. In 1879 she stated that, "one thing we do have very delicious and that is speckled trout." She also stated " the magnificent trout we have here. We get them so fresh and caught in this mountain stream constantly fed by melting snow." The mountain stream is a reference to the Little Wind River running near the Fort.

Former Governor Bryant B. Brooks also provided an early reference to trout in the Wind River area when he discovered what would become Brooks Lake on a hunting trip in 1889. In his memoirs Brooks (1939) describes coming down Brooks Lake Creek and

seeing, “numberless mountain trout of mammoth size”. The next day Brooks returned to the area with fishing equipment and stated, “There was but little sport in fishing. It required no skill to catch them, for they would bite at anything as fast as one could haul them in, and they seemed too fat and lazy even to fight the hook when captured.”

Evidence of the historic distribution of Yellowstone cutthroat trout in the Wind River Mountains is limited. Evidence points to the presence of trout, which were undoubtedly Yellowstone cutthroat, only in the lower Wind River basin extending upstream to the source of the Wind River. This would include areas in the Little Wind River and the Popo Agie River systems. No barriers to migration are known to have existed in early times. From the written accounts of early explorers it is assumed no trout were present in the Sweetwater River in the southern Wind River Mountains.

It is assumed that most areas at high elevations in the upper portions of tributaries of the Wind River were barren of trout. This was due to the steep gradient and physical barriers that limited upstream migration. One puzzling exception was the presence of “large mountain trout” in the upper Brooks Lake area as noted by Bryant Brooks in 1889. Brooks Lake Creek leading into the area is separated from the Wind River by a steep falls a short distance from the confluence with the Wind River. The falls should act as a barrier, however, fish were noted above the falls before any documented stocking by early settlers in the area.

Present Distribution in the Lander Region**.**

The Wyoming Game and Fish Department’s stream-lake inventory database lists 1,974 waters within the Lander Region. Discounting those waters that are definitely outside the historic range for YSC (Sweetwater drainage, North Platte drainage, Great Divide Basin), leaves a total of 742 lakes and 906 stream segments that are managed by the Lander Region. Of these, cutthroat (YSC/SRC) were found in 79 lakes and 100 streams (Table 2). Some of these waters are found at high elevations and above physical barriers, and were probably not historically occupied by YSC. Because specific information will probably never be available to allow an accurate assessment of the historic distribution in the Lander Region, calculation of percent of historic habitat presently occupied is difficult.

Non-native trout introductions began sometime around 1899 and had probably the greatest impact on YSC populations within the Lander Region. Various stocking programs were carried out to provide increased sport fishing opportunities. Very few records are available to document these stocking efforts.

Of the waters presently occupied by YSC/SRC, all are the direct result of stocking or have probably been influenced by past stocking. At this time there are no known endemic populations within the region, nor have there been records of such since the inception of the Fish Management Region in 1950. However, there is the possibility that remnant endemic populations exist in remote, headwater areas within the region. Proposals to investigation these areas have been submitted.

Present Management in the Lander Region.

Fisheries management objectives and activities for the region have been detailed in sub-basin management plans (Figure 5). Objectives vary by basin, but all follow the general

Table 2. Total miles of streams and acres of standing waters within drainages historically occupied by YSC, SRC or combination thereof. Information is directly from Wyoming Game and Fish Department stream-lake inventory database.

Drainage Basins within Historic Range	Total Miles of Streams with Cutthroat Trout	Total Acres of Standing Waters with Cutthroat Trout
Wind River Proper	93.6	0.0
North Tributaries of the Wind River above Dubois	93.1	107.9
South Tributaries of the Wind River above Dubois	80.2	61.5
Horse Creek Drainage	14.0	1.4
East Fork Drainage	167.1	0.0
Jakey's Fork Drainage	30.7	104.0
Torrey Creek Drainage	21.0	715.0
Dinwoody, Blue Hole, and Red Creek Drainages	46.0	139.0
Dry Creek Drainage	10.0	204.0
Bull Lake Creek drainage	0.0	65.0
South Fork of the Little Wind River Drainage	17.7	659.0
North Fork Popo Agie Drainage	35.5	132.0
Middle Fork Popo Agie Drainage	50.0	232.2
Little Popo Agie Drainage	58.7	113.0
Beaver Creek Drainage	4.5	0.0
Total	722.1	2534.0

premise of preserving native species and their habitats while providing recreational opportunities for the angling public. Stream fisheries are managed as wild fisheries whenever possible. Habitat protection and/or restoration is achieved through participation in the NEPA process and by more direct means when feasible. These direct means include such actions as filings for instream flow water rights, instream improvement structures to correct degradation or habitat limitations, cooperative grant programs to encourage riparian and stream channel improvements by private land owners, and general extension work with private entities and governmental organizations to promote sound land use practices.

Fish stocking is used as a management tool to provide and enhance fishing opportunities within the region. The majority of fish are stocked in lakes and reservoirs where natural reproduction is limited or absent. Stocking streams is only considered when required to compensate for habitat limitations, lack of adequate natural reproduction, catastrophic environmental events, or high angling pressure. In the past, the majority of cutthroat

trout stocking, both YSC and SRC, was done solely for the purpose of providing recreational fishing opportunities. Current stocking still reflects this (Table 3), though in recent years fish management goals in some drainages has placed a higher emphasis on native cutthroat management for other than just recreational reasons.

The East Fork Drainage, including the Wiggins Fork and Bear Creek, is managed strictly for cutthroat trout. Special fishing regulations limit the harvest of cutthroat trout to two fish per day throughout the drainage to protect cutthroat populations from being overexploited. The Wyoming Game and Fish Department is a major landowner within the drainage, and the result has been the ability to provide greater protection and enhancement of habitat for cutthroat trout. The upper reaches of this drainage, within the Washakie Wilderness of the Shoshone National Forest, may provide the best likelihood of finding endemic populations within the Lander Region.

Future Management Efforts in the Lander Region.

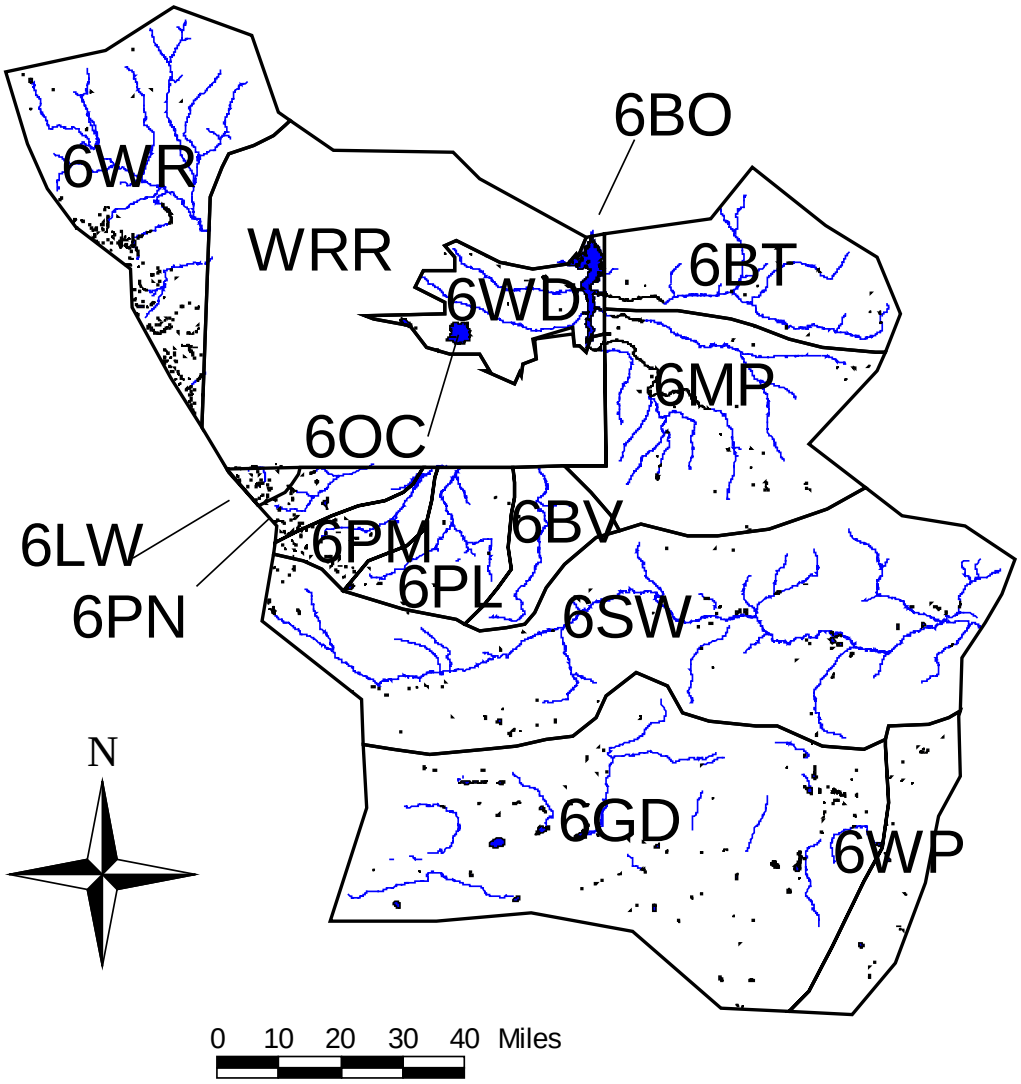
Maintenance or enhancement of YSC populations will be arduous because of the stocking of non-native species over the years. Data is lacking on the distribution and abundance of pure stocks of YSC within this region. A study proposal has been submitted as part of the FWS YSC initiative to further define YSC populations.

Within the Lander Region, we have identified two priority drainages that may have the possibility of harboring endemic populations of YSC. The East Fork of the Wind River Drainage and the Big Warm Springs Creek Drainage will be surveyed in the near future and fish will be collected for genetic testing. The Lander Management crew will continue to survey drainages where YSC are thought to exist using methodologies outlined by Kruse (1998).

As noted by the Cody Region, GIS technology will be utilized to determine the exact extent of historic and present YSC ranges. A cooperative effort will be carried out with the US Forest Service and the Bureau of Land Management as well as all of the management regions in the state that contain YSC populations to produce this information.

Future plans to conserve or enhance YSC populations will be developed after more detailed inventory work has been completed. Habitat preservation and enhancement should be a priority for all agencies within the historic range of the YSC. A coordinated effort among all agencies is needed to maintain or enhance habitat occupied by YSC. Agencies should work together to develop plans to identify and minimize any impacts to YSC populations.

Other management efforts will include stocking, educational efforts and regulations. Stocking from genetically pure brood stocks will be used to enhance YSC populations where needed or to re-establish populations in suitable habitats. Educational programs are needed to inform the public about the status of YSC populations and conservation efforts to maintain or enhance these populations. Educational programs will also be used to



Code	Basin Name	Code	Basin Name
6WR	Wind River	6PL	Little Popo Agie drainage
WRR	Wind River Indian Reservation	6PM	Middle Fork Popo Agie drainage
6OC	Ocean Lake	6PN	North Fork and main stem Popo Agie River drainages
6BO	Boysen Reservoir		
6WD	Withdrawl Area of Wind River Indian Reservation	6LW	South Fork of the Little Wind River drainage
6BT	Badwater, Tough, and Birdseye Creek drainages	6SW	Sweetwater River drainage
		6GD	Great Divide Basin
6MP	Poison and Muskrat Creek drainages	6WP	North Platte River tributaries above the Sweetwater River
6BV	Beaver Creek drainage		

Figure 5. Lander region sub-basin delineation, 1999.

Table 3. Current stocking of YSC and SRC within the historic range of YSC in the Lander Region.

Water	Basin	Species	Stocking Frequency
Wiggins Fork	6EF	YSC	Periodically
Pinto Lake	6JY	YSC	4 year
Pelham Lake	6WS	YSC	Annually
Irish Gulch Creek Ponds	6BV	SRC	2 year
East Fork Wind River	6EF	SRC	Annually
Rim Lake	6JY	SRC	2 year
Helmet Lake	6LW	SRC	4 year
Holster Lake	6LW	SRC	4 year
Little Cherry Creek Ponds	6PL	SRC	2 year
Fawn Lake	6PL	SRC	2 year
Snow Creek Ponds	6PL	SRC	2 year
Lower Jade Lake	6WN	SRC	2 year
Murray Lake	6WN	SRC	2 year
Slim Lake	6WN	SRC	2 year
Upper Jade Lake	6WN	SRC	2 year
Fish Lake	6WS	SRC	Annually

inform the public about other possible impacts to YSC populations such as whirling disease or exotic species introductions. Restrictive harvest regulations will be used to conserve YSC populations when needed. Regulations will also be used to increase the harvest of species that are competing with YSC for available habitat.

In summary, the Lander Management Crew will be carrying on an active program to inventory and protect YSC populations. As noted by the other management crews, restoration efforts that include chemical treatment to eliminate non-native species will take substantial effort to obtain public support. The existence of non-native fish species will make expansion of the present range of the YSC very difficult.

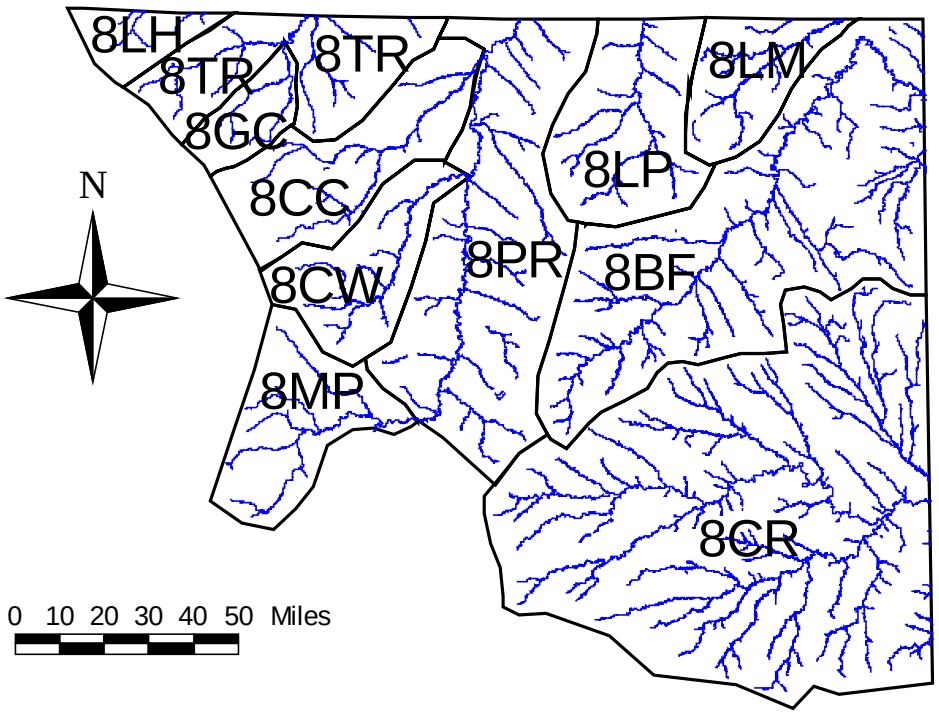
Sheridan Fish Management Region.

Established in Buffalo in 1950, the Sheridan Fish Management Region was responsible for the fisheries in the northern third of the state including the present Sheridan and Cody Regions (John Mueller, personal communication). When the Cody Region was formed, management of the then Buffalo Area was reduced to the northeast part of the state. The fish management crew was relocated to Sheridan when the new Regional Office was completed in 1991. The current area of responsibility covers about 21,000 square miles of northeast Wyoming and includes the major drainages of the Little Bighorn, Tongue, Powder, Little Powder, Little Missouri, Belle Fouche, Cheyenne, and Niobrara rivers. The Sheridan Region is bordered by the hydrographic divide of the Bighorn Mountains on the west, the Montana-Wyoming state line to the north, and the South Dakota-

Wyoming state line on the east. The southern boundary is less distinct, but separates management by drainages between the Casper and Sheridan Regions near the mouth of the South Fork of Powder River (Figure 6).

The Sheridan crew has the responsibility for the management, maintenance, and well being of the fishery resource. This includes the propagation and enhancement of native game and non-game fish species. Emphasis on the identification of the range, and the propagation and enhancement of native, wild, Yellowstone cutthroat trout has focused more of our management efforts on that species and its habitat in recent years. Important management tools include species distribution surveys, habitat protection, stocking (maintenance/establish new stocks), habitat enhancement, and restrictive regulations.

For purposes of discussion, the large-spotted Yellowstone cutthroat (YSC) is distinguished from the fine-spotted Snake River cutthroat (SRC) in the Sheridan Region. Introductions of the fine-spotted cutthroat in the Sheridan Region came from fish stocks originating in the Snake River drainage, while the YSC are considered to be the endemic to this region. Stocked YSC came from brood stocks originating in the Yellowstone River drainage.



Code	Basin Name	Code	Basin Name
8TR	Tongue River	8CW	Crazy Woman
8GC	Goose Creek	8LP	Little Powder
8LH	Little Bighorn	8BF	Belle Fourche
8PR	Powder River	8CR	Cheyenne River
8MP	Middle Fork Powder River	8LM	Little Missouri
8CC	Clear Creek		

Figure 6. Sheridan region sub-basin delineation, 1999.

Historic distribution in the Sheridan Region.

Historic distribution of YSC in the Sheridan Region is sketchy at best. Most accounts suggest that YSC historically occupied the Little Bighorn and Tongue River (includes Goose Creek drainage, tributary to Tongue) drainages, but not the Powder River drainage.

Relating to historic accounts of YSC in the Little Bighorn River (LBH) and Tongue River (TR) drainages, Duff (1996) noted that YSC were not present in the lower portions of those drainages. Trotter (1987) summarized information on historic distribution of YSC from their principal source at Yellowstone Lake downstream in the Yellowstone River to the mouth of the Tongue River. Behnke (1992) concluded that, "In the Yellowstone drainage, Yellowstone cutthroat trout spread down the Yellowstone River (and up all the tributaries encountered) as far as the Tongue River. The Powder River, the next downstream tributary, was barren of native trout when reached by the first collectors, so it appears that this subspecies did not disperse in the Missouri basin beyond the confines of the Yellowstone drainage". Therefore, it appears historic occupancy of the LBH and TR drainages would have been via migration movements upstream from the mouths of those streams, rather than originating from any other source, such as glacial isolation of the species in the headwaters. However, with the accounts of more recent history and the observations reported by Evermann and Cox (1894), and citations noted in Trotter (1987) and Duff (1996), YSC populations in the LBH and TR drainages must have primarily been isolated in the headwaters upstream of the Montana state line. Extent of upstream occupation is less evident.

The most site-specific accounts of YSC in the TR drainage come from Evermann and Cox (1894) and early historic encounters by the military. In 1892-93 surveys, Evermann and Cox reported YSC in the Tongue River and Goose Creek drainages near the town of Sheridan, and extending to the canyon mouths of those streams. They indicated, "Many persons were seen along the river fishing for trout. Taking everything into consideration, it would certainly be hard to find a more ideal trout stream. Small parties have reported as many as 800 fish taken with hook and line in a few days".

Although Evermann and Cox also speculated that YSC were undoubtedly present in the Clark Fork of the Yellowstone and Bighorn rivers, and probably found in the headwaters of the Powder River system, they collected no trout from those streams. They noted the most eastern point from which specimens were obtained was from "...south fork of Tongue River, and Big Goose Creek." The reference to south fork Tongue, based on the description of their fishing expedition, is likely what is presently known as Little Tongue River. Evermann and Cox (1984) also list Wolf Creek, Little Goose Creek, the Powder River at Arvada, and Clear Creek at Clermont (sic), in addition to the Tongue River and South Tongue River at Sheridan as streams examined in the Missouri River Basin in 1892 and 1893. They provide no more detailed accounts of trout collected in the Powder and Clear Creek drainages.

Few historic records exist that document the presence of YSC distribution in the LBH drainage. Duff (1996) cites family accounts of early settlers of Lodge Grass, Montana that indicate trout were taken in the LBH drainage upstream, but not downstream of the town. Other evidence of YSC occupancy in the Bighorn and Little Bighorn is more circumstantial (Evermann and Cox 1894). The presence of genetically pure YSC populations in west slope tributaries of the Bighorn River (Deer, Cedar, and Paintrock Creeks) provides more conclusive evidence of their historic presence in that drainage (Kruse 1998).

Early accounts from Tongue River basin ranching families provide evidence that YSC probably were present in the upper reaches of Little Goose Creek and the Little Bighorn River. Due to potential upstream migration barriers, they were excluded from upper reaches of other stream drainages, such as Tongue River and Big Goose Creek.

The stocking of hatchery cutthroat and brook trout had begun by 1895 with the construction of the Sheridan Branch Hatchery on Wolf Creek (Land 1895). Eggs from wild cutthroat were taken from Wolf Creek were initially used at the hatchery. Mr. Land obtained eggs and brood stock from a number of waters in the region. He traveled into Montana and collected eggs from native cutthroat in Soap Creek on the Crow Indian Reservation, while additional "Black-spotted Mountain trout were taken from Lodge Grass Creek. He also collected eggs from Ten Sleep lakes in Johnson County, Wyoming. He referred to these fish as being "true *Salmo Mykiss* of the cold waters of the upper mountain lakes" and intended their use for stocking barren waters of the "upper mountains". Land also collected additional cutthroat from 12 streams in the Big Horns for brood stock purposes.

In 1895, Land was also receiving brook trout from Sand Creek and the Laramie Hatchery. These fish were placed in Spring Creek that was the site for the future development of the Sundance Hatchery (Crook County). Brook trout had been stocked in the Big Horn Mountains in 1892. The Dome Lake Company imported brook trout from New England for use in Big Horn Mountain waters. By 1899, stocking of native and exotic trout in northeast Wyoming was well underway from hatcheries near Sheridan and Sundance (Land 1899).

Duff (1996) reported 596 miles of stream habitat and 11 lakes were historically occupied by YSC in the LBH and TR drainages in Wyoming. Estimates generated for his report included most of the LBH, TR and Goose Creek (tributary to TR) drainages, including the headwaters. Duff points out that stream mileages for both historic and currently occupied habitat are likely <u>over</u> estimates and include stream sections that would <u>not</u> support fish.

Assuming the historic distribution in the TR drainage was restricted by the falls on Goose Creek and the Tongue River, only about 384 miles of the TR drainage should be considered historical range for YSC in the Sheridan Region. Estimated historic distribution for the Little Bighorn drainage is 122 miles, although it is unlikely YSC historically occupied the upper portions of the West Fork LBH due to barrier falls within Dark Canyon that apparently restrict present day fish distributions. The canyon area of

the main stem of the LBH also contains numerous falls, but it is unknown whether they were barriers to historic upstream movements of YSC. Surveys are underway to identify barriers to upstream distribution in the LBH and TR drainages. Once this is determined, the estimates of historic YSC distribution may be adjusted. There is no evidence any natural headwater lakes in these drainages were historically occupied by YSC.

Until more definitive data are available, an estimated 506 miles are considered historic occupancy for YSC in the Sheridan Region (Appendix 4). This is still likely an over estimate since it includes stream sections that occur above barriers or would not support trout due to unsuitable water conditions.

In conclusion, it appears Yellowstone cutthroat were endemic to a number of streams in the LBH and TR drainages. From early accounts it appears YSC in the TR drainage may have been restricted in their historic upstream distribution by barrier falls on the Tongue River and Goose Creek. Present day barrier falls on the West Fork LBH also likely restricted historic upstream range in that drainage. The stocking of cultured YSC and exotic salmonids, especially brook trout, was taking place concurrently with the documentation of wild, native cutthroat trout populations. Due to such early introductions, just which streams, portions of streams, and lakes in the Bighorns contained endemic YSC populations is in doubt..

Present distribution in the Sheridan Region.

One hundred twenty two miles (24%) of historic stream habitat is believed to be occupied by cutthroat (Appendix 4). Most of the stream miles and lakes reported as presently occupied is based on stocked cutthroat (YSC and SRC) that may or may not presently be supported through natural reproduction. Eliminating stocked and wild SRC from this consideration, the present distribution of the large-spotted YSC is much lower. Considering only suspected remaining endemic YSC populations, the amount of historic habitat now occupied is probably less than 5%. No endemic YSC populations are believed to presently occupy historic range in the TR drainage, and the majority of YSC occupying the LBH drainage may be upstream from historically occupied habitats. Better data is needed to quantify present cutthroat distribution will be obtained from additional surveys.

Present management in the Sheridan Region.

Sheridan area trout streams are primarily managed as wild trout fisheries. Stocking is required in some waters where temperature, icing, reduced winter flows, inadequate spawning habitat, or high public use limit fisheries. Current stocking programs are continually being evaluated and several streams have been deleted from the stocking schedule to shift management to wild trout.

Early in the management crew's existence, stocking records would occasionally refer to "cutthroat" or "natives", without detail to determine their exact genetic origin. In many cases, these early introductions may have been SRC due to availability. Some streams

within the historic range of YSC, not currently supporting a wild fishery, have been converted to stocking YSC to restore these populations and provide angling diversity.

YSC have also been used in regional management activities outside their historic range, in the Powder River drainage. While this stocking has been largely done to meet recreational fish management goals, these populations may also serve as extended refugia for the species. YSC have been stocked in recent years in the Powder River drainage in Long and Ringbone Lakes (Cloud Peak Wilderness), Lake DeSmet, and Tie Hack Reservoir.

The Sheridan Fish Management Crew has long recognized the possible existence of YSC in portions of their historic range, particularly in the LBH drainage. Management measures have been adopted to protect these populations until detailed genetic and population data can be collected. Environmental comments about potential population impacts have noted consideration for possible endemic YSC. Other cooperative efforts between the WGFD, USFS, and local chapter of TU have focused on identification, inventory and study proposals for the protective management of YSC.

Streams in the West Fork LBH drainage, an area that has the most chance of isolated populations of YSC, have been managed as wild since the early 60s (Sheridan Region files). Special restrictive angling regulations have not been implemented because of limited angler use of the remote area and the desire to preserve population integrity by minimizing public attention.

As noted earlier, endemic YSC may have historically been restricted to the lower reaches of the West Fork LBH due to barrier falls. Stocking occurred before 1960 in the West Fork LBH proper, Lodgegrass Creek, and Crater Lake (now dry). The lower end (below Black Canyon) of the West Fork was stocked with rainbow in 1961. Fish stocking in the headwaters of the West Fork consisted of one recorded plant of 16,576 fingerling "cutthroat". Lodgegrass Creek received plants of rainbow between 1938 and 1944, cutthroat in 1945, brook trout in 1953, and cutthroat in 1956 and 1958. The exact location, hatchery source and genetic stock of these cutthroat trout were not recorded. Crater Lake (now dry) was stocked with "cutthroat" from 1959 through 1967, and records indicate rainbow may have been stocked in the mid-50s. It is unknown whether these cutthroat stockings resulted in successfully establishing self-sustaining populations.

Management for the maintenance and/or restoration of YSC, in their native range, is currently being done in portions of the LBH drainage, and portions of the North TR drainage. In the Goose Creek drainage, YSC are stocked in Park Reservoir and Hope Lake (within the Cloud Peak Wilderness). Presently, most of the efforts, outside of the West Fork LBH, are maintenance stocking of YSC where no natural reproduction has been identified.

SRC are used extensively for stocking waters managed for recreational fisheries in the Cloud Peak Wilderness of the Bighorn National Forest. Most of these lakes are outside the historic range of YSC, in the headwaters of the Powder River drainage. Stocking

SRC in the Sheridan Region has expanded the range of this fine-spotted cutthroat. SRC are also used in managing the recreational fishery of North TR and some tributaries of North TR such as Bull Creek, and Big Willow Creek, above where it is believed YSC historically existed in the TR drainage. However, options are being investigated to use YSC stock to maintain these recreational fisheries and help in restoration efforts in the drainage.

Instream flows for maintenance of fish habitat and life stages have been granted for segments of the LBH and TR. A direct flow water right was approved in 1996 (with a 1989 priority date) for a 4.4-mile segment of the LBH below the confluence of the Dry Fork LBH. An instream flow water right (1987 priority date) was granted in 1990 for a 8.28-mile segment of the TR downstream from the confluence of the North and South Forks of TR. Although these flows are junior to downstream water rights, the instream flow appropriation will preserve flows for critical life stages of YSC in any future restoration efforts.

Basin Management Plans for the Sheridan Region direct most of the management actions for these drainages within historic YSC range. Summarizing stream and standing water data from those plans provides some idea of the status of cutthroat trout in the Little Bighorn, Tongue and Goose Creek drainages (Table 4).

Table 4. Streams and standing waters rated suitable for trout in the Little Bighorn, Tongue and Goose (tributary to Tongue) drainages, showing present management for cutthroat trout*.

Drainage	Total Stream Miles	Total "Suitable" Stream Miles	Suitable Stream Miles w/ CUT (%)	Total Acres of Standing Waters	Surface Acres of Standing Waters w/ CUT (%)
Little Bighorn	124	107	53.9 (50.3%)	44	Unknown
Tongue	291	244	43.7 (17.9 %)	482	37.5 (7.8 %)
Goose	170	152	0	613	258.7 (42.2 %)
Total	585	503	95.5 (19.0%)	1139	296.2 (26.0%)

* Some streams or standing waters within these databases may not list an estimate of stream miles or surface acres. For instance, in the TR drainage the database lists a total of 89 streams, 44 of which do not have stream mileage estimates included. Most of these unmeasured stream sections are considered to either be streams of relatively little importance for fisheries or absence of surveys.

Waters listed in Table 4 include those stocked with hatchery-raised SRC or YSC, as well as waters thought to contain endemic stocks of native YSC or established wild CUT populations. In some cases the cutthroat stocks may be co-existing with other salmonid species such as rainbow and brook trout.

Little Bighorn Drainage (LBH). Considering the large-spotted YSC, approximately 39.4 stream miles of the LBH drainage is managed for either introduced or wild YSC stocks. A variety of management options have been implemented on behalf of native trout, including stocking genetically pure YSC, improving habitat, protection of riparian areas,

recognition of YSC in their native range during environmental reviews, and a diversity of special angling regulations. The LBH drainage has the greatest potential for restoring YSC populations in the Sheridan Region. The primary management emphasis in the LBH drainage is for existing and potential Yellowstone cutthroat populations (McDowell 1996).

Tongue River Drainage (TR and Goose Creek). In the TR drainage, the largespotted YSC are presently managed only in Fools Creek (LaHardy Rapids brood stock), where they share the habitat with a small population of rainbow trout. Stocked and wild SRC are used in the management of the remaining 35 miles of cutthroat waters. This includes a large portion of the North TR drainage where restrictive angling regulations are used to manage a popular SRC fishery (Stewart 1995). SRC are stocked for recreational fisheries in Calvin and Sibley lakes in the TR drainage. At this time, no remnant populations of endemic YSC are known to be present in the TR drainage. Additional surveys are needed.

Future Management In The Sheridan Region.

McDowell (1996), Stewart (1995), and Bradshaw (1997) recognized the need for comprehensive investigations of existing cutthroat stocks and available habitat in the LBH and TR drainages. Planning for such a survey was delayed in hope that studies being conducted by Kruse (1998) would extend into the LBH drainage and/or the results from his study would serve to guide similar efforts in the Sheridan Region.

Although select stream reaches in the Sheridan Region have been sampled for YSC, planning and funding for a comprehensive survey was delayed until 1999. This comprehensive survey will focus on drainages where YSC might be present within their historic range. The highest priority in the Sheridan Region for native cutthroat management is to assess the current populations, genetic integrity, and available habitat for potential restoration.

A total of 545 miles in 131 streams in the LBH and TR drainages from the Sheridan Region Streamlake Database have been prioritized for inventory over the next several years. Streams were considered high priority when they either currently support YSC, or are suspected of supporting YSC. High priority streams (217 miles) may also be near streams that support YSC, or were judged to have the highest likelihood of supporting YSC. Medium priority (156 miles) streams were those judged to have a fair to low probability of supporting YSC because of known stocking history or proximity to streams supporting other salmonids for which no data exist but appear to lie within probable historic YSC range. Low priority (172 miles) streams were those judged to have little or no probability of supporting YSC because of existing information about barriers, fish stocking, water conditions, or historical distributions.

Inventories will start in 1999 on high priority streams in the LBH drainage through a cooperative effort between the WGFD and USFS, Bighorn National Forest. The goal of sampling is simply to obtain more complete baseline information so informed

management and conservation decisions can be made based on the best information. Fish population data, phenotypic and genetic information, and habitat evaluations are planned for the survey.

Regulations designed to reduce competition on cutthroat populations have been in place on several waters. A "bonus" brook trout limit allowing harvest of 10 additional brook trout under 8 inches, has been in place for several years on all waters in the region. Special regulations requiring the immediate live release of all cutthroat trout were in place on the North TR and Bull Creek in 1990, and the LBH above Dayton Gulch in 1994. To minimize release mortalities, terminal tackle is restricted to artificial flies and lures.

The presence of whirling disease in the Yellowstone Ecosystem is an ongoing concern to all fishery managers and is being addressed by Fish Division Protocol for prevention and protection of the fishery resource (WGFD, 1999). Fish samples for whirling disease in the Sheridan region have been collected from several waters in the major drainages and found to be disease free. Although the *Myxobolus cerebralis* (MC) pathogen has not been found in any of the waters in the Sheridan Region, select waters from the major drainages will be sampled in 3-4 year intervals following established monitoring and sampling protocol.

The recent finding of New Zealand mud snails (*Potamopyrgus antipodarium*) in Yellowstone Park boundary waters (Snake River) by Park biologists was noted in November 1998. Management effort will continue to follow standard protocol for importation of salmonid and non-salmonid fishes from approved out-of-state hatchery facilities. Each load of fish is subject to inspection for any visual pathogens and non-approved fish or aquatic organisms such as mud snails.

It is anticipated crew personnel will be increasing efforts to present information relative to whirling disease status in the state, NZ mudsnail, and continued concern for introduction of other exotics at various public meetings within the region.

State-wide Recommendations.

Most Wyoming management objectives have been in place for over 25 years, and the expansion of recommendations will be driven by the need to further characterize the genetics of Yellowstone cutthroat stocks using DNA or protein electrophoresis techniques. Alternatives for fine-tuning the management of YSC stocks by Wyoming Game and Fish Department fish management crews will include the following:

1. Continue to sample and analyze the genetic integrity of representative stocks of YSC in Wyoming waters. DNA and/or protein electrophoresis analyses will be used to determine the purity rating and classification of existing populations of YSC.

2. Maintain the current wild fishery (game and non-game) programs, and examine the need for maintenance stocking of hatchery stocks to prevent genetic contamination.

3. Work with private landowners, service organizations, and local, state, and federal agencies to maintain, protect and rehabilitate fishery habitat when needed.

4. Maintain/monitor the status of native stocks by the regularly scheduled inventory of waters to determine the distribution, abundance, habitat conditions, and general well being of YSC fisheries.

5. Restore YSC stocks in historic waters when/where feasible.

6. Continue and enhance educational programs outlining the needs of all native fish.

7. Utilize passage barriers to protect select populations of high rated populations when reasonable and feasible. Conversely, remove barriers to allow movement to native range where feasible.

8. Maintain/expand YSC broodstocks to preserve/expand distinct population as needed and necessary.

9. Utilize restrictive regulation to preserve and protect specific populations as needed and necessary.

10. Continue to monitor native fish populations for fish health problems and concerns such as whirling disease and the presence of exotics such as New Zealand mud snails.

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APPENDICES

Appendix 1. Suitable lakes that contain YSC or YSC with other salmonids in the Cody Region

Basin Code	Water Name	Native Species	Other Species	Total Acres	Information needed
2BP	BEARTOOTH LAKE	YSC	BKT, GRL, RBT	110	
			LAT		
2BP	BEAUTY LAKE	YSC	BKT	94.4	
2BP	BECKER LAKE	YSC	BKT	78.6	
2BP	DEEP LAKE	YSC	BKT	317	yes
2BP	ECHO LAKE	YSC		15.9	
2BP	EMERALD LAKE	YSC	BKT	39.2	yes
2BP	GLACIER LAKE	YSC	BKT	176	yes
2BP	GRANITE LAKE	YSC	BKT, RBT	263.2	
2BP	HAUSER LAKE	YSC	BKT	12.3	
2BP	IVY LAKE	YSC	BKT, RBT	77.7	
2BP	LITTLE GLACIER LAKE	YSC	BKT	11	yes
2BP	LITTLE MOOSE LAKE	YSC		7.9	
2BP	LONG LAKE	YSC	BKT, RBT	70.3	
2BP	MULE LAKE	YSC	BKT	7.8	
2BP	NATIVE LAKE	YSC		6.5	
2BP	SAWTOOTH LAKE	YSC	BKT, RBT	98.8	
2BP	SOLAR LAKE	YSC	BKT	10.3	
2CF	COPPER LAKE 1	YSC		35	
2CF	HOGAN RESERVOIR		SRC, BNT	35	
2CP	CRATER LAKE		CUT, BKT	37	yes
2CP	EMERALD LAKE		CUT	33	yes
2CP	LAKE SOLITUDE		CUT, BKT	72	yes
2CP	LITTLE SHELL LAKE		CUT, BKT	5	yes
2CP	LOST TWIN LAKE 1	YSC	BKT, RBT	40.9	
2CP	LOWER LAKE OF THE ROUGH		CUT	4	yes
2CP	MARGARET LAKE		CUT	4	yes
2CP	MAYBELLE LODGE LAKE	YSC		24	
2CP	MCCLAIN LAKE		CUT, BKT	15	yes
2CP	UPPER LAKE OF THE ROUGH		CUT	6	yes
2GR	LOWER SUNSHINE RESERVOIR	YSC	BNT, SRC, SPK	900	
2GR	PINEY LAKE	YSC		1	
2GR	UPPER SUNSHINE RESERVOIR	YSC	SPK, SRC	1200	
2LS	BECK LAKE	YSC	BNT, SRC, RBT	108	
2LS	DEAVER RESERVOIR	YSC	RBT	80	
2LS	MARKHAM RESERVOIR		BNT, RBT, SRC	14	
2LS	NEW CODY RESERVOIR		BNT, SRC	30	
2LS	WEST NEWTON LAKE	YSC	BKT	30	
2NR	EAST TENSLEEP LAKE		CUT, BKT	56.3	
2NR	MEADOWLARK LAKE	YSC	BKT, BNT, RBT	182	
2PR	LOST LAKE	YSC		14	
2US	BLACK WATER POND	YSC		0.4	
2US	BUFFALO BILL RESERVOIR	YSC	BNT, RBT, SRC	6691	
2US	DIAMOND CR DIKE POND		BNT, SRC	34	
2US	EIKSTER LAKE	YSC	BKT	3.7	
2US	HUNTER LAKE	YSC		8.8	
2US	KITTY CREEK POND	YSC		0.5	
2US	SOUTH FORK DIKE POND	YSC	BNT, SRC	156	
2YS	BRIDGER LAKE	YSC		104	
	Total lakes=48			11,211.511,	

BKT= Brook trout, BNT= brown trout, CUT= unidentified cutthroat, RBT=rainbow trout, RXC= rainbow x cutthroat hybrid, SPK= Splake, SRC= Snake River cutthroat, YSC= Yellowstone cutthroat.

Appendix 2. Suitable streams that contain YSC or YSC with other salmonids in the Cody Region.

Basin Code	Water Name	Native Species	Other Species	Minimum Miles	Information needed
2CF	CLARKS FORK R, CANYON	YSC	BKT, BNT, RBT	20.5	
			SRC		
2CF	CLARKS FORK R, LOWER	YSC	BNT, RBT, SRC	23.7	
2CF	CLARKS FORK R, UPPER	YSC	BKT, RBT, RXC	15.1	
2CF	CLOSED CREEK	YSC		7.5	
2CF	CRANDALL CREEK	YSC	RBT, RXC, SRC	18	yes
2CF	CRANDALL CREEK, NF	YSC	RBT, RXC, SRC	15	
2CF	DEAD INDIAN CREEK	YSC	RBT	15	
2CF	ELK CREEK		BKT, CUT, RBT	8	yes
2CF	HOODOO CREEK	YSC		10	
2CF	LINE CREEK	YSC	BKT	7	yes
2CF	LODGEPOLE CREEK		BKT, CUT	6	yes
2CF	MUDDY CREEK	YSC	BKT	7	
2CF	OLIVER GULCH CREEK		BKT, CUT	1	yes
2CF	ONE HUNT CREEK	YSC		3	
2CF	PAPOOSE CREEK	YSC		7	
2CF	PAT O'HARA CR, <2 DOT RCH		BKT, CUT	8	yes
2CF	PAT O'HARA CR, >2 DOT RCH		CUT	5	yes
2CF	PILOT CREEK	YSC	RBT, RXC	0.1	
2CF	RAPIDS CREEK		CUT	0.5	yes
2CF	SUNLIGHT CR, <GF UNIT	YSC	BKT	13	
2CF	SUNLIGHT CR, >GF UNIT	YSC	BKT, RBT	7	
2CF	TABLE CREEK		BKT, CUT, RBT	2.5	yes
2CF	TEMPLE CREEK	YSC		5.5	
2CF	TOUGH CREEK	YSC		0.5	
2GR	ANDERSON CR, <FALLS	YSC		4.4	
2GR	ANDERSON CR, >FALLS	YSC	CUT	5	
2GR	ANDERSON CREEK, SF	YSC		2.7	
2GR	BROWN CREEK	YSC	SRC	1.6	
2GR	CHIMNEY CREEK	YSC	CUT	3.5	
2GR	COW CREEK	YSC		3.5	
2GR	DEER CREEK	YSC	BKT, CUT, SRC	2.5	
2GR	DICK CREEK	YSC	BKT, SRC	5	
2GR	DICK CREEK, NF		SRC	2	
2GR	DUNDEE CREEK	YSC		2.5	
2GR	ELEANOR CR, <TRAIL	YSC		4	
2GR	ELEANOR CR, >TRAIL	YSC		0.2	
2GR	FRANC'S FORK	YSC	CUT	12	
2GR	GREYBULL R, <WOOD R CON	YSC	SRC	30	
2GR	GREYBULL R, >WOOD R CON	YSC	BNT, CUT, SRC	0.1	
2GR	HORSE CREEK		SRC	1.5	
2GR	JACK CREEK		SRC	10	
2GR	MAY CREEK	YSC		2	
2GR	MEETEETSE CREEK	YSC	SRC	20	yes
2GR	MEETEETSE CREEK, NORTH		CUT	2.5	yes
2GR	MIDDLE CREEK		CUT	2.5	yes
2GR	PAPPAPAW CREEK	YSC		4	
2GR	PICKETT CREEK	YSC	CUT, SRC	7.5	
2GR	PICKETT CREEK, NF	YSC	SRC	1	
2GR	PINEY CREEK		CUT	5	yes
2GR	QUAKING ASPEN CREEK	YSC		2	
2GR	RAWHIDE CR, LITTLE		CUT	2.5	yes
2GR	RAWHIDE CR, N BRANCH		CUT	5	yes

Basin Code	Water Name	Native Species	Other Species	Minimum Miles	Information needed
2GR	RAWHIDE CREEK		CUT	6	yes
2GR	RED CREEK	YSC		0.5	
2GR	SUNSHINE CREEK	YSC		0.1	
2GR	TIMBER CREEK, WEST	YSC		4	
2GR	TIMBER CREEK, WEST		SRC	4	
2GR	VENUS CREEK	YSC	CUT	6	
2GR	WARHOUSE CREEK	YSC	CUT	5	
2GR	WILLOW CREEK	YSC		0.1	
2GR	WOOD RIVER	YSC	BKT, SRC	25	
2GR	WOOD RIVER, MF	YSC	SRC	10	
2GR	WOOD RIVER, SF	YSC	SRC	10	
2LS	HEART MOUNTAIN CANAL	YSC	RBT	0	
2LS	SHOSHONE R, BB>CORBETT	YSC	BNT, RBT, SRC	15.1	
2LS	SHOSHONE R, CORBETT>WILL	YSC	BNT, RBT, SRC	7.6	
2LS	SHOSHONE R, MORMAN>PEN		BNT, RBT, SRC	7.3	
2LS	SHOSHONE R, PENROSE>BHL		BNT, RBT, SRC	24.5	
2LS	SHOSHONE R, WILLWOOD>MOR		BNT, RBT, SRC	15.5	
2NE	CEDAR CREEK	YSC		7.5	
2NE	DEER CREEK	YSC		8	
2NR	LAKE CREEK	YSC	BNT, RBT	3	
2NR	LAKE CREEK		BKT, CUT, RBT	1.2	yes
2NR	LAKE CREEK, NORTH		BKT, CUT	3.5	yes
2NR	LEIGH CREEK		BKT, SRC	11	yes
2PC	TROUT CREEK	YSC	RBT, RXC	7.5	
2PR	BUCKSKIN ED CREEK	YSC	BKT	7.5	
2PR	PAINTROCK CR, SOUTH	YSC	BKT, CUT	7	
2PR	SOLDIER CREEK	YSC	BKT, CUT	5	
2SH	BEAVER CREEK	YSC		7.5	
2SH	BEAVER CREEK, NORTH	YSC	RBT, BKT	5	yes
2SH	BEAVER CREEK, SOUTH	YSC		1.5	yes
2SH	WHALEY CREEK	YSC	BKT, RBT	1.5	yes
2SW	COTTONWOOD CREEK	YSC	RBT	15	
2SW	OWL CREEK, SF	YSC	BKT, RBT, SRC	6	
2SW	ROCK CREEK	YSC	RBT, SRC	3.5	
2SW	WILLOW CREEK	YSC		1	
2UB	BIG HORN R, WIN>ROBERTSON	YSC	BNT, RBT	11.4	
2UB	BIG HORN R, WW>BLK MTN	YSC	BNT, RBT, SRC	17.1	
2US	AGEE CREEK	YSC	CUT, RBT	1	
2US	BEAR CREEK	YSC	BKT, CUT, RXC	4	
2US	BEAR GULCH		CUT, RXC	0.5	
2US	BIG CREEK	YSC	RBT, RXC, SRC	9	
2US	BIG CREEK, EF		CUT	5	
2US	BIG TREE CREEK	YSC	RXC, SRC	1	
2US	BLACKWATER CR, WF		CUT, RBT, RXC	5	
			SRC		
2US	BLACKWATER CREEK		BKT, CUT, RBT	7.6	
			RXC		
2US	BLOOM CREEK		CUT, RXC	1	yes
2US	BOBCAT CREEK	YSC	BKT, BNT, CUT	5	
			RXC, SRC		
2US	BOULDER CREEK	YSC	BNT, CUT	8	yes
2US	BOULDER CREEK,LITTLE		BNT, SRC	2	yes
2US	BURNT TIMBER CREEK	YSC	BKT, CUT	0.1	
2US	CABIN CREEK	YSC	BKT, BNT	3	
2US	CABIN CREEK	YSC	RBT, RXC	4	
2US	CLEARWATER CREEK	YSC	RBT	8	
2US	CLOCKTOWER CREEK	YSC	RBT, RXC, SRC	3	
2US	CROW CREEK	YSC	BKT, RBT, RXC	7.5	
			SRC		

Basin		Native	Other Species	Minimum	Information
Code	Water Name	Species		Miles	needed
2US	DEER CR SPRING CR #1		BKT, CUT	2	yes
2US	DEER CR SPRING CR #2		BKT, CUT	2	yes
2US	EAST FORK CREEK	YSC	BKT	8	
2US	ELIZABETH CREEK		CUT, RXC	2	
2US	ELK FORK CREEK	YSC	BKT, BNT, RBT	15	
			RXC		
2US	FISH HAWK CREEK	YSC	BKT, RBT, RXC	12	
2US	FLY CREEK	YSC	RBT, RXC, SRC	1	
2US	GENTIAN CREEK	YSC	BKT	4	
2US	GRINNELL CREEK	YSC	BKT, BNT, RXC	10	
2US	GRIZZLY CREEK	YSC	RBT, RXC	5	
2US	HARDPAN CREEK	YSC	BNT, CUT	8	
2US	HORSE CREEK	YSC	RBT, RXC, SRC	2.5	
2US	ISHAWOOA CREEK	YSC	BKT, BNT, CUT	15	
			SRC		
2US	J-9 SPRING 1		BKT, CUT	0.3	yes
2US	JIM CREEK	YSC	RBT	3	
2US	JONES CREEK	YSC	BKT, CUT, RBT	7.0	
			RXC, SRC		
2US	JUNE CREEK		CUT, RBT, RXC	1.5	
2US	KITTY CREEK	YSC	RBT, RXC, SRC	5	
2US	LAKE CREEK	YSC	BKT, RXC	3	
2US	LIBBY CREEK		CUT, RBT, RXC	2.5	
2US	MARQUETTE CREEK	YSC	CUT, SRC	8	
2US	MIDDLE CREEK	YSC	BKT, RXC, SRC	2.5	
2US	MORMON CREEK		BKT, CUT, RXC	3	
2US	MOSS CREEK	YSC	CUT, RBT, RXC	3	
2US	NAMEIT CREEK		CUT, RBT, RXC	2.5	
2US	NEWTON CREEK		BKT, CUT, RBT	1.5	
			RXC, SRC		
2US	NO 2 A2Z SPRING CR		BKT, BNT, CUT	2	yes
2US	PAGODA CREEK		CUT, RBT, RXC	1	
			SRC		
2US	RED CREEK	YSC	CUT, RXC	4	
2US	ROBBERS ROOST CREEK	YSC	RBT, RXC, SRC	5	
2US	SADDLE CREEK	YSC		5	
2US	SCHULTZ SPRING CREEK		BKT, BNT, CUT	1.3	
2US	SECLUSION CREEK	YSC	BKT, RXC	4.5	
2US	SHEEP CREEK		BNT, RBT, RXC	2.5	
			SRC		
2US	SHEEPHEAD CREEK	YSC	RXC	1	
2US	SHOSHONE R, NF	YSC	BKT, BNT, RBT	48	
			RXC		
2US	SHOSHONE R, SF <FALL CR	YSC	BKT, BNT, CUT	5	
			RBT, RXC, SRC		
2US	SHOSHONE R, SF >FALL CR		BKT, BNT, CUT	48	
			RBT		
2US	SINGING BROOK CREEK	YSC	RBT, RXC	1	
2US	SNYDER SPRING CR 1		BKT, BNT, CUT	0.4	yes
			RBT		
2US	SNYDER SPRING CR 2		BKT, BNT, CUT	1.3	yes
2US	SWEDE CREEK	YSC	BKT, CUT, RBT	3.5	
			RXC		
2US	SWEETWATER CREEK	YSC	CUT, RBT, RXC	10	
			SRC		
2US	T E SPRING CREEK		BNT, CUT	1	
2US	TORRENT CREEK	YSC	RXC	2	
2US	TROUT CREEK	YSC	RBT, SRC	6	

Basin Code	Water Name	Native Species	Other Species	Minimum Miles	Information needed
2US	VALLEY SPRING CREEK		BKT, BNT, CUT	2	yes
			RBT		
2US	WHIT CREEK	YSC	RBT, RXC, SRC	4	
2US	WINANTS SPRING CREEK		BKT, BNT, CUT	1	yes
2US	YELLOW CREEK	YSC	BKT, BNT	4.5	
2US	YOUNTS CREEK	YSC	BKT	6	
2YS	ATLANTIC CREEK	YSC		5	
2YS	BRUIN CREEK	YSC		3.5	
2YS	BUTTE CR, NORTH FORK	YSC		5	
2YS	BUTTE CREEK	YSC		5	
2YS	CASTLE CREEK	YSC		3.5	yes
2YS	COYOTE CREEK	YSC		1	yes
2YS	DELL CREEK	YSC		3	yes
2YS	ELK CREEK	YSC		3	yes
2YS	ESMOND FORKS	YSC		0.5	yes
2YS	FALCON CREEK	YSC		0.5	yes
2YS	FALLS CREEK	YSC		2	yes
2YS	HIDDEN CREEK	YSC		7	
2YS	JAY CREEK	YSC		1.5	yes
2YS	OPEN CREEK	YSC		8	
2YS	PASS CREEK	YSC		8	
2YS	SCATTER CREEK	YSC		1.5	yes
2YS	SENECIO CREEK	YSC		1	yes
2YS	SIGGINS FORK	YSC		1	yes
2YS	SILVERTIP CREEK	YSC		4.5	yes
2YS	THIRD CREEK	YSC		2	yes
2YS	THOROFARE CREEK	YSC		18	
2YS	VALLEY FORK	YSC		3.5	yes
2YS	YELLOWSTONE R, NF	YSC		3.5	yes
2YS	YELLOWSTONE R, SF	YSC		6	
2YS	YELLOWSTONE RIVER	YSC		14.5	
	Total streams= 170			1,107.8	

BKT= Brook trout, BNT= brown trout, CUT= unidentified cutthroat, RBT=rainbow trout, RXC= rainbow x cutthroat hybrid, SPK= Splake, SRC= Snake River cutthroat, YSC= Yellowstone cutthroat.

Appendix 3. Waters designated for DNA sample collection in the Jackson region.

Basin Name	Basin Code	WATER NAME
Snake River Basin below Jackson Lake Dam	4BJ	Bailey Creek Dog Creek Fall Creek N. Horse Creek Mosquito Creek Cache Creek Upper Flat Creek Fish Creek Ditch Creek Cottonwood Creek near Sohare
Snake River Basin above Jackson Lake Dam	4AJ	Trapper Lake Moose Creek Berry Creek Glade Creek Arizona Creek
Snake River Basin Wilderness Waters	4SW	Upper Pilgrim Creek Coulter Creek Rodent Creek Wolverine Creek
Hoback River Basin	4HR	Willow Creek Little Granite Creek Upper Granite Creek Shoal Creek
Gros Ventre River Basin	4GV	Slate Creek Cottonwood Creek
Fish Creek Basin	4FC	N. Fork Fish Creek Bacon Creek S. Fork Fish Creek
Spread Creek Basin	4SC	S. or N. Fork Spread Creek
Buffalo Fork Basin	4BF	Blackrock Creek
North Buffalo Fork Basin	4NB	Soda Fork
South Buffalo Fork Basin	4SB	S. Fork Buffalo below falls
Cub Creek Basin	4CC	NONE
Pacific Creek Basin	4PC	Pacific Creek Whetstone Creek Mink Creek Trail Creek
Palisades Basin	4PB	Big Elk Creek N. Fork Indian Creek

Basin Name	Basin Code	WATER NAME
Teton River Basin	4TR	S. Badger Creek S. Leigh Creek Bitch Creek Conant Creek
Lower Salt River Basin	4LS	Spring Creek Willow Creek
Upper Salt River Basin	4US	Dry Creek Cottonwood Creek Salt River
Greys River Basin	4GR	Spring Creek N. 3-Fork Creek Sheep Creek
Little Greys River Basin	4LG	Little Greys River

Appendix 4. Estimated historic and present YSC/SRC distribution in the Sheridan Region.

Drainage and specific water	Estimated historic habitat		Estimated occupied habitat (% of historic)		Source of YSC for occupied habitat and comments
Little Bighorn Drainage	**Stream miles**	**Lakes**	**Stream miles**	**Lakes**	
Lodgegrass Creek	5.5	0	5.5 (100%)	0	Possible endemic populations
West Fork LBH + tribs.	14.0	0	9.0 (64%)	0	Possible endemic populations; Barriers likely limited occupancy.
LBH proper + Wagon Box (4 mi.)and Duncum (2 mi.)Creeks	23.0	0	3.5 (15%)	0	Possible endemic populations + stocking of YSC in main stem LBH; possible historic barriers
Half Ounce Cr.	0.5	0	0.5 (100%)	0	YSC introduced 1998
Dry Fork LBH	8.0	0	0	0	May be SRC/YSC present from drift out of tributaries; barriers in LBH may have restricted historic occupancy.
Lick Creek	9.0	0	4.5 (50%)	0	Stocked SRC and YSC
Lake Creek	10.0	0	0	0	Past stocking of SRC/YSC
Miller Creek	1.0	0	0	0	
Bear Trap Creek	6.0	0	0	0	
Elk Horn Creek	4.0	0	1.5 (37.5)	0	Possible endemic population + introduced YSC/SRC
West Pass Creek	12	0	10 (83)	0	Introduced and possible endemic pop. of SRC and YSC
East Pass Creek	14	0	12 (86)	0	Introduced and possible endemic pop. of SRC and YSC
Twin Creek	15	0	10 (67)	0	Introduced and possible endemic pop. of SRC and YSC
Crater Lake		0	0 (0)	0	Lake no longer exists
Total Little Bighorn drainage	122	0	56 (46%)	0 (0%)	
Goose Creek (trib to Tongue)	**Stream miles**	**Lakes**	**Stream miles**	**Lakes**	
Goose Creek	37.9	0	18 (47%)	0	Includes Walker, Sawmill, Coney, Wilderness, West Fk. Intro. SRC
Soldier Creek	18	0	0	0	
Owl Creek	6	0	0	0	
Beaver Creek	10	0	0	0	
Little Goose	45	0	0	0	Includes Compartment Cr, Sackett, Hurlburn, Jackson Crs. - possible past intros. of SRC, endemic YSC pops. unknown.
Lakes: Cross Cr., Sawmills, Stull, Coney, etc.		0	0	20 (0)	4 lakes YSC; 16 lakes SRC - Introduced SRC & YSC; unlikely historic occupancy due to barriers.
Total Goose Creek	117	0	18 (15.4%)	20 (200%)	
Tongue River	**Stream**	**Lakes**	**Stream miles**	**Lakes**	

Drainage	**miles**				
Tongue R.-main stem MT line to Box Canyon	68.8	0	15 (22)	0	Drift of stocked SRC from N. Tongue and YSC from Fool Cr.; unknown pop. of endemic YSC.
North Fk Tongue	0	0	11 (0%)	0	Stocked SRC
Fool Creek	0	0	2 (0)	0	Stocked YSC
Big Willow Creek	0	0	5 (0)	0	Stocked SRC
Bull Creek	0	0	4 (0)	0	Stocked SRC
Sheep Creek	3	0	0	0	Possible endemic population YSC
South Tongue and East Fk. ST	0	0	0	0	Past SRC introduction.
West Fk South Tongue, Compartment & Prospect Crs.	0	0	0	0	No CUT present - recent surveys
Sucker Creek	0	0	0	0	No CUT present
Cutler Creek	0	0	0	0	Possible YSC/SRC from Tongue
Smith Creek	9	0	0	0	Unknown endemic YSC
Little Tongue + east and south fks	11	0	0	0	Unknown endemic YSC
Amsden Creek	4	0	0	0	Unknown endemic YSC
White Tail Creek	4	0	0	0	Unknown endemic YSC
Columbus Creek	13	0	6.5 (41)	0	Introduced YSC; unknown endemic YSC
Wolf, Sibley, Gloom, Quartz, and Alden Crs.	26	0	4 (15)	0	Possible endemic YSC & introduced SRC
5 Mile Creek	12	0	0	0	Possible endemic YSC?
6 Mile Creek	9	0	0	0	Possible endemic YSC?
Slate Creek	6	0	0	0	No information
Ash Creek	5	0	0	0	No information-unsuitable water?
Prairie Dog and Dutch Crs.	56	0	0	0	No information-unsuitable water?
Little Badger	6	0	0	0	No information-unsuitable water?
Big Badger	15	0	0	0	No information-unsuitable water?
Hanging Woman drainage	19	0	0	0	No information-unsuitable water?
Total Tongue Drainage	267	0	47.5 (17.8%)	0	9 miles YSC occupancy; 24 miles SRC occupancy
Total for Sheridan Region	506	0	122 (24%)	20 (0%)	