EVALUATION OF CUTTHROAT TROUT FROM THE LITTLE SNAKE (Tributaries of Savery Creek) DRAINAGE, CARBON COUNTY, WYOMING

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Samples of 10 specimens from Dirtyman Creek and 2 specimens from Hell Canyon Creek were examined and the data evaluated in relation to the degree of purity as native cutthroat trout. All specimens were badly faded and the Hell Canyon specimens were partly decomposed. Thus, an accurate interpretation of the spotting pattern could not be made. Under these conditions and with the small number of specimens, only tentative conclusions can be made on the relative purity of the populations from which these specimens represent. The genetics of the specimens are overwhelmingly that of the native cutthroat trout, *Salmo clarki pleuriticus*, but there is a slight indication of a rainbow trout influence in the Dirtyman Creek specimens and a stronger influence from rainbow trout in the Hell Canyon Creek specimens.

Cutthroat Trout of Little Snake Drinage

In several reports written for the Wyoming Game and Fish Department, I have pointed out that the cutthroat trout native to the Green River drainage, Wyoming, *S. c. pleuriticus*, is separated into two distinct groups, based on the size of the spots on the body. The trout native to the upper Green River drainage have relatively small spots and the native trout of the Little Snake drainage have much larger spots. Representatives of the two groups are illustrated by Binns (1977).

Previously, the only specimens I have examined from tributaries of Savery Creek were from the headwaters of Big Sandstone Creek and from tributaries to Big Sandstone Creek. I assume that pure populations from other tributaries of Savery Creek should be virtually identical to the pure populations in the Big Sandstone drainage.

Unfortunately, the distinctive spotting pattern, diagnostic of Little Snake drainage native trout, could not be fairly evaluated because of the badly faded condition of the specimens. I did not observe any indication of an obvious influence of rainbow trout in the spotting pattern, however. Table 1 compares the meristic data of the present specimens with a general composite of values derived from 25 specimens from 6 streams of the Big Sandstone drainage.

Table 1. Comparison of specimens from Dirtyman Creek and Hell Canyon Creek with specimens of S. c. pleuriticus from the Big Sandstone drainage.

Locality	Gillrakers	Pyloric caeca	Scales above l.l. and in lat. ser.	Basibranchial teeth
Big Sandstone Crk. and Tributaries N=25	1 18-21 (19-20)	1 30-40 (35)	1 42-50 (46-47) 175-205 (185-190)	1 3-15 (8-10)
Dirtyman Crk. N=10	17-21 (19.3)	31-38 (35)	41-50 (44.8) 166-192 (182.1)	2 no teeth 8 w/1-5(3.0)
Hell Canyon Crk. N=2	19,20	36,36	41,46 174 (2)	teeth absent in both specimens

1 typical ranges and (mean) values of 6 samples.

(2) body decomposed in one specimen and lateral series scale counts not possible.

Two of 10 specimens lack basibranchial teeth in the sample from Dirtyman Creek and the number of teeth is reduced in comparison with Big Sandstone specimens. Except for slightly lower scale counts, there is no other indication of a rainbow trout hybrid influence. Such a population would rank as a "B" grade (probably "B+") in the system of Binns (1977). The two specimens from Hell Canyon Creek both lack basibranchial teeth. The scale counts are lower than expected for pure *pleuriticus*, but the caecal counts are typical. Rainbow trout typically have 25 to 30 scales above the lateral line and 120 to 140 scales in the lateral series and 50 to 60 pyloric caeca. A very slight influence from rainbow trout can greatly suppress basibranchial teeth. Larger samples would be necessary for a more authoritative opinion, but the Hell Canyon population would probably merit a "C" grade *S. c. pleuriticus* (about 75% or more native).

Hybrid gradients may occur in some streams, as discussed in my last Wyoming report on Little Snake drainage cutthroat trout. Obvious hybrid specimens may occur in a downstream area and apparently pure specimens are found a few miles upstream in the headwaters of some streams. Precisely how purity can be maintained in such situations without some physical barrier isolating and protecting the pure populations is not known, but it can be assumed that where a pure population is not physically isolated from hybridization and no evidence of a hybrid influence (or very slight influence) can be detected, the environment must greatly favor the maintenance of the native genotype and strongly select again non-native genes in the population. In such situations, any change in the environment may favor the hybrid genes and the hybrid influence would be stimulated.

LITERATURE CITED

Binns, No. a. 1977. Present status of indigenous populations of cutthroat trout, Salmo clarki, in southwest Wyoming. Wyo. Game and Fish Dept. Fish. Tech. Bull. 2:58p.

THE TROUT OF CRAZY FISH LAKE, FLATHEAD INDIAN RESERVATION, MONTANA

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A sample of 30 specimens of cutthroat trout from Crazy Fish Lake are judged to represent a virtually pure population of native trout, *Salmo clarki lewisi*. Some characteristics, particularly the numbers of basibranchial teeth and pyloric caeca, differ slightly from samples of *S. c. lewisi* from Glacier Park. These differences can not be readily attributed to a hybrid influence. If this population was influenced from hybridization with non-native trout in the past, no influence can be detected by outward appearance of present specimens. This population is identified as *S. c. lewisi*. The slow growth and small size of the specimens suggests some management considerations.

Native Trout of Clark Fork Drainage

I recognize 15 subspecies of the cutthroat trout species, *Salmo clarki*, but all subspecies can be grouped into three major branches in the phylogeny of the species. The coastal cutthroat trout, *S. c. clarki*, is distribured along the Pacific Coast from California to Alaska. The coastal cutthroat has a profusion of fine spots, irregular in outline, distributed all over the body, and 68-70 chromosomes. The second major branch in cutthroat trout evolution is represented by a trout commonly callec the "Westslope" cutthroat which is native to the upper Columbia River basin, the South Saskatchewan drainage, and the upper Missouri drainage. The correct scientific name for this trout is S. c. lewisi. This subspecies is characterized by small spots, irregular in outline, with the spots concentrated on the caudal peduncle area of the body. Typically, an arc drawn from the anal fin to the pectoral fin would have no spots (or very few) on the body within the area encompassed. S. c. lewisi has the hereditary basis to develop bright coloration, particularly red hues on the ventral region, in sexually mature fish. S. c. lewisi has 66 chromosomes.

The third major group of cutthroat trout is the Yellowstone cutthroat trout, S. c. bouvieri, native to the upper Snake River drainage and to the Yellowstone drainage. This subspecies has larger, more rounded spots, lacks the hereditary basis for bright coloration and has 64 chromosomes. All other subspecies are derived from a common ancester of the Yellowstone cutthroat.

Crazy Fish Lake is in the Jocko River drainage, tributary to the Flathead River. The only native trout of the Flathead-Clark Fork drainage is S. c. lewisi (the native "bull trout," Salvelinus confluentus, is a char). The data obtained from the 30 specimens collected in Crazy Fish Lake was compared with data from samples of S. c. lewisi of the Flathead River drainage collected in Glacier Park in 1978 and 1979.

The most consistent character that best diagnoses S. c. lewisi is its unique spotting pattern. The spotting pattern of the specimens from Crazy Fish Lake is identical to specimens of pure populations of S. c. lewisi from Glacier Park. Besides the spotting pattern, the characters that best evaluate a hybrid influence from Yellowstone cutthroat trout and from rainbow trout are numbers of scales, gillrakers, pyloric caeca, and basibranchial teeth. Yellowstone cutthroat trout have more gillrakers and more basibranchial teeth than does S. c. lewisi and rainbow trout have fewer scales, more caeca, and lack basibranchial teeth. Genes derived from previous hybridization between S. c. lewisi and Yellowstone cutthroat and/or rainbow trout can be detected by their influence on spotting pattern and on the meristic characters.

Identification of Specimens

Table 1 lists the data from the key characters of the Crazy Fish Lake specimens and compares these values with typical values obtained from 15 samples of S. c. lewisi from Glacier Park.

Table 1. Character values of specimens from Crazy Fish Lake compared with composite of S. c. lewisi from Glacier Park.

	Gillrakers	Scales above l.l. and in lat. series	Pyloric caeca	Basibranchial teeth
Crazy Fish L. N=30	15-20 (17.5)	35- 46 (42.3) 150-193(172.8)	32- 52 (43.2)	1 no teeth 29 w/1-20(7.6)
Composite of 15 samples of S. c. lewisi Glacier Park (Flathead R. drainage)	[1] 17.3-19.0 (17.5-18.5)	[1] 37.8-42.6 (38-41) 162-194 (165-180)	[1] 34- 42.4 (36-41)	[1] 3.0-7.9 (5-7) typically 5-10% of sample lack teeth.

1. Minimum and maximum mean values with typical means given in parentheses.

The number of gillrakers is typically low (ca. 18) in S. c. lewisi. Yellowstone cutthroat trout average about 21 gillrakers. Thus, the low mean value (17.5) for the sample from Crazy Fish Lake, although at the extreme of low values found in S. c. lewisi from Glacier Park, can not be attributed to a hybrid influence. More indicative of a pure population of S. c. lewisi is the feeble development of gillrakers on the posterior side of the first gill arch. S. c. lewisi typically has none, one, or two very tiny knobs on the posterior part of the first gill arch. Yellowstone cutthroat trout have from 5 to 14 more highly developed gillrakers on the posterior side of the first arch. Only 14 of 30 specimens have a small knob on the posterior side of the first arch ($\bar{x}$ of .5 posterior gillrakers). This count is lower than found in any sample from Glacier Park. The low total gillraker number and the extremely feeble development of posterior gillrakers would appear to rule out any influence from hybridization with Yellowstone cutthroat.

The scale counts are typical of S. c. lewisi except that the number of scales above the lateral line is toward the high end of the expected value.

The mean number of pyloric caeca is slightly higher than found in any sample so far examined from Glacier Park. This could indicate an influence from rainbow trout which typically have from 50 to 60 caeca. However, there is no indication of a rainbow trout influence in any other character.

All specimens except one have basibranchial teeth (97% occurrence). In the Glacier Park samples, three samples have 100% occurrence but the other 12 samples typically exhibit 90 to 95% occurrence of basibranchial teeth. The mean number of basibranchial teeth is relatively high (7.6). Yellowstone cutthroat typically have more than 20 basibranchial teeth, but I do not believe an influence from Yellowstone cutthroat trout would influence teeth number without affecting gillraker development.

There is no way a population can be proved to be pure native trout with 100% certainty. The evidence reviewed indicates that the trout of Crazy Fish Lake are probably pure, but if there is some hybrid hereditary material in the population it is not manifested in any obvious manner. Most important is that the spotting pattern--the phenotypic appearance--of the specimens are wholly typical of *S. c. lewisi*, and the correct classification of the trout of Crazy Fish Lake is *Salmo clarki lewisi*.

Management Considerations

The total length of the specimens ranged from 206 to 267 mm ($\bar{x}$ 234 mm) total length. This is a relatively small size for adult trout and indicates an overpopulation of the lake. This size range is typical of *S. c. lewisi* in Glacier Park lakes where natural reproduction is high and where there is no predation from bull trout.

Two approaches might be combined to increase the growth rate and average size if this is a desired goal. Overpopulation can be treated by thinning out the population and/or reducing the level of natural reproduction. Thinning out might be accomplished by increasing the exploitation of small fish (8-9 inches and less). Anglers might be allowed an extra "bonus" of 10 trout if they are 9 inches or less. Trout between 8-9 inches and 12-14 inches might be protected by a "slot" limit. This type of regulation would maintain a reasonable amount of trout in this size range so that a good catch rate would be maintained. Where a significant part of the catch is to be released to be caught again, angling should be restricted to artificial flies and lures to insure high survival.

Reproduction can be reduced by an artificial propagation program that would ship most of the eggs to other areas. For example, the Paiute Tribe in Nevada for many years has sold the eggs of the Lahontan cutthroat trout of Summit Lake to the U.S. Fish and Wildlife Service. A recent paper by Fred Allendorf and Steve Phelps of the University of Montana, demonstrated that the artificial propagation of S. c. lewisi in Montana has caused a loss of more than 50% of the genetic variability (more than one gene at a given gene locus) in the hatchery brood stock. Their recommendation was to infuse new genes into the hatchery brood stock by using fish from wild, native populations. The potential market for an annual sale of 100,000 to 300,000 eggs of wild, native S. c. lewisi might be investigated.

In most trout populations, a large size is not possible unless there are large food items in the diet so that the older, larger trout can exploit a resource without intense competition from abundant young, small trout. I do not have any information on the food regime in Crazy Fish Lake (a few fingernail clams, Pisidium, were noted) but the major food is likely to be small zooplankton (copepods and cladocera) and midge larvae (Chironomidae) of a size of only from one to a few millimeters. If such food is abundant, growth can be rapid up to a size of about 12 inches (unless the fish population is too dense). At a size of 12 to 14 inches, however, the energy expended to capture the tiny ogranisms is only sufficient for body maintenance with little surplus for growth.

Under no circumstances should a forage fish be stocked. S. c. lewisi is not an effective predator on fishes and other fish species would only compete for a common food supply. If Crazy Fish Lake lacks a relatively large invertebrate organism, three species might be considered for introduction. The freshwater shrimp or scud, Gammarus, is perhaps the most ideal trout food. The aquatic isopod, Asellus, is an important food in many lakes, particularly in the fall and winter. The crawfish is an excellent food for large trout.

In Towave Reservoir on the Ute Reservation in Utah, the maximum size of cutthroat trout increased from about two pounds to five and six pounds after crawfish were introduced.

A lake with large (14 to 18 inch), native cutthroat trout could be an attraction for a tourist type of private fishery where special licenses could be sold for the opportunity to catch a rare and beautiful trout in its native environment.