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TAXONOMY OF THE COLORADO CUTTHROAT TROUT (*Salmo clarki pleuriticus*) OF THE WILLIAMSON LAKES, CALIFORNIA

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We have examined 13 meristic characteristics, 19 morphometric measurements, coloration and spotting, and dentition from 21 specimens of cutthroat trout from the Williamson Lakes of the southern Sierra Nevada, California. According to records of the California Department of Fish and Game, these trout are descendant from fertilized eggs of the Colorado cutthroat trout, *Salmo clarki pleuriticus*, which were taken in 1931 from Trapper's Lake, Colorado. A comparison of selected meristic characteristics revealed no differences between the Williamson Lakes cutthroat trout and *S. c. pleuriticus* from Colorado, Wyoming, and Utah. Life colors, spotting, and the presence of basibranchial dentition also identify the Williamson Lakes cutthroat trout as *S. c. pleuriticus*. The similarities between the Williamson Lakes *pleuriticus* and those from present day Trapper's Lake suggest that the stocking of Trapper's Lake (subsequent to the California transplant) with Yellowstone cutthroat trout, *S. c. lewisi*, has had no detectable effect on the native Trapper's Lake *pleuriticus* population.

INTRODUCTION

Cope (1872) first described the Colorado cutthroat trout on the basis of specimens taken from the Green River basin in Wyoming, and from several streams in Idaho and Montana. He named the trout "*Salmo pleuriticus*", and believed it to be the native form of the Colorado—Green River drainage. At present, *pleuriticus* is recognized as a subspecies of the polytypic inland cutthroat trout, *Salmo clarki* (Miller 1950).

The past distribution of *S. c. pleuriticus* apparently included the upper Green and Colorado River system of Wyoming, Colorado, Utah, and New Mexico (Behnke 1970, 1974, 1975). The southernmost distribution of *pleuriticus* was the Dirty Devil River in Utah to the west, and the San Juan River in New Mexico to the east. Reports of *pleuriticus* from the Little Colorado River in Arizona are considered erroneous (Behnke 1974). Phenotypically pure populations of *pleuriticus* presently exist only in a few, isolated headwater tributary streams in a small part of its native range (Behnke 1974; Behnke and Zarn 1976). Taxonomic information on *pleuriticus* is limited to the early observations of Cope (1872) and Jordan (1891) and to the recent studies of Behnke (1970, 1974, 1975). In this note, we present taxonomic data on a population of *pleuriticus* which was transplanted from Colorado to California.

According to records of the California Department of Fish and Game, 30,000

fertilized trout eggs were taken in 1931 from Trapper's Lake, Colorado, and the resulting fry stocked in the five barren Williamson Lakes of the southern Sierra Nevada, Inyo County, California. In 1931, Trapper's Lake apparently contained pure *pleuriticus,* although Yellowstone cutthroat trout (*S. c. lewisi*) subsequently stocked in Trapper's Lake may have hybridized with the native *pleuriticus* population (Snyder and Tanner 1960; but see Behnke 1974). We have examined 21 specimens from the Williamson Lakes to compare with pure *pleuriticus* populations from Colorado, Wyoming, and Utah. The purposes of this study were to document the occurrence of pure *S. c. pleuriticus* in the Williamson Lakes, to add to the limited taxonomic data on the subspecies, and to assess whether the existing Trapper's Lake *pleuriticus* population might have been affected by the introduction of *S. c. lewisi.*

METHODS

The 21 specimens were collected by the California Department of Fish and Game on September 11, 1974, from the lower three of the five Williamson Lakes. Counts of meristic characters and morphometric measurements followed Hubbs and Lagler (1947). The latter were converted to permillage proportions of standard length. Vertebrae, interneurals, interhaemals, and epurals were counted from radiographs. Life colors and other pigmentation traits were observed from color slides and photographs (courtesy of E. P. Pister of the California Department of Fish and Game), and from the preserved specimens. Basibranchial dentition was examined using a staining technique suggested by R. J. Behnke (cited in Gold 1977).

To normalize the morphometric data, the permillage proportions were transformed to arcsin values (see Gold 1977). Means of taxonomic characters for males and females were subjected to "t" tests, each having 19 degrees of freedom.

RESULTS AND DISCUSSION

No sexual dimorphism for 13 meristic characters (Table 1) was revealed by the "t" tests. The means and ranges of 12 characters for both sexes combined are similar to those reported for other subspecies of *S. clarki* except the lacustrine-adapted *S. c. henshawi* (Behnke and Zarn 1976). The high mean number of scales in the lateral series ($\bar{X} = 188.9$) is a characteristic trait of *pleuriticus.* Among other western *Salmo,* only *S. c. stomias* of the Arkansas and Platte rivers and *S. aguabonita* of the Kern River are as finely scaled (Dieffenbach 1966, Behnke 1969, 1973; Gold and Gall 1975*a, b*; Behnke and Zarn 1976).

TABLE 1. Meristic Characteristics of 21 Cutthroat Trout from the Williamson Lakes, California.†

Character	*Females (n = 10)*	*Males (n = 11)*	*Combined (n = 21)*
Fork length (cm)	23.4 ± 0.9 (19.0–27.3)	22.0 ± 1.0 (15.8–28.1)	22.7 ± 0.6 (15.8–28.1)
Pyloric caecae	39.7 ± 0.4 (37–41)	38.0 ± 1.2 (30–45)	38.8 ± 0.7 (30–45)
Dorsal rays	11.2 ± 0.1 (11–12)	11.2 ± 0.2 (10–12)	11.2 ± 0.1 (10–12)

Anal rays	11.0 ± 0.2 (10–12)	10.7 ± 0.1 (10–11)	10.9 ± 0.1 (10–12)
Pectoral rays	14.6 ± 0.2 (13–15)	14.4 ± 0.1 (14–15)	14.5 ± 0.1 (13–15)
Pelvic rays	9.2 ± 0.1 (9–10)	9.0 ± 0.0 (9–9)	9.1 ± 0.1 (9–10)
Branchiostegal rays (left)	11.3 ± 0.2 (10–12)	11.3 ± 0.2 (10–12)	11.3 ± 0.1 (10–12)
Vertebrae	61.6 ± 0.2 (60–63)	61.6 ± 0.2 (61–63)	61.6 ± 0.1 (60–63)
Gill rakers (left)	20.5 ± 0.4 (18–22)	20.3 ± 0.3 (19–22)	20.4 ± 0.3 (18–22)
Scales in lateral line	126.0 ± 1.3 (121–134)	126.5 ± 1.1 (119–133)	126.2 ± 0.8 (119–134)
Scales in lateral series	186.9 ± 2.9 (173–203)	190.7 ± 2.3 (180–209)	188.9 ± 1.8 (173–209)
Interneurals	13.1 ± 0.2 (12–14)	13.3 ± 0.2 (12–14)	13.2 ± 0.1 (12–14)
Interhaemals	12.8 ± 0.2 (12–14)	12.5 ± 0.1 (12–13)	12.6 ± 0.1 (12–14)
Epurals	2.6 ± 0.2 (2–3)	2.8 ± 0.1 (2–3)	2.7 ± 0.1 (2–3)

† Data are shown as mean ± standard error, with ranges shown below in parentheses.

Significant sexual dimorphism in six morphometric characteristics was indicated by the "t" tests: body depth, head length, distance from occiput to snout tip, maxillary length, width of gape, and length of anal fin base (Table 2). In all but length of anal fin base, the values for males exceeded those of females.

TABLE 2. Permillage Proportions of 21 Cutthroat Trout from the Williamson Lakes, California.†

Measurement	*Females (n = 10)*	*Males (n = 11)*	*Pooled s. e.††*	*"t"*
Standard length (cm)	16.6–24.2 (20.6)	13.8–25.0 (19.5)	1.221	0.93
Body depth	196–238 (215)	221–254 (239)	0.414	−3.89**
Head length	227–258 (245)	235–275 (259)	0.325	−2.83*
Head width	99–114 (106)	101–121 (111)	0.229	−1.88
Interorbit, least width	57–63 (60)	51–72 (64)	0.210	−1.76
Occiput to snout, length	155–176 (168)	165–190 (176)	0.284	−2.29*
Maxillary length	98–118 (111)	104–149 (123)	0.387	−2.87**
Caudal peduncle length	155–175 (162)	159–174 (166)	0.187	−1.76
Caudal peduncle depth	99–114 (104)	99–115 (108)	0.188	−1.70
Width of gape	132–164 (145)	138–187 (160)	0.436	−2.71*
Predorsal length	462–525 (486)	473–514 (497)	0.389	−1.64
Preanal length	726–773 (748)	726–780 (750)	0.455	−0.26
Prepectoral length	206–239 (224)	215–251 (233)	0.296	−2.03
Prepelvic length	519–559 (539)	525–577 (547)	0.409	−1.12
Dorsal fin base length	121–148 (131)	118–147 (131)	0.325	0.00
Anal fin base length	109–128 (120)	103–119 (112)	0.250	3.00**
Pectoral fin length	158–176 (166)	159–184 (172)	0.236	−1.86
Pelvic fin length	125–148 (136)	127–148 (141)	0.282	−1.49
Preadipose length	835–868 (849)	835–869 (853)	0.391	−0.84
Eye diameter	44–56 (49)	44–58 (50)	0.230	−0.26

† For each proportion, the range is shown, followed by the mean in parentheses.

†† Pooled standard errors for "t" tests were computed using a weighted analysis for unequal sample size and using arcsin transformed means.

* $P < .05$; ** $P < .01$.

Detailed morphometric data on western *Salmo* are generally lacking, and some authors (e.g. Schreck and Behnke 1971) feel that these characters have little discriminatory value in western *Salmo* taxonomy. However, comparing morphometric characteristics of *S. c. pleuriticus* from Williamson Lakes with those of *S. gairdneri* (Needham and Gard 1959) and *S. apache* (Miller 1972), we found that *pleuriticus* has a narrower head than both *S. gairdneri* and *S. apache,* and is shorter than *S. apache* in occiput to snout tip length, head length, length of dorsal fin base, and pectoral and pelvic fin lengths.

All 21 specimens from Williamson Lakes had well developed basibranchial teeth ($\bar{X} = 12.5$, range = 2–22). The teeth were arranged fairly uniformly, usually in 1 to 3 anterior to posterior rows. The unusal glossohyal teeth, found occasionally on the undescribed redband trout and rarely on *S. aguabonita* (Gold 1977), were not observed.

Life colors and spotting of *S. c. pleuriticus* from Williamson Lakes are similar to those described by Behnke (1970, 1974) for *S. c. pleuriticus.* The ventral region is a bright, almost gaudy crimson. Laterally, the colors become bronze-gold with overlying shades of light red. The blood-red cutthroat marks are conspicuous. Spots on the body are large, pronounced, and concentrated posteriorly; they are most numerous on the caudal peduncle. Spots on the dorsal, anal, and particularly the caudal fins are numerous (Figure 1).

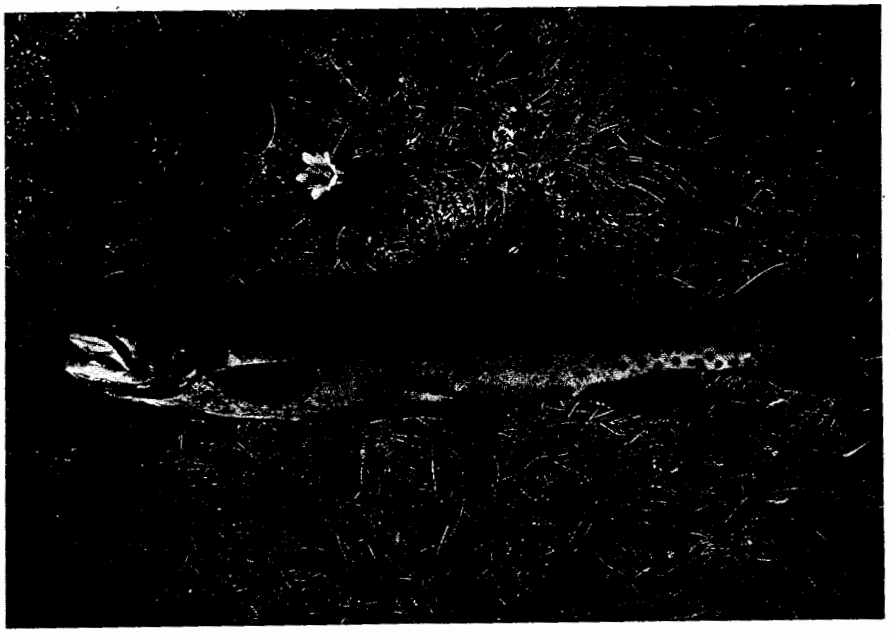

Figure 1. *S. c. pleuriticus* from Williamson Lakes, California. *Photograph by E. P. Pister, 1974.*

No apparent differences in meristic characters exist between *S. c. pleuriticus* from Williamson Lakes and *S. c. pleuriticus* from Wyoming, Colorado, and Utah (Table 3). In conjunction with the similarities in coloration and spotting, and the presence of basibranchial dentition, we conclude that the Williamson Lakes trout are a phenotypically pure population of *S. c. pleuriticus.* We also note that the

similarities between the Williamson Lakes *pleuriticus* and those from present-day Trapper's Lake, particularly in the distinctive lateral series scale count (Table 3), suggest that the stocking of Trapper's Lake with *S. c. lewisi* apparently has had no detectable effect on the purity of the native *pleuriticus* population.

TABLE 3. Selected Meristic Characters from Colorado Cutthroat Trout of the Colorado-Green River Drainage and Williamson Lakes, California. †

Character	*Vertebrae*	*Gill rakers*	*Pyloric caecae*	*Scales in lateral series*
Location				
Rock Creek, Wyoming	60–64 (62.0) n = 14	18–20 (18.8) n = 14	27–46 (35.4) n = 14	175–200 (187.3) n = 14
North Fork Beaver Creek, Wyoming	60–62 (61.4) n = 14	18–22 (20.2) n = 15	35–44 (39.4) n = 15	163–197 (182.3) n = 15
Douglas Creek, Wyoming	61–63 (62.0) n = 14	18–21 (19.4) n = 14	31–42 (37.1) n = 14	159–197 (178.6) n = 14
Little West Fork Black Fork, Utah	61–63 (62.2) n = 21	18–21 (19.1) n = 10	32–41 (37.4) n = 10	164–204 (185.4) n = 10
Trapper's Lake, Colorado	59–63 (60.5) n = 24	18–22 (20.1) n = 15	32–41 (37.4) n = 15	162–204 (185.4) n = 15
Williamson Lakes, California	60–63 (61.6) n = 21	18–22 (20.4) n = 21	30–45 (38.8) n = 21	173–209 (188.9) n = 21

† All data except for Williamson Lakes are from Behnke (1970, 1975). Data are shown as ranges, means (in parentheses), and sample sizes.

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