

An Unusual Trout in the Upper
Sacramento River System

Part II

by

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Fish collections made from tributaries of the upper Pit and McCloud Rivers in northern California during recent summers have revealed an unusual trout. The peculiar upper Sacramento trout manifests basic characteristics of rainbow, golden, and cutthroat trout. Gross external appearance of the trout is unlike other described species. Specimens are fine-scaled, rather thickly spotted and exhibit a reddish brown band laterally. Lower sides are pale gold fading to white on the belly. A white band is prominent in the anal ^{dorsal} and paired ventral fins. Some specimens bear basibranchial (hyoid) teeth and show faint cutthroat-like pale slashes under the jaw. Laboratory analyses of several meristic characteristics were made this spring of specimens collected in 1967 (Table 1).

Faunal affinities between the upper Sacramento and adjacent drainages were considered in a preliminary report (May, 1968). The most plausible explanation for fish distributions as they are seen in western United States may be derived from Taylor's (1960) account based on fossil and recent distributions of the clams Pisidium, Carnifex, Ceriphasis, and Pyrgulopsis. With Taylor's scheme in mind, it would be profitable to consider the meristic features of trout collected from several semi-ise-

Table 1. Comparison of meristic characteristics of undescribed populations of Salmo in California

	Vertebrae number	Gill rakers	Pyloric caeca	Lat. Ser. scales	Basibranchial teeth	Pelvic rays	Branchiostegal L- rays -R	
Sheep-haven Cr.	21 60-62 61.1	21 14-18 15.6	21 27-47 40.6	21 149-191 166	11 of 21 with -	21 9-10 9.7	21 8-11 9.2	21 8-11 9.4
Moose-head Cr.	8 61-63 62.2	8 17-19 18	33 29-38 33.6	6 139-172 153	0	6 9-10 9.7	8 10-12 11	8 10-11 10.7
Trout Cr.	3 63 63	2 17-18 17.5	-	3 173-182 177	-	2 9-10 9.5	3 9-10 9.7	3 9-10 9.7
Star City Cr.	4 62-63 62.7	4 16-19 17.7	-	4 137-160 147	-	4 9-10 9.75	4 10-12 11	4 10-11 10.3
Raccoon Cr.	1 63	1 17	-	1 170	0	1 9	1 11	1 11
Snow-slide Cr.	3 62-64 62.7	3 15-19 16.6	3 53-63 57	3 129-139 134	-	3 9 9	3 11 11	3 10-11 10.5
Koske Cr.	3 62-63 63.3	3 17-19 18	3 58-71 65	2 164-168 166	-	3 9-10 9.3	3 10-12 11	3 10-11 10.7

note: figures given for this and the following table (2) list sample size (top), range (middle), and mean (bottom) figures.

Table 1 - continued,

	Vertebrae number	Gill rakers	Pyloric caeca	Lat. Ser. scales	Basibranchial teeth	Pelvic rays	Branchiostegal L- rays -R	
Edson Cr.	7 61-62 61.8	7 16-18 17	7 35-50 41	6 159-168 163	one of 7 with	7 9-10 9.4	7 10-11 10.4	7 10-11 10.4
Lost River	7 61-64 62.3	7 16-22 18.5	5 58-68 62.2	4 129-148 138	-	6 9-10 9.5	6 11-13 11.6	5 10-12 10.8
Hawkins Cr.	10 - 61.0	12 17-19 18	12 40-53 45.8	-	-	-	-	-

lated basins in southeastern Oregon (Table 2).

Table 2. Meristic features of trout from several isolated basins in southeastern Oregon.

Basin	Gill rakers	Vertebrae number	Lat. Ser. scales	Pelvic rays	Basibranchial teeth
Fort Rock Buck Cr.	6 19-22 20.2	6 63-65 63.7	6 138-147 141.7	7 9-10 9.7	4 of 6 with -
Chewaucan Chewaucan Cr.	6 20-23 22.3	6 63-64 63.3	6 132-143 138	6 9	1 of 6 with
Malheur Silvies R.	4 20-22 21	6 64-66 65	6 146-154 150.8	4 9-10 9.5	0
Silver R.	6 21-24 22.3	6 64-66 64.8	6 147-158 151.8	6 9-10 9.8	0
Warner Honey Cr.	8 23-24 23.1	8 61-63 62.3	8 140-162 153.5	8 9-10 9.6	0
Goose L. Cottonwood Cr.	6 21-24 22.8	6 61-64 62.8	6 132-149 139.1	5 9-10 9.4	0
Klamath L.	1 22	1 65	1 146	1 10	0

data provided by Dr. R. Behnke, Colorado State Univ.

Meristic features for "typical" rainbow, golden, and cutthroat trout are given in Table 3.

Table 3. Meristic characteristics for typical rainbow, golden, and cutthroat trout

	Rainbow trout	Golden trout	Cutthroat trout
Vertebrae number	62-64 ⁶³	58-61	60-63 ⁶¹⁻⁶²
Gill rakers	17 - 21 range, mean usually 18-20 all species		
Pyloric caeca	40-70	25-35	25-60
Lat. Ser. scales	25-30 120-140	150-200	35-45 140-200
Pelvic rays	10	9	9
Branchiostegal rays	10-11 left; 9-11 right, all species		
Basibranchial teeth	absent	absent	present

The true significance of the upper Sacramento trout is not readily apparent. Meristic data alone does not reveal a single outstanding feature to indicate positively that the trout is a distinct species. Interpretation of meristic characters from upper Sacramento trout and south east Oregon populations is best approached through comparison with typical numbers as seen in described species.

Pelvic fin rays: Generally intermediate between cutthroat, golden, and rainbow trout. Strong rainbow influence in Sheephaven, Moosehead, and Star City Creek populations and in trout from Warner and portions of Malheur basins in Oregon.

Vertebrae counts: Typical of cutthroat in trout from upper Sacramento grading to rainbow-like in Oregon basins.

Pyloric caeca: Extremely variable; populations of upper Sacramento trout showing range of means from 33.2 to 65 suggesting rainbow/cutthroat influences.

Gill rakers: Numbers unusually low for upper Sacramento trout; Oregon specimens showing slightly higher than normal numbers suggesting lacustrine influence.

Lateral Series scales: Variable; lower counts in Oregon populations grading to higher, typically cutthroat/golden numbers in upper Sacramento trout.

Branchiostegal rays: Normal variation in populations throughout upper Sacramento and southeast Oregon basin populations. Sheephaven trout slightly low.

Basibranchial teeth: Present in some populations from both the upper Sacramento and Oregon basins; absent in others. Presence positively indicates cutthroat influence.

The relative isolation of the upper Sacramento trout and the apparent lack of associated pairs of species characters is not suggestive of recent hybridization. Reports by early investigators seem to confirm that the fish existed in the area in essentially the same form prior to drainage alterations brought by Man. Based on our limited understanding of the geology and drainage history of the area, faunal associations, and consideration of certain meristic characters, it might be reasonable to speculate that the scattered populations of upper Sacramento trout represent remnants of a formerly widespread population of a distinct species. The species may have been a form which arose from cutthroat lineage, or, conceivably, it could have been a cutthroat predecessor. Cutthroat genes are definitely present in these populations. Former drainage connections may have contributed to long-term intergradation of upper Sacramento trout with coastal forms of rainbow and/or golden trout. Almost certainly, all of the populations sampled are not pure strains of the obscure upper Sacramento trout.

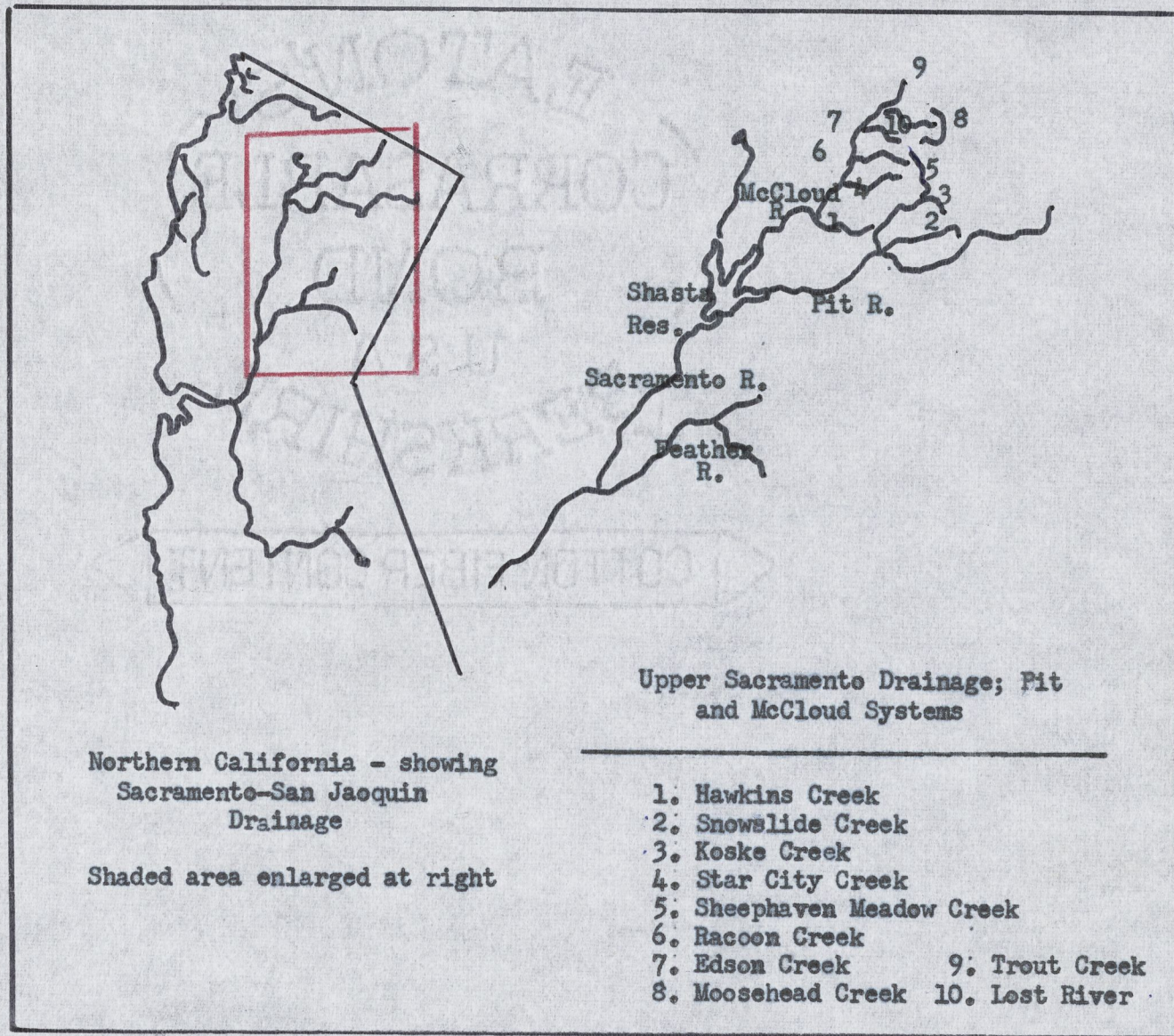
Future investigations should be strengthened considerably by chromosome studies and more critical analysis of natural color and marking patterns.

Major emphasis should be placed on vertebrae numbers, gill rakers, lateral series scales, basibranchial teeth, and perhaps pelvic rays. Branchiostegal rays are of questionable importance in the case of the upper Sacramento trout. Close attention should be given the isolated Sheephaven populations as the meristic features in those specimens suggest the least amount of change and may offer the most promise for additional clues about the trout. The Catlow Valley Trout populations mentioned by Carl Bond should be investigated for the possibility of shedding some light on the problem of the upper Sacramento populations.

Literature Cited

- Taylor, Dwight.
1960. Distribution of the freshwater clam Pisidium ultramontanum; a zoogeographic inquiry. Amer. J. Sci., Bradley Vol. 258-A: 325-334.

Appendix A



Appendix B

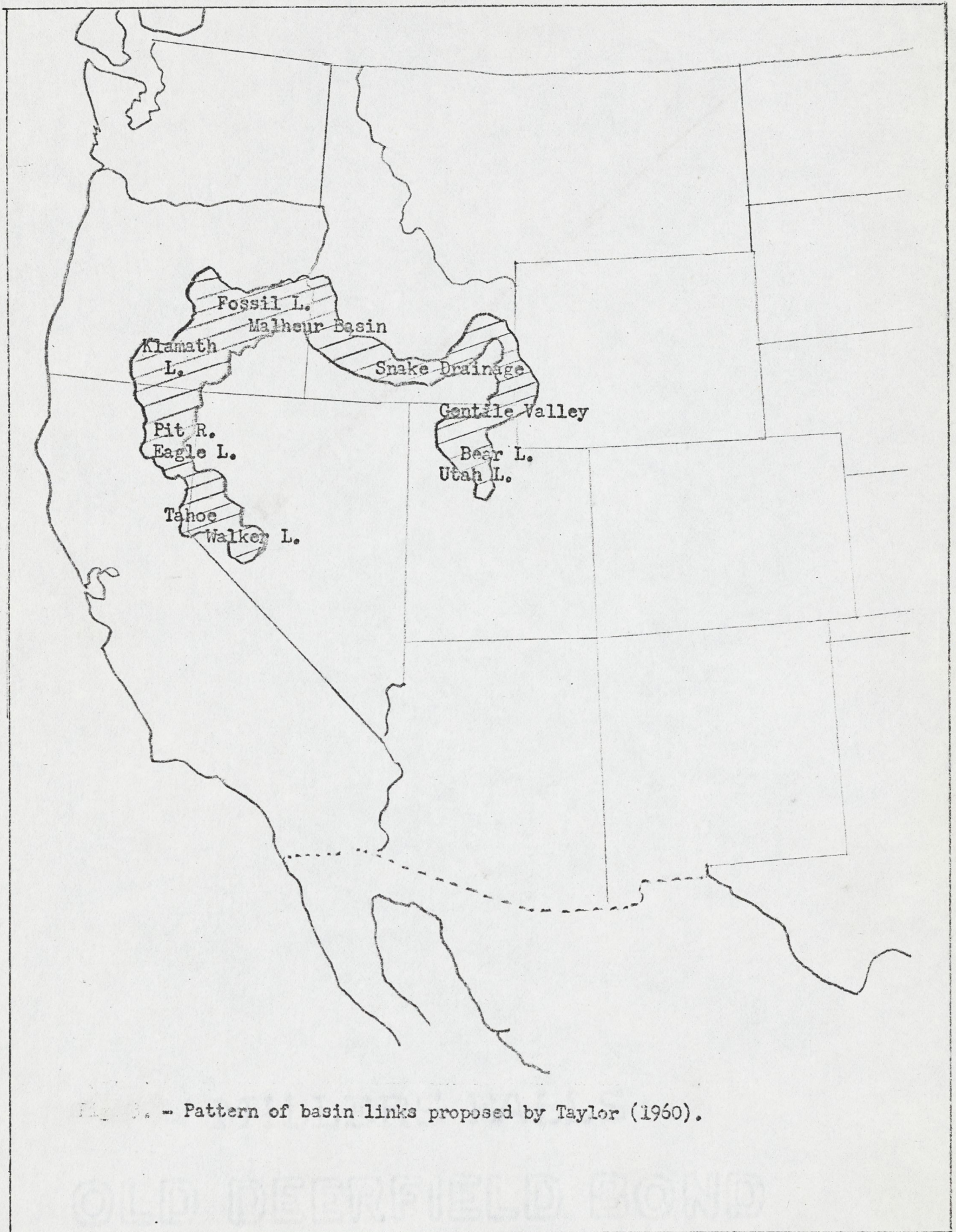


Fig. 3. - Pattern of basin links proposed by Taylor (1960).

OLD DEERFIELD BOND

50% COTTON CONTENT

Table . -- Some Meristic Characters of Kern River Trout Populations (exclusive of aguabonita)

Sample and Collection Date	Gillrakers			Vertebrae			Pyloric Caeca			Scales Lateral Series		
	No.	Range	Mean	No.	Range	Mean	No.	Range	Mean	No.	Range	Mean
<u>gilberti</u>												
Kern River (1876-1912)	17	18-23	19.9	17	60-63	61.5	--	--	--	13	137-172	153.4
Kern River (1956)	3	18-20	19.0	3	59-63	61.3	3	35-52	43.7	3	139-148	143.3
Coyote Creek (1956) (below falls)	12	18-22	19.8	12	61-63	62.2	1	40	--	12	138-154	144.8
<u>'whitei'</u>												
Little Kern River and Coyote Creek (1904)	7	20-21	20.6	8	60-63	61.5	--	--	--	8	148-167	159.0
Coyote Creek (1956)	33	19-23	21.0	33	59-63	61.2	15	29-46	39.8	20	135-182	150.5
Rifle Creek (1956)	22	18-22	20.0	22	60-62	61.2	15	29-48	37.1	15	139-172	154.7
Little Kern River (1956)	5	20-22	21.2			5	60-63		61.4	5	36-43	39.2

Table . Meristic Data On Cutthroat Trout From Alaska And British Columbia.

Sample	Gillrakers			Vertebrae			Basibranchial Teeth			Pelvic Rays			Lateral Series		
	No.	Range	Mean	No.	Range	Mean	No.	Range	Mean	8	9	10	No.	Range	Mean
ALASKA															
Lake Baranof and Parlof Creek	6	18-20	19.2	6	61-62	61.8	6	6-28	17.5	--	6	--	--	--	--
Makaka Pt. Stream, Hawkins Is.	30	16-21	18.0	30	60-63	62.0	30	2-46	11.0	--	22	8	16	136-178	155.4
Lake No. 1, Hawkins Island	19	16-20	17.7	19	62-64	63.1	19	5-44	17.1	--	17	2	10	144-168	155.8
Hassolberg Lake	25	15-21	18.2	25	61-64	62.0	25	3-35	13.9	--	24	1	10	137-160	147.8
Long Lake	8	17-18	17.5	8	61-62	61.4	8	4-40	19.2	--	3	5	8	148-186	167.4
Luck Lake.....Cutthroats	16	16-19	17.8	16	60-63	61.9	16	1-20	12.0	--	16	--	10	142-171	158.7
..Rainbows or Hybrids	4	18-21	19.3	4	63-64	63.8	4	0	--	--	--	4	4	126-132	129.3
Herman Creek, Behm Canal	11	17-20	18.1	11	60-63	61.2	11	7-14	10.7	--	11	--	11	152-168	156.9
BRITISH COLUMBIA															
Flannigan Slough, Taku River	3	17-20	19.0	3	61	--	3	6-12	9.7	--	3	--	--	--	--
Lake near mouth of Stukine River	5	17-21	18.6	5	60-61	60.8	5	12-18	15.7	--	5	--	--	--	--
Quinsam Lake.....Cutthroats	26	16-23	17.9	26	61-63	61.7	26	1-27	12.8	--	26	--	--	--	--
Rainbows or Hybrids	8	19-20	19.6	8	62-65	63.5	8	1 with 11 teeth 7 with no teeth	--	--	1	7	--	--	--
Middle Quinsam Lake	30	14-20	17.4	30	60-64	62.0	30	0-25 1 with no teeth	13.3	--	30	--	--	--	--

Locality	Vertebrae						Gill rakers								Pyloric caeca	Scales, lat. ser. and above lat. line	Branchio-stemal rays	Pelvic fin rays	Basibranch teeth				
	60	61	62	63	64	65	66	15	16	17	18	19	20	21	22	23	24	N range \bar{X}	N range \bar{X}	N range \bar{X}	N range \bar{X}	N	
<u>KLAMATH</u>			62			1											Several counts ranged from 58 to 65	146 35	4 13-13	10	0		
Holotype <i>Salmo newberryi</i> coll. 1854	1			65			1																
Trout Crk. 1968			4	7	4						2	4	4	4	1			15 41-56 48,3	14 132.5 127-141 14 29-33 30,9	15 9-12 11.2 10-13 11.9	15 9-10 9.4	0	
Butte Crk. Hart's Mdwr. 1968			3	4	1						1	3	3	1			8 40-54 46.0	7 139.4 135-144 8 29-33 31.4	8 10-12 11.4 11-12 11.8	8 10.0 10	0		
Williamson R. 1968			1		1						1				1			2 rotten can't count	125, 133 28, 30	11-12 12-12	9, 10	0	
	2						2																
<u>GOOSE L.</u>			1	1	2	2									1	1	2	2	not counted	6 132-149 6 29-34 30.2	6 11-12 11.8 11-12 11.5	6 9-10 9.6	0
Snyder, 1904 Cottonwood Crk.	6						6																
Davis Crk. BS 9 - lower			1	2	1						1	0	2	1			N=486-48 36, 40, 43, 48 41.8	137, 143, 149, 166 31, 32, 33, 38	10-11 (11) 12-13 (12)	7 4 10	0		
BS-9A - upper			1	5	1						2	3	0	2	0	1			35, 40, 40, 41, 45 46, 47 42.0	136, 138, 141, 145 146, 160, 15 30-35 145.1 0.32.3	10-12 11 11-12 11.8	21 10	1 of 8 w/ 2 tooth
Wassen Crk. 68			4	15	16	3					1	4	8	6	1			15 35-54 42.9	17 126-143 136.3 28-33 30.4	20 10-12 11.2 10-13 11.5	20 9-10 9.15	20 0	
	38																						

note: * USNM
33961, 33958; 33961

Williamson R.
Capt. Bendire

Pit R. Basin Locality	Vertebrae						Gill rakers						Pyloric caeca		Scales, lat. ser. and above lat. line		Branchio- stegeal rays		Pelvic fin rays		Basibranch teeth										
	60	61	62	63	64	65	66	15	16	17	18	19	20	21	22	23	24	N	range	\bar{X}		N	range	\bar{X}	N	range	\bar{X}	N	range	\bar{X}	N
Clark Crk 1968		1	1	2								1	2	1				4			3			4	11-12		4				
																			37-47	41.0		140-156	149.7	4	10-12	11.3		10	10.0		0
Green Burney Crk 1968				2								1	1					2			2	142-150	146.0	2	11-12	11.5	2	10		0	
																			57-64	60.5		32-35	33.5	2	12	12.0		10.0			
Rock Crk 1968				3	5	1						1	1	6	1			9			9	126-140	132.4	9	9-11	10.3	4	10		0	
																			36-42	38.1		27-31	29.6	9	10-12	10.9		10.0			
Nelson Crk 1968			3	4	6	10						6	12	4	2			20			14	134-155	144.2	24	10-12	10.9	24	8-10		0	
																			38-76	51.8		28-33	30.6	24	10-12	11.1		9.5			
Snowslide 1967			2		1							1	1					3													
																			53-63	57.3											
Kosk 1967				2	1								1	1	1			3													
																			58-71	65.0											
McGill Crk 1968												1	2	3				6			6	154-170	159.7	6	9-11	10.0	6	10		1 of	
																			34-40	37.3		32-37	33.8	6	10-11	10.5		10.0		6 with	
Roaring Crk 1968			1	7	3	1	1						1	3	7	1		12			10	134-154	145.6	13	10-11	10.8	13	10-11		0	
																			38-51	45.8		29-32	30.5	13	11-12	11.4		10.5			

Locality	Vertebrae						Gill rakers								Pyloric caeca		Scales, lat. ser. and shove lat. line		Branchio-stegal rays		Pelvic fin rays		Basibranch teeth									
	60	61	62	63	64	65	66	15	16	17	18	19	20	21	22	23	24	N	range	\bar{X}	N	range	\bar{X}	N	range	\bar{X}	N	range	\bar{X}	N		
McCloud Trout Crk. 1968			1	2						1	1	1						3	33-54	45.0	3	167-184	177.7	3	9-11	10	3	9-10	9.3	1 of 3 with 3 teeth		
	$\bar{X} = 63.7$ $n = 3$ (1967) $\bar{X} = 63.0$						$\bar{X} = 18.0$ $N = 2$ (1967) $\bar{X} = 17.5$											3	36-39	37.7	3	10-12	10.7									
Edson Crk 1968		1	4					1										4	36-51	43.8	3	144-159	149.3	4	10-11	10.3	4	9-10	9.5	0		
	$\bar{X} = 62.0$ $N = 5$ (1967) $\bar{X} = 61.8$						$N = 4$ 15.75 $\bar{X} = 16.8$ 1967 $N = 7$ $\bar{X} = 17.1$								5	35-50	41.9	5	159-168	163.2	4	10-11	10.8									
Tate Crk. 1968			1	2								3						3	50-56	53.3	3	158-163	161.0	3	10-11	10.3	3	10.0	10.0	0		
	$\bar{X} = 63.7$						$\bar{X} = 19.0$											3	34-36	35.0	3	10-11	10.7									
Raccoon Crk 1967			1							1																						
	$\bar{X} = 63.0$						$\bar{X} = 17.0$																									
McKay																																
Sheephaven Crk. 1968	2	15	4					13	4	3	1							11	35-45	40.0	7	153-191	170	1	9	9	1	9	9.0	1 with 1 tooth		
	$\bar{X} = 60.05$ $N = 21$ (1967) $\bar{X} = 61.1$						$N = 12$ 17.0 $\bar{X} = 16.0$ (1967)								1	35.0	35.0	12	(1967) 161-191	173.3	1	10	10.0	11 of 21 w/ teeth								
	$\bar{X} = 60.0$ (1968) $N = 7$														10	(1967) 36-45	40.5	1	34	34.0	8	33-40	26.1									
Moosehead Crk 1968	2	4	7	1				2	3	8	1							11	29-46		14	161-184	169.8	15	10-11	10.2	15	9-10	9.9	3 of 15 with 1-2 teeth		
	$N = 14$ $\bar{X} = 62.5$ $N = 9$ (1967) $\bar{X} = 62.2$						$N = 14$ $\bar{X} = 17.6$ $N = 7$ (1967) $\bar{X} = 17.1$								3	29-38	33.7 (1967)	12	139-172	153.0 (1967)	15	9-11	10.6									
															3	35.5		8	32-38	34.8												
Star City 1967			1	2						1	1	2																				
	$N = 3$ $\bar{X} = 62.7$						$N = 4$ $\bar{X} = 17.8$																									

Locality	59	Vertebrae					Gill rakers								Pyloric caeca		Scales, lat. ser. and above lat. line		Branchio-stegal rays		Pelvic fin rays		Basibranch teeth										
		60	61	62	63	64	65	66	15	16	17	18	19	20	21	22	23	24	N	range	\bar{X}	N		range	\bar{X}	N	range	\bar{X}	N				
McCloud	1	7	6	5							10	7	3								15	39-55	46.5	15	109-132	118.7	20	10-12	10.9	20	10-11 [?]	10.0	0
Hawkins Crk. 1968		2	6	2						3	5	3									16	123-27	24.7	16	123-27	24.7	20	10-12	11.4				
		N=14 \bar{X} =60.8 N=10 (1967) \bar{X} =61.0					N=20 \bar{X} =18.7 N=11 (1967) \bar{X} =18.0																										
Pit River Basin																																	
Joseph																																	
S. Fork Parker Crk 1968			2	2	3	2							2	2	4	1	1				10	37-49	42.8	10	143-154	148.5	10	10-12	11.1	10	9-10	9.1	0
			N=9 \bar{X} =63.6					N=10 \bar{X} =20.7																									
East and Parsnip Crks. 1968			4	6	6	1							1	4	7	5	1				18	40-59	49.3	15	136-162	148.1	18	10-11	10.9	18	9-10	9.2	2 of 18 with 1 tooth
			N=17 \bar{X} =63.2					N=18 \bar{X} =20.1																									
Ash Crk.																																	
Pot Holes near Rising R 1968				1									1								1	67	67	1	146	146	1	11	11	1	10	10	0
			63.0					20.0																									
Lost 1967			1	4	1	1					1	1	2	2			1				5	58-68	62.2										
			N=7 \bar{X} =62.3					N=7 \bar{X} =18.4																									
Hat Crk 1968				3	2									1	2	2					5	53-79	63.6	5	133-148	138.6	5	11-12	11.2	5	9-10	9.8	0
			N=5 \bar{X} =62.4					N=5 \bar{X} =19.2																									

see 1895 p. 407 - acclimating hatches - Klamath

P. oregonium

95 x 96 Rep.

Evermann, B. W. & S. E. Meek. 1898. A report upon salmon investigations in the Columbia River basin and elsewhere on the Pacific Coast in 1896. Bull. U.S. Fish Comm. for 1897, 17:15-84

1889 400,000 Coregonus clupeaformis in Klamath L.
(also L. Bend O'reill)

Trout very abundant in Klamath L. 8-10 lbs. not rare.

p. 63. "The trout of Upper Klamath L. are probably not surpassed by any lake-dwelling trout in America in beauty, size, gaminess, or sweetness & delicacy of flavor." - advised culture station for their propagation & distribution.

→ P. oregonensis - p. 76 - under Coregonus williamsoni. specimen at Sherar's Bridge (Des Chutes R.) "adipose fin" remarkably large" - this species spawns in Oct. in Payette L. Idaho - but condition of Sherar's Bridge spec. prob. spawn much earlier

* - p. 81 - Salmo mykiss clarkii : - particularly abundant - - - - - walls & alturas lakes, Upper Klamath L. & Des Chutes R. -

- Comparison of many specimens indicates that it will be necessary to recognize more species or varieties of Salmo in the northwestern U.S. than hitherto admitted

* → S. gairdneri only 2 spec. obtained in Upper Klamath L.

Mid Col. Salmo

- Evermann & Gilbert - Col. basin 1894 Bull.
p. 200 - S. mykiss - "every additional coll. - - -
- - - Upper Snake R. (Ross Fork & Milk Crk.) at Pocatello
Id. - typical mykiss scarcely distinguished from
S. m. yelowianus of Col. R. ⁱⁿ larger river channel
lighter colored, finer spots - no line between
coastal gairdneri & typical mykiss - Wood R.
150-163 scales - usually no cutt mark
- Umatilla R. (Pendleton) Wathco R. (W. Yakima) &
Pataha R. (Starbuck) 142-163 scale - no cutt mark
Coen d'Alene region: Wardner 165-170 typical mykiss
C. d. A. Lake 130-166 (145) * - at Spokane R. at Dair's
mill - conspicuous red dash w/s scale 125
- think coast form should be S. m. gairdneri
- S. malin - not found in Snake - doubted if it
occurs above falls.
- Evermann 1896 Bull. 16: 198 - Payette Lakes -
color description of "gibbsi" the int. form.
- Gilbert 1898 Bull 1897 17: 1-13 162-163

Klamath R, rainbow!!

Gairdner (1857 . P. A. N. S. P., 8: 219) -

in Pacific R. R. report (F 593^{V. 10}_{U 5} - : 313) gave
account of Fario gairdneri - coll. by
Dr. Newberry in Klamath R, Ore, in 1855
plate XXI (missing) - Branch, 12-12 V-11
A-13 - P-13

- (1859) - P. A. N. S. P., - 10: 223 - said:

~~to distinguish~~ Species figured and described under

Fario gairdneri is not Salmo gairdneri

of Sir John Richardson, nor does it appear
to be any other species recorded - - to distinguish

it hence from its congeners we will call it

Fario newberryi or else Salmo newberryi just as

it may suit systematic writers.

Suckley (1874) said specimen at Nat. Mus.
lost and believed it probably a variation
of iridus.

J. & E. (1896) 499 - considered synonym
of gairdnerii - a full species by J. E. & C.
(1950)

- Bond -

Klamath L.

Burny
Crk.

Upper Sizer Trout

- McClell - Joe Walsh

Evermann, B.W. & H.C. Bryant 1919: California
Trout. Calif. Fish and Game, 5(3): 105-135

- 65,000 lake trout stocked Tahoe 1895 (not Thwait
present but,
as well as other introduced sp. 1

Salmo regalis Royal Silver trout (greenback, grayback)

perfectly smooth basibranchials 11-13 branchial rays

29-31 above; 144-150 lat. ser., i. 19-21 rakers.

classified w/ cutthroat series

- henshawi - included as Tahoe trout,
silver trout, redfish, Tommy, royal silver trout.

p. 109: "There is a trout, apparently of the
Rainbow Series, in the Klamath River which fish
culturists believe to be different from any of the
above, which has not yet been described. There is
still another in Burney Creek, Shasta County,
which also remains to be described."

Klamath — Dolly Varden
(Schultz - Keys to Ore -) — Trout - salmon

Schultz, H. P. 1935. Fishes of the Pacific Northwest. Mid-Pacific Mag., 48(4): 365-380

Salvelinus malma spectabilis (heading)

- Records. Klamath L. Cope, 1879-1884.

* S. gairdneri. Ore. L. drainage. Chewaucan R. - Fowler (1912) Eldor Crk. - in UW coll.

- Snyder, J. O. 1931, Salmon of the Klamath River California, Calif. Div. Fish and Game, Fish Bull. 34: 130 pp. p. 22: footnote. - Williamson R. a ^{closed} enter K. L. basin now closed to migration by Copco Dam. (1917). - Testimony conflicting as to former runs thru Klamath L. - whether King salmon ever went up Williamson but is certain they passed point where Copco Dam now is.

- ~~Wales~~ Miller, R. R. 1946. The need for ichthyological surveys of the major rivers of western North America. Science, 104(2710): 517-519.
- Moore - Vert. N. Am. North America. Science, 104(2710): 517-519.
- Lindsey 21(51) Ditt. L. Trout Table 1 - Klamath River
----- Salvelinus⁵ | 5: Now extinct in the Klamath basin.

Cope, E. D. (1879). The fishes of Klamath Lake, Oregon. *Am. Nat.*, 13: 784-785.

1. Salmo iridea Gibb. - found abundantly in the lake, as well as streams trib. - Sprague, Wood, Crooked Crk., Fort Crk. - to 10 lbs. varies from white to red on sides.

2. Salmo spectabilis Girard. The (Dolly Varden) is less common than S. iridea; the only locality from which I procured it is Seven Mile creek, near Fort Klamath. - names Chasmistes luxatus & Chas. brevirostris.

1889. The Silver Lake of Oregon and its region. *ibid.*, 23: 970-982.

- 3/4 days from Ft. Klamath to Silver L., - via Sprague R. & ^(sic) Siacan Valley "soldiers brought in splendid lot of trout from these rivers & preserved several in alcohol. They were the Salmo purpuratus Pallas - (described numerous variations in *Phil. Acad. Sci.*) (1862) - largest 12 lbs. -
- Salmo purpuratus numerous in Silver Crk. - but doesn't enter lake.

Cope, E. D., 1884. On the fishes of the recent and Pliocene lakes of the western part of the Great Basin, and of the Idaho Pliocene lake. Proc. Acad. Nat. Sci. Phila., (1853) 35: 134-167.

- Geologist shown there were once large lakes - Bonneville & Lahontan - probable future work will demonstrate a 3rd lake existed in Ore. - N. of Lahontan - incl. Warner, Abert, Summer, Silver & prob. Harney & Malheur lakes. - larger fish species identical in all & dif. from Bonneville - Catost. taboensis common to all Ore. lakes & Lahontan. - may have been once continuous & - Goose, Klamath & Doubtless. Kelt & Clear lakes form another series - not known yet if once a common lake & - Still another Tertiary lake once in east. Ore. & W. & S. Idaho - No remnants today & fossils dif. from Ore. lake basin. - This lake (L. Idaho) separate & of earlier age (Pliocene) ^{all in} however. - " did not get near view of Abert L. - It is ^{about L. Chewaucan?} It ^{about} supplied w/ water by Chewaucan R., w/ fishes, esp. the trout, Salmo purpuratus. fished Goose L. - no success ~~for~~ but got specimens from those dropped by birds. Upper Klamath L. more prolific in animal life than any body of water known to me.

- List of fishes

Salmo purpuratus Pallas: Pyramid L.; Chewaucan R.; Silver Crk. (trib. Silver L.); Klamath L. & Williamson R. not mentioned from Warner or Goose lakes -

- mentions silvery-white Klamath & spec. c
darker in Williamson R. -

Bo: H, 12, 12, D. A. 10 $\frac{1}{2}$ 11 $\frac{1}{2}$ 12 $\frac{1}{2}$
 11 12 13 9 $\frac{1}{2}$

- Salvelinus malma Walb. : Seven-mile Creek,
which enters Lake Klamath from the northwest.

- fossils in Idaho 2,
R habdofaris - max. cylindrical - skull large
as salar

- mentions fossils of Amiurus

- map

- Warner Lake also called Christmas Lake