Cavender 78 — really char but Atr (long usage) precedence over trout - brook

disjunct McCloud

Upper Klamath

E. Fk. Jarbidge (Malheur R. - Big Crk

(John Day R - several trib)

(why not above S.R. falls) ?

Fraser, Colum - Coastal drainage Bear R - Townsend 1st

(Headwater) McKenzie, Yukon B.C. N, S. Saskatchew (Hudson Bay)

Char 2N=78 - Kronocius

S. confluentus Suckley, 1858 - Puget Sound (Puyallup R. near Steilacoon WA)

IGFA

-Max size 32 lbs 40 lb Kootenay

rakers 24-31 combined

mandib. pores 16 combined

rakers 21-36

vert. 62-67

basibr. 0-11 average ×4 typically 3-5 but 6 of 40 w/o teeth (alizarin)

322 specimens -

caeca · 9 samples x? · 25-30

gill rakers x, 10 16-18

- Long Crk. hybrids - dorsal fin (+ caudal) mottled - clear on and - lower fins tri colored -

- Nat. Mus. - 80 km N.E. of Klunzde type locality

Long.

Hedish - my meaning

confluentus

broad, blunt head snout

head length 3.2-4.1 (3.7) S.L. same fontinalis

gill rakers heavily denticulated

malma

branch. rays - 24-3~~2~~ (27.4) N=120 confl.

20-25 (22.8) N=31 fontinalis

10-12 malma 19-27 (23-24)

mandib. pores:

fontinalis N=21 12-17 (14.9)

confluentus 63 12-19 (15.7)

malma 10-15 (12)

vert. confl. - 62-66 (64.7)

fontinalis 58-62 (59.5)

rakers 14-20 (16.6) confl. N=120

16-22 (17.7) fontinalis

caeca - 21-36 (27.8) confl.

28-46 (38.4) font..

	Isabel	Lavender	Cracker	Whale Cak.	brook.
- H.L.	2.81 - 3.7		— 2.7	— 2.7	
Branch.	24.3	27.4	— 23.3	— 24.5 — 22	
- M.P.	13.2 - 15.7		— 14.0	— 15.3 — 14.9	
- rakers	16.9 - 16.6	→ 16.5	— 16.5	— 17.7	
caeca	30.3 - 27.8	→ 25.4	— 26.8	— 38.4	
Bassibranch	~~9.0~~ 5.5		5.9	5.0	— 0
pelvic	9.0 rays 9.6		— 9.6	9.6	pelvic 8

rakers | branch. rays | caeca | bassibr. rays | pelvic rays | Mandib. pores

10 copies $00
Invoice

IGFA records - - - Idaho - 70 lbs
- name bull or Dolly Varden - Jos. Dunn 1962
McCloud

- Old Am. Angler

bull trout

- Dolly varden
- Dynamo -
- arctic char
- all brook x

bull x brook hybrids - not sterile (no proof but Long Crk).

Isabel L. - crimson color, white border of pectoral fins
how polymorphic - - no real previous basis. Carender - museum
specmis - no one compared coloration, marking, variability -
Color - cutts - in diet (reds) -
Cracker L. or Isabel L. - can regard as unique for
mgt. ?
- Mont. Study - Prov. West. Div. -

Cracker L - headwaters Canyon Crk. drainage - into
Many Glacier Valley via Swiftcurrent Crk. - isolated by
barriers.
So. Saskatchewan (Hudson Bay drain.)

-- McDonald L.
status w/ mamaycush -- evd. w/ darki + Prosopium + Thymallus

Upper & Lower Isabel L. - drain via Park Crk. &
Mid. Fk. Flathead (Columbia) In 1927 1800 catchable
brook trout stocked into Lower Isabel L.

- Mullan - Wenatchee - 1900 photo - now rare - few hrs/season/yr.
large specmis vulnerable to 'specialists' - but Trout L. - not fly.?
- Alberta - Yukon Terr - chunks meat -

World record Pend Oreille - but Kootenay (Hart - 40)

Whale R. N. Fk. Flathead

- J.E. bull trout esp. Idaho - but Idaho 70's - to IGFA

1977 Sept. McDonald 499 fish specimens of 11 species
bull trout (10 - 2% wt. & 1.8% ct.
3% wt. lake trout
73% cutthroat, whitefish - 22
- kokanee - 51

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CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

SPECIES Salvelinus confluentis LOCALITY Whale Creek, N.FK. Flathead R. Glacier Nat'l Park, MT

COLLECTED BY Brad Sheppard, MDFWP DATE Aug 1982

Cat. # _____ Measurements by Eric Wagner DATE Jan 23, 1982

Specimen #	1	2	3	4	5	6	7	8
Total L.	222	255	223	221	258	234	253	271
Standard L.	187	219	188	186	219	197	216	231
Body D								
Head L.	49	58	50	50	62	55	55	62
Orbit L								
Upper Jaw L	26	26	27	27	28	28	25	27
Dors. Orig. to Snt. tip								
Dorsal fin basal L								
Dorsal fin depressed L								
Adip. fin depressed L								
Caudal peduncle D								
Caudal peduncle L								
Vertebrae								
1st Arch gillrakers (up)	7	5	6	6	6	5	5	6
(lower)	10	10	11	12	11	10	10	10
(total)	17	15	17	18	17	15	15	16
Branchiostegal rays right	12	11	11	12	12	12	12	11
(left)	13	11	12	12	13	13	12	12
Dorsal rays								
Anal rays								
Pectoral fin rays								
Scales in lateral line								
Scales above lateral line								
Scales 2 rows above lat.								
Pelvic fin rays	10	9	9	9	10	10	10	10
Pyloric caeca	27	26	20	23	24	26	20	23
Dentition	7	7	6	4	8	6	4	4
Mandibular Pores	14	12	14	14	14	15	10	15
			B+W		white			white + black ventral fins
					black			
					ventral			
					fins			

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CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

SPECIES Salvelinus confluentis LOCALITY Whale Creek, N.Fk. Flathead R. Glacier Nat'l Park, MT

COLLECTED BY Brad Sheppard DATE Aug 1982

Cat. # _____ Measurements by Eric Wagner DATE Jan 23, 1982

Specimen #	9	10	11	12	13	14	15	16
Total L.	227	237	228	264	232	220	236	222
Standard L.	192	202	194	227	193	185	197	188
Body D								
Head L.	56	53	50	57	55	52	57	49
Orbit L.								
~~Upper Jaw L~~ % HL	29	26	26	25	28	28	29	26
Dors. Orig. to Snt. tip								
Dorsal fin basal L								
Dorsal fin depressed L								
Adip. fin depressed L								
Caudal peduncle D								
Caudal peduncle L								
Vertebrae								
1st Arch gillrakers (up)	5	5	5	6	6	6	5	5
(lower)	10	10	11	10	10	10	11	11
(total)	15	15	16	16	16	16	16	16
Branchiostegal rays right	12	11	12	12	11	11	12	12
(left)	12	12	13	13	11	10	12	13
Dorsal rays								
Anal rays								
Pectoral fin rays								
Scales in lateral line								
Scales above lateral line								
Scales 2 rows above lat.								
Pelvic fin rays	9	10	9	9	10	10	10	10
Pyloric caeca	25	28	28	18	26	27	27	23
Dentition	8	4	10	10	4	3	5	6
Mandibular Pores	13	14	14	13	12	14	16	13
	Black		B+W	B+W	B+W			
	+ White		Pectorals		Ventral	B+W	B+W	
	ventral				Fins			
	Fins							

3d5

CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

SPECIES Salvelinus confluentis LOCALITY Whale Cr N. Fork FlatheadR Glacier NP, MT

COLLECTED BY Brad Shepard DATE Aug 1982

Cat. # _____ Measurements by E. Wagner DATE Jan 23, 1983

Specimen #	17	18	19	20	21	22	23	24
Total L.	251	224	238	170	152	164	147	132
Standard L.	213	190	200	142	127	139	124	112
Body D								
Head L.	63	50	53	40	35	39	35	30
Orbit L.								
Upper Jaw L	30	26	27	28	28	28	28	27
Dors. Orig. to Snt. tip								
Dorsal fin basal L								
Dorsal fin depressed L								
Adip. fin depressed L								
Caudal peduncle D								
Caudal peduncle L								
Vertebrae								
1st Arch gillrakers (up)	6	6	5	6	6	6	5	5
(lower)	10	11	11	12	12	10	11	11
(total)	16	17	16	18	18	16	16	16
Branchiostegal rays right	11	12	12	12	12	12	12	11
(left)	11	13	13	13	12	13	14	13
Dorsal rays								
Anal rays								
Pectoral fin rays								
Scales in lateral line								
Scales above lateral line								
Scales 2 rows above lat.								
Pelvic fin rays	9	10	9	10	9	9	10	10
Pyloric caeca	23	26	29	28	29	31	28	30
Dentition	7	6	3	3	5	3	8	2
Mandibular Pores	14	15	16	15	17	17	16	16
	B+W							
	ventral							
	fins							

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CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

SPECIES *Salvelinus confluentis* LOCALITY Cutbank Cr. N. Fork Flathead R. Glacier NP, MT

COLLECTED BY Brad Sheppard DATE Aug 1982

Cat. # _____ Measurements by E. Wagner DATE Jan 23, 1983

Specimen #	25	26	27	28	29	30	31	32
Total L.	153	113	149	—	164	134	116	118
Standard L.	129	96	126	135	137	114	97	96
Body D								
Head L.	35	26	36	36	40	30	27	27
Orbit L.								
Upper Jaw L	27	27	29	27	29	26	28	28
Dors. Orig. to Snt. tip								
Dorsal fin basal L								
Dorsal fin depressed L								
Adip. fin depressed L								
Caudal peduncle D								
Caudal peduncle L								
Vertebrae								
1st Arch gillrakers (up)	6	6	6	5	5	6	6	5
(lower)	11	12	11	11	11	12	11	11
(total)	17	18	17	16	16	18	17	16
Branchiostegal rays right	12	12	12	11	12	13	13	14
(left)	14	13	13	12	13	14	14	12
Dorsal rays								
Anal rays								
Pectoral fin rays								
Scales in lateral line								
Scales above lateral line								
Scales 2 rows above lat.								
Pelvic fin rays	10	9	9	9	10	10	—	10
Pyloric caeca	32	25	33	26	27	27	24	31
Dentition	9	7	3	5	7	1	2	4
Mandibular Pores	19	15	18	17	18	16	14	19

SDS

CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

SPECIES *Salvelinus confluentus* LOCALITY *Whale Cr., N. Fork Flathead R. Glacier NP, MT*

COLLECTED BY *Brad Sheppard* DATE *Aug 1982*

Cat. # _____ Measurements by *E. Wagner* DATE *Jan 23, 1983*

Specimen #	33	34	35	36	37	38	39	40	
Total L.	113	137	121	108	126	125	106	126	
Standard L.	95	117	102	89	104	106	90	105	
Body D									
Head L.	26	31	27	26	29	29	26	30	
Orbit L									
Upper Jaw L	27	26	26	29	29	27	29	29	Mn. 27% .01
Dors. Orig. to Snt. tip									
Dorsal fin basal L									
Dorsal fin depressed L									
Adip. fin depressed L									
Caudal peduncle D									
Caudal peduncle L									
Vertebrae									$\bar{X}$ SD
1st Arch gillrakers (up)	6	6	5	6	6	5	5	6	
(lower)	12	12	11	11	11	12	12	11	
(total)	18	18	16	17	17	17	17	17	16.5 .93
Branchiostegal rays right	13	11	12	12	12	12	13	13	11.9 .69
(left)	13	13	13	13	12	12	13	13	12.6 .87
Dorsal rays									
Anal rays									
Pectoral fin rays									
Scales in lateral line									
Scales above lateral line									
Scales 2 rows above lat.									
Pelvic fin rays	10	9	10	9	10	10	10	9	9.6 .50
Pyloric caeca	26	28	33	28	31	27	29	29	26.8 3.39
Dentition	7	2	5	1	6	3	3	1	5.0 2.43
Mandibular Pores	16	16	16	18	18	17	16	16	15.3 1.99

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CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

SPECIES *Salvelinus confluentis* LOCALITY *Isabel Lake, Middle Fk Flathead R. Glacier NP, MT*

COLLECTED BY *L. F. Marnell* DATE *Aug. 12, 1982*

Cat. # _____ Measurements by *C. Wagner* DATE *Jan 25, 1983*

Specimen #	1	2	3	4	5	6	7	8
Total L.	239	236	275	174	257	232	180	239
Standard L.	204	198	230	147	216	199	159	203
Body D								
Head L	54	55	65	41	60	54	44	56
Orbit L								
Upper Jaw L	26	28	28	28	28	27	28	28
Dors. Orig. to Snt. tip								
Dorsal fin basal L								
Dorsal fin depressed L								
Adip. fin depressed L								
Caudal peduncle D								
Caudal peduncle L								
Vertebrae								
1st Arch gillrakers (up)	5	6	6	6	6	7	7	6
(lower)	11	10	11	11	10	12	10	10
(total)	16	16	17	17	16	19	17	16
Branchiostegal rays right	12	13	11	12	11	11	11	13
(left)	13	12	13	12	13	12	12	12
Dorsal rays								
Anal rays								
Pectoral fin rays								
Scales in lateral line								
Scales above lateral line								
Scales 2 rows above lat.								
Pelvic fin rays	9	9	9	9	9	9	9	1
Pyloric caeca	32	30	30	25	32	32	32	35
Dentition	6	5	4	2	2	11	5	7
Mandibular Pores	13	13	14	13	12	13	12	12

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CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

SPECIES Salvelinus confluentis LOCALITY Isabel Lake, Middle Fk. Flathead R. Glacier NP, MT

COLLECTED BY L. Mansell DATE Aug 12, 1982

Cat. # _____ Measurements by E. Wagner DATE Jan 25, 1983

Specimen #	9	10	11	12	13	14	15	16
Total L.	259	179	278	255	275	200	264	285
Standard L.	217	153	231	215	226	169	222	236
Body D								
Head L	63	42	67	63	66	47	63	71
Orbit L								
Upper Jaw L	29	27	29	29	29	28	28	30
Dors. Orig. to Snt. tip								
Dorsal fin basal L								
Dorsal fin depressed L								
Adip. fin depressed L								
Caudal peduncle D								
Caudal peduncle L								
Vertebrae								
1st Arch gillrakers (up)	6	7	6	6	7	8	6	8
(lower)	10	11	10	10	9	11	10	11
(total)	16	18	16	16	16	19	16	19
Branchiostegal rays right	10	13	11	11	12	12	12	12
(left)	12	13	12	12	13	14	12	13
Dorsal rays								
Anal rays								
Pectoral fin rays								
Scales in lateral line								
Scales above lateral line								
Scales 2 rows above lat.								
Pelvic fin rays	9	9	9	9	9	9	9	9
Pyloric caeca	34	30	28	32	28	30	30	32
Dentition	7	2	4	6	6	3	7	4
Madibular Pores	15	13	12	13	12	16	13	15

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CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

SPECIES Salvelinus confluentus LOCALITY Isabel Lake, Middle Fk Flathead R., Glacier NP, MT

COLLECTED BY L Mamell DATE Aug 12, 1982

Cat. # _____ Measurements by C. Wagner DATE Jan 25, 1983

Specimen #	17	18	19	20	21	22	23	24
Total L.	247	247	229	220	179	260	259	236
Standard L.	208	206	196	185	152	218	216	200
Body D								
Head L.	56	56	53	52	42	67	65	53
Orbit L.								
Upper Jaw L	27	27	27	28	28	31	30	27
Dors. Orig. to Snt. tip								
Dorsal fin basal L								
Dorsal fin depressed L								
Adip. fin depressed L								
Caudal peduncle D								
Caudal peduncle L								
Vertebrae								
1st Arch gillrakers (up)	7	6	6	5	6	6	7	6
(lower)	11	10	11	11	11	11	10	10
(total)	18	16	17	17	17	17	17	16
Branchiostegal rays right	12	11	12	12	12	11	12	12
(left)	13	12	13	14	13	11	13	12
Dorsal rays								
Anal rays								
Pectoral fin rays								
Scales in lateral line								
Scales above lateral line								
Scales 2 rows above lat.								
Pelvic fin rays	9	9	10	9	9	9	9	9
Pyloric caeca	29	32	39	26	31	30	27	26
Dentition	4	9	6	5	3	6	7	7
Mandibular Pores	12	15	16	–	12	16	15	10

CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

4d4

SPECIES Salvelinus confluentis LOCALITY Isabel Lake, Middle FK. Flathead R. Glacier NP, MT

COLLECTED BY L. Marnell DATE Aug 12, 1982

Cat. # Measurements by E. Wagner DATE Jan 25, 1983

Specimen #

	25	26	27	28	29	30			
Total L.	262	218	268	240	219	267			
Standard L.	217	183	230	207	186	225			
Body D									
Head L.	60	51	66	57	52	61			
Orbit L.									SD
Upper Jaw L	28	28	29	27	28	27	HL = 28.1%		1.06
Dors. Orig. to Snt. tip									
Dorsal fin basal L									
Dorsal fin depressed L									
Adip. fin depressed L									
Caudal peduncle D									
Caudal peduncle L									
Vertebrae								X	SD
1st Arch gillrakers (up)	6	6	6	6	7	7			
(lower)	11	10	10	10	12	11			
(total)	17	16	16	16	19	18		16.9	1.06
Branchiostegal rays right	11	12	11	12	12	11		11.7	.71
(left)	13	13	13	11	13	13		12.6	.73
Dorsal rays									
Anal rays									
Pectoral fin rays									
Scales in lateral line									
Scales above lateral line									
Scales 2 rows above lat.									
Pelvic fin rays	9	9	9	9	9	9		9.0	
Pyloric caeca	27	28	29	32	28	32		30.3	2.94
Dentition	6	6	5	6	3	11		5.5	2.29
Mandibular Poree	13	13	12	12	13	13		13.2	1.47

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CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

SPECIES *Salvelinus confluentis* LOCALITY Cracker L. - St. Mary Dr. Glacier NP MT

COLLECTED BY L. Macnell DATE July 10, 1982

Cat. # _____ Measurements by E. Wagner DATE Jan 22, 1983

Specimen #	♀ 1	2	3	4	5	6	7	8
* Total L.	239	282	252	246	252	249	218	224
* Standard L.	203	242	215	210	209	210	182	190
Body D								
* Head L	50	70	58	58	60	57	50	56
Orbit L								
Upper Jaw L	25	29	27	28	29	27	27	29
Dors. Orig. to Snt. tip								
Dorsal fin basal L								
Dorsal fin depressed L								
Adip. fin depressed L								
Caudal peduncle D								
Caudal peduncle L								
Vertebrae								
1st Arch gillrakers (up)	6	7	6	6	6	5	7	5
(lower)	11	11	11	11	10	11	11	10
* (total)	17	18	17	17	16	16	18	15
* Branchiostegal rays right	12	12	11	12	11	11	12	11
(left)	12	13	13	12	12	13	12	12
Dorsal rays								
Anal rays								
Pectoral fin rays								
Scales in lateral line								
Scales above lateral line								
Scales 2 rows above lat.								
Pelvic fin rays	10	10	9	9	9	10	10	10
* Pyloric caeca	25	33	30	22	28	25	26	23
Dentition	9	3	4	5	5	5	12	7
* Mandibular pores (Total R+L)	12	13	13	11	14	13	11	13

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CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

SPECIES Salvelinus confluentis LOCALITY Cracker L. - St. Mary Dr. - Glacier Nat'l Park, MT

COLLECTED BY L. Marnell DATE July 10, 1982

Cat. # _____ Measurements by C. Wagner DATE Jan 22, 1983

Specimen #	9	10	11	12	13	14	15	16
Total L.	227	213	221	239	242	257	239	269
Standard L.	190	178	185	204	208	216	199	227
Body D								
Head L.	52	50	52	55	57	57	56	65
Orbit L								
Upper Jaw L	27	28	28	27	27	26	28	29
Dors. Orig. to Snt. tip								
Dorsal fin basal L								
Dorsal fin depressed L								
Adip. fin depressed L								
Caudal peduncle D								
Caudal peduncle L								
Vertebrae								
1st Arch gillrakers (up)	6	7	6	7	5	6	5	7
(lower)	11	12	10	11	11	11	9	10
(total)	17	19	16	18	16	17	14	17
Branchiostegal rays right	12	11	11	12	11	12	11	11
(left)	13	12	11	13	12	12	11	12
Dorsal rays								
Anal rays								
Pectoral fin rays								
Scales in lateral line								
Scales above lateral line								
Scales 2 rows above lat.								
Pelvic fin rays	10	10	9	9	10	9	9	10
Pyloric caeca	25	23	25	27	26	22	28	25
Dentition	5	11	11	5	2	9	6	7
Mandibular Pores	11	14	14	15	15	14	18	15

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CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

SPECIES *Salvelinus confluentis* LOCALITY Cracker L. - St. Mary Dr. Glacier National Park, MT

COLLECTED BY L. Marnell DATE July 19, 1982

Cat. # _____ Measurements by E. Wagner DATE Jan 22, 1983

Specimen #	17	18	19	20	21	22	23	24
Total L.	245	229	231	230	253	234	267	221
Standard L.	208	193	194	195	217	198	226	186
Body D								
Head L.	56	53	53	52	58	55	61	52
Orbit L								
Upper Jaw L	27	27	27	27	27	28	27	28
Dors. Orig. to Snt. tip								
Dorsal fin basal L								
Dorsal fin depressed L								
Adip. fin depressed L								
Caudal peduncle D								
Caudal peduncle L								
Vertebrae								
1st Arch gillrakers (up)	6	6	6	5	6	6	5	6
(lower)	11	10	10	10	10	10	11	10
(total)	17	16	16	15	16	16	16	16
Branchiostegal rays right	12	11	11	12	12	12	11	11
(left)	12	12	13	11	13	13	12	11
Dorsal rays								
Anal rays								
Pectoral fin rays								
Scales in lateral line								
Scales above lateral line								
Scales 2 rows above lat.								
Pelvic fin rays	10	10	10	9	9	9	10	9
Pyloric caeca	23	23	20	26	24	26	21	25
Dentition	3	4	5	8	4	7	4	6
Mandibular Pores	14	15	14	14	14	15	16	13

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CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

SPECIES Salvelinus confluentis LOCALITY Cracker L. St. Mary Dr. Glacier National Park, MT

COLLECTED BY L. Marnell DATE July 10, 1982

Cat. # Measurements by E. Wagner DATE Jan 22, 1983

Specimen #	25	26	27	28	29	30		X	SD
Total L.	211	241	210	212	214	187			
Standard L.	177	205	174	180	181	159			
Body D									
Head L.	48	51	51	50	49	44			
Orbit L.									
Upper Jaw L	27	25	29	28	27	28	HL	27%	.01
Dors. Orig. to Snt. tip									
Dorsal fin basal L									
Dorsal fin depressed L									
Adip. fin depressed L									
Caudal peduncle D									
Caudal peduncle L									
Vertebrae									
1st Arch gillrakers (up)	6	6	5	5	7	6			
(lower)	11	11	10	11	10	11			
(total)	17	17	15	16	17	17		16.5	1.04
Branchiostegal rays right	12	11	11	11	11	11		11.4	.50
(left)	12	13	12	12	12	12		12.9	1.98
Dorsal rays									
Anal rays									
Pectoral fin rays									
Scales in lateral line									
Scales above lateral line									
Scales 2 rows above lat.									
Pelvic fin rays	10	10	10	10	9	10		9.6	.50
Pyloric caeca	32	26	24	25	27	28		25.4	2.93
Dentition	5	5	6	8	4	2		5.9	2.58
Mandibular Pores	16	15	15	13	14	15		14.0	1.54

HABITAT UTILIZATION BY WESTSLOPE CUTTHROAT AND BULL TROUT IN THE UPPER FLATHEAD RIVER BASIN, MONTANA

BY
Stephen A. Leathe
Fisheries Biologist, Montana Dept. Fish, Wildlife and Parks

One of the goals of the Flathead River Basin Study is to predict and if need be mitigate the effects of environmental perturbation on fish populations. In order to address this problem, we must first understand the types of stream or riverine habitat required by the indigenous fish species for the purposes of spawning, rearing and migration. Consequently, this past year we began an extensive survey of stream habitat and associated fish popultions in tributaries to the North and Middle Forks of the Flathead River.

Habitat evaluation

Existing stream habitat was inventoried using a modification of a system developed by the Resource Analysis Branch of the British Columbia Ministry of the Environment which has been used in the Canadian portion of the North Fork drainage. It draws upon multidisciplinary knowledge to describe the various biological and physical factors which interact to form the environment of a particular reach of stream.

Drainages were partioned into one or more reaches. A reach is defined as a segment within the drainage having distinct associations of stream habitat components. Stream gradient was usually the overriding factor considered in reach delineation as slight gradient changes (on the order of tenths of one percent) were found to noticeably alter channel morphology and bed material composition.

Initially, reaches on Middle Fork and North Fork tributaries were identified by survey parties consisting of two or three persons traveling down the stream on foot. Two North Fork drainages were surveyed by helicopter prior to ground surveys. This method was a rapid and effective means for delineating reaches and identifying important stream features and representative portions of each reach were later checked by ground crews. Representative sections of reaches varied from one to four kilometers in length depending upon the length and uniformity of the entire reach.

A habitat inventory card was completed by survey crews for each reach or portion of reach surveyed (Figure 1). The extensive abbreviation system developed by the Canadian agency allowed a large amount of information and commentary to be effectively recorded on the compact water-resistent cards. Virtually all of the important physical and biological components of the stream were addressed. Field personnel carried a 36-page glossary of terminology published by the Resource Analysis Branch to aid in completing the cards. One significant addition by our group to the Canadian system was the pool rating scheme outlined in Table 1, which is currently being used in Forest Service stream inventories in the Kootenai National Forest.

Fish populations and stream order relationships

A 120-150 meter section within each stream reach was selected for fish population censusing. Fish present in each section were counted by a single diver working slowly upstream wearing a diving mask, snorkel and wetsuit. This method of fish abundance estimation is well suited for streams in the Flathead drainage because of their high clarity and has been successfully used in similar areas in Idaho (Pollard and Bjornn 1973; Thurow and Bjornn 1978).

The fish species assemblage in upper Flathead tributaries was quite simple. Westslope cutthroat (*Salmo clarki lewisi*) and bull trout (*Salvelinus confluentus*) together comprised more than 87 percent of all fish observed; the remainder consisted of mountain whitefish (*Prosopium williamsoni*) and two species of sculpins (*Cottus cognatus* and *C. confusus*) shown in Table 2.

Fish densities in upper Flathead tributaries were low. Cutthroat densities in tributaries to the North and Middle Forks averaged 16 fish per 100 m (Table 3), which translates to approximately 48 fish per 1000 feet of stream.

A total of 33 transects were snorkeled during 1979 in tributaries to the North and Middle Forks. Using a stream ordering procedure described by Platts(1979) it was found that a total of 6 second order, 15 third order and 12 fourth order stream sections were snorkeled. No first order sections were examined since these streams were ephemeral and typically dry during low water periods. Cutthroat were the dominant species in second and third order reaches where they comprised 71 percent of the trout observed with bull trout accounting for the remaining 29 percent. The converse was true for fourth order reaches which were dominated by bull trout (65 percent) with cutthroat comprising the remaining 35 percent.

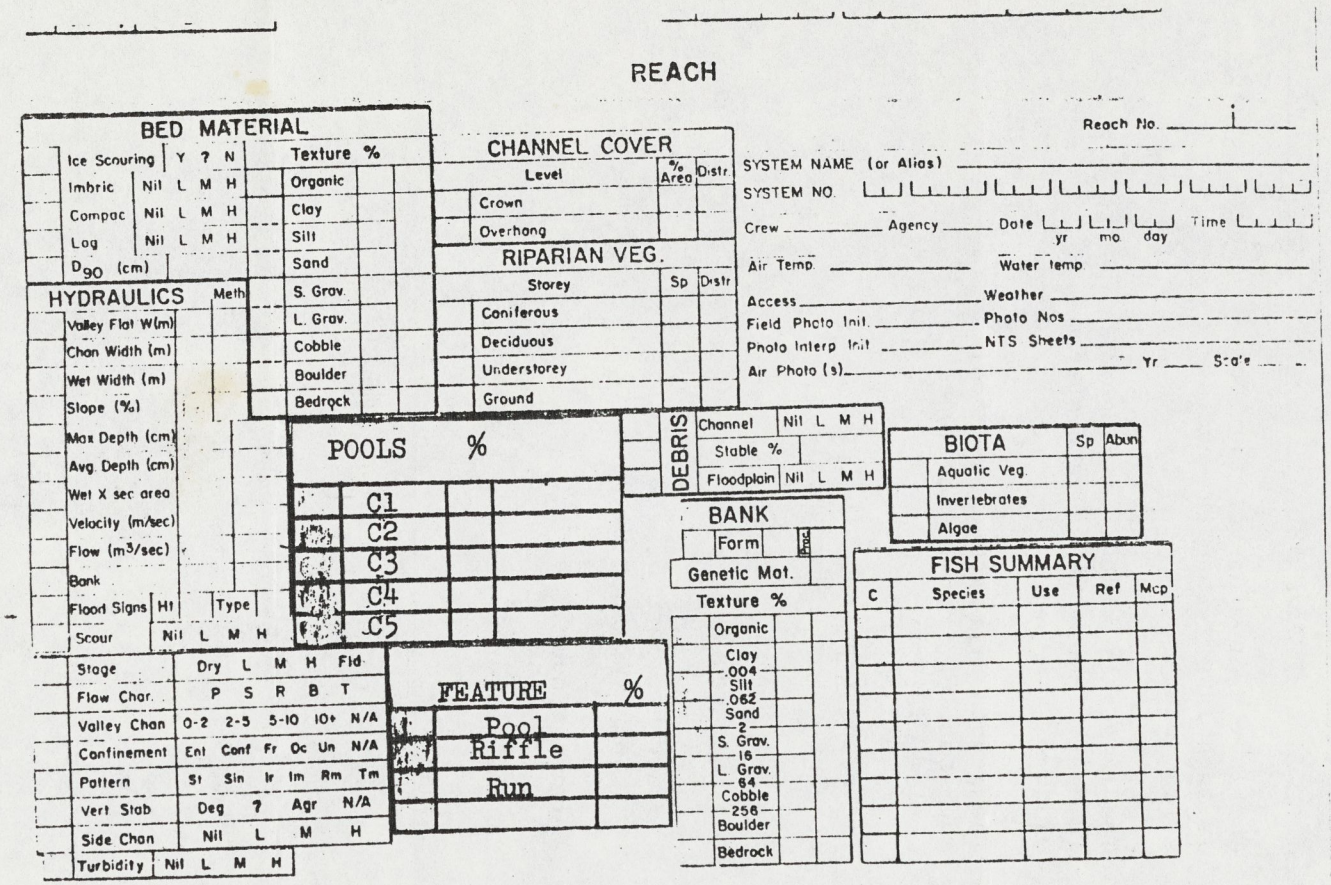

Figure 1. Reach card employed in habitat surveys of triutaries to the North and Middle Forks of the Flathead River

Table 1. Pool rating system used in habitat inventories conducted on North and Middle Fork Flathead River tributaries during 1979.

Parameter	Description	Points
Area	The length or width of the pool is much larger than the average stream width	3
	The length or width of the pool is nearly equal to average stream width	2
	The length or width of the pool is much smaller than the average stream width	1
Depth	The deepest part of the pool is greater than three feet deep	3
	The deepest part of the pool is two to three feet deep	2
	The deepest part of the pool is less than two feet deep	1
Cover	Abundant cover	3
	Partial cover	2
	Exposed	1

Total points		Pool class
8 - 9	=	1
7	=	2
5[1/] - 6	=	3
4 - 5	=	4
3	=	5

[1/] The total of five points for class 3 pools must include two points for depth and two points for cover.

Table 2. Species composition by numbers and percent of fish observed in 33 underwater fish census transects in tributaries to the North and Middle Forks of the Flathead River during 1979.

	Cutthroat	Bull Trout	Mountain Whitefish	Sculpins	Total
Number observed	740	397	115	48	1,300
Percent of total	56.9	30.5	8.8	3.7	--

Table 3. Average density (fish per 100 m stream length) of the three principal fish species in upper Flathead tributaries.

	Westslope cutthroat	Bull trout	Mountain whitefish	total
Middle Fork tributaries	14.9	12.6	3.1	30.6
North Fork tributaries	17.1	6.6	1.9	25.6

We suspect that the apparent segregation of the two trout species by stream order reflects their respective spawning habitat preferences. Spring spawning cutthroat apparently utilize small tributaries which were frequently inaccessible to the much larger fall spawning bull trout. As will be pointed out later, the highest quality bull trout spawning reaches in North Fork drainages were characteristically wider and deeper than reaches utilized to a lesser extent. Hartman and Gill (1967) proposed a similar hypothesis to explain segregation of cutthroat trout and anadromous steelhead trout in coastal British Columbia drainages.

Fish species composition and densities were markedly different in twelve Middle Fork River pools snorkeled in the late summer as compared to tributaries. Cutthroat densities in second and third order tributaries were approximately three times larger than numbers found in fourth order reaches or in the river (Table 4). The trend for mountain whitefish was exactly opposite of that observed for cutthroat (Table 4). This species achieved largest densities in river pools (an average of 325 per 100 m) which was nearly three orders of magnitude larger than the mean density in second and third order reaches (0.4 fish per 100 m). Whitefish densities were also markedly larger in fourth order reaches (8.3 per 100 m) than in upstream reaches. Fish trapping information on several North Fork tributaries suggests that mountain whitefish move into the tributaries during spring runoff and return to the river by late July. Similar movements were documented by Davies and Thompson (1976) in an Alberta watershed.

Bull trout spawning habitat

Bull trout redds were counted in a total of five major North Fork and seven Middle Fork drainages during October of 1979. These counts serve to monitor the spawning adult bull trout population in the system and also aid in elucidating the spawning habitat requirements of this species.

Data presented in Figure 2 indicate that bull trout spawning occurs primarily in third and fourth order stream reaches. The following analysis incudes only North Fork data since habitat surveys were not completed on half of the six high quality bull trout spawning reaches in Middle Fork tributaries.

Three classes of bull trout spawning reach quality were assigned to North Fork tributaries (Table 5). Five North Fork reaches provided medium-high quality bull trout spawning habitat and supported an average of 28 redds. Seven reaches provided low quality spawning habitat and had only four redds present on the average. Ten reaches supported a nil amount of spawning.

Table 4. Average cutthroat and mountain whitefish densities (fish per 100 m) in Middle Fork River pools and in tributaries to the Middle Fork Flathead River.

	Tributaries		
	Second and Third order	Fourth order	River pools
Westslope cutthroat	19.5	6.6	7.5
Mountain whitefish	0.4	8.3	325.0

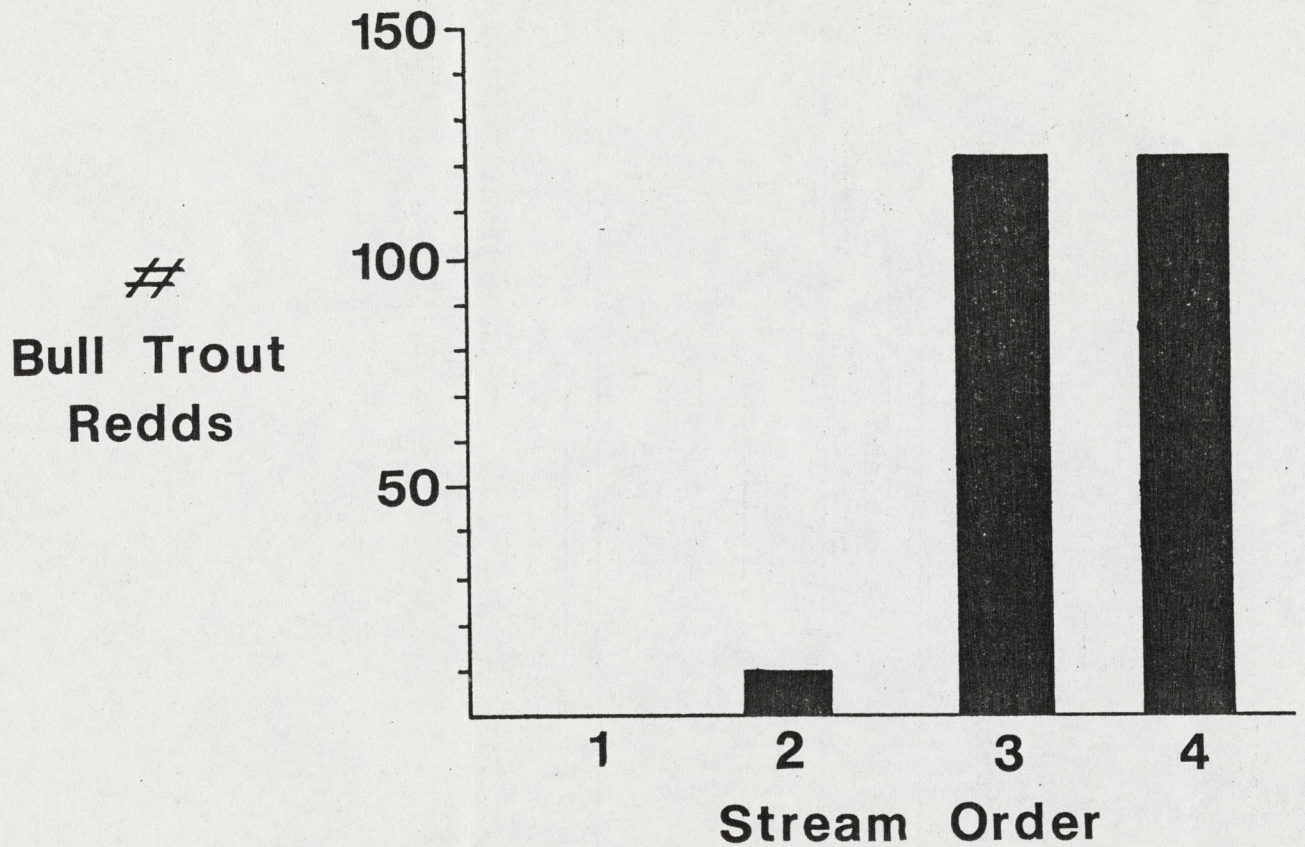

Figure 2. Numbers of bull trout redds observed in reaches of various order in tributaries to the North and Middle Forks of the Flathead River.

Table 5. Sample size and mean number of bull trout redds in reaches of various spawning habitat quality in tributaries to the North Fork of the Flathead River.

	Reach quality		
	Nil	Low	Medium-high
Number of reaches	10	7	5
Mean number of redds	0	4	28

Table 6. Relationships between bull trout spawning habitat quality and mean stream gradient, flow, width, and depth of reaches in tributaries to North Fork Flathead River.

	Reach quality		
	Nil	Low	Medium-high
Gradient (%)	6.3	2.5	1.5
Late summer flow (cfs)	11	12	31
Wetted width (m)	5.5	6.5	16.5
Mean depth (cm)	20	21	30

Relationships between bull trout spawning reach quality and stream size and gradient were apparent (Table 6). Reaches providing high quality spawning habitat typically had a low gradient (1.5 percent) and were characterized as having large late summer flows (31 cfs), wetted widths (16.5 m) and mean depths (30 cm).

Reaches of North Fork tributaries selected by bull trout for spawning purposes had a higher percentage of run and lower percentage of riffle than did unsuitable reaches (Table 7). Medium-high quality spawning reaches characteristically displayed a hgiher percentage of pool (28 percent) than did low quality reaches (17 percent) or reaches which were not used (14 percent; Table 7). In addition, it was found that medium-high quality spawning reaches had a much higher percentage of large, high quality (class one and two) pools than other reaches (Table 7).

The substrate of medium-high quality bull trout spawning reaches was generally comprised of higher amounts of fine materials and gravel and lower amounts of coarse textured materials (cobbles, boulders and bedrock) than poorer quality reaches (Table 8). The D90 (average size of the largest 10 percent of substrate material in a reach) of medium-high quality reaches (35.6 cm) was much lower than that observed in non-spawning reaches (59 cm; Table 8). This supports other substrate data indicating that spawning bull trout prefer reaches having relatively small bed materials.

SUMMARY

An extensive pre-impact survey of fish populations and associated stream habitat was initiated during 1979 in tributaries to the North and Middle Forks of the Flathead River. Average fish density in 33 snorkel transects was approximately 28 per 100 meters and was comprised almost exclusively of westslope cutthroat trout, bull trout, mountain whitefish and sculpins. Cutthroat were the predominant trout species in second and third order stream reaches where they comprised 71 percent of the trout observed, whereas bull trout were dominant in fourth order reaches, accounting for 65 percent of observed trout. Cutthroat densities in the Middle Fork drainage were three times greater in second and third order tributaries than in fourth order reaches or in river pools, whereas the reverse was true for mountain whitefish. Bull trout redd locations indicate that spawning activity was greatest in large streams (third and fourth order) having low gradients, high percentage of high quality pools and relatively small substrates.

Table 7. Characteristics of bull trout spawning reaches of various quality in tributaries to the North Fork Flathead River.

	Reach quality		
	Nil	Low	Medium-high
Run (%)	35	47	48
Riffle (%)	42	36	30
Pool (%)	14	17	28
Class I & II pools (%)	9	13	33

Table 8. Substrate composition in bull trout spawning reaches of various quality in tributaries to the North Fork Flathead River.

	Reach quality		
	Nil	Low	Medium-high
Fines (%)	16	24	28
Gravel (%)	21	35	42
Cobble-boulder (%)	38	36	30
Bedrock (%)	24	4	trace
D90 (cm)	59.0	38.4	35.6

LITERATURE CITED

Davies, R. W. and G. W. Thompson. 1976. Movements of mountain whitefish (Prosopium williamsoni) in the Sheep River watershed, Alberta. J. Fish. Res. Board Can. 33:2395-2401.

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Pollard, H. A. and T. C. Bjornn. 1973. The effects of angling and hatchery trout on the abundance of juvenile steelhead trout. Trans. Amer. Fish. Soc. 102(4):745-752.

Thurow, R. F. and T. C. Bjornn. 1978. Response of cutthroat trout populations to the cessation of fishing in St. Joe River tributaries. Idaho Dept. Fish and Game, Bull. No. 25.

Department of Fishery and Wildlife Biology

Colorado State University
Fort Collins, Colorado
80523

III:5:84

Dear Bill:

Enclosed are original data sheets. I believe this covers all specimens used for report. I recall that many small specimens were difficult to make accurate scale counts and some were later recounted — thus, there may be some slight discrepencies between these original data and final data, but if so, it should be slight.

Sincerely,

Bob

6/2

CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

SPECIES Cutthroat LOCALITY Carmanah Creek below falls

COLLECTED BY F. Berry R. Axford DATE 23 Sept 1980

Cat. # _____ Measurements by Eric Wagner DATE 10 April 1981

Specimen #	8	10	1	13	5	6	4	12
Total L.	124	121	139	135	119	136	115	123
Standard L.	101	99	115	111	97	112	95	102
Body D								
Head L.								
Orbit L.								
Upper Jaw L								
Dors. Orig. to Snt. tip								
Dorsal fin basal L								
Dorsal fin depressed L								
Adip. fin depressed L								
Caudal peduncle D								
Caudal peduncle L								
Vertebrae								
1st Arch gillrakers (up)	7/0	7/0	7/0	6/0	7/0	7/0	6/0	7/0
(lower)	12/0	12/0	13/0	12/0	12/0	12/0	12/0	11/0
(total)	19	19	20	18	19	19	18	18
Branchiostegal rays right								
(left)								
Dorsal rays								
Anal rays								
Pectoral fin rays								
Scales in lateral line								
Scales above lateral line	31	30	27	26	26	28	30	29
Scales 2 rows above lat.	135	129	135	126	121	128	126	134
Pelvic fin rays	10	10	10	10	10	10	10	10
Pyloric caeca	36	—	46	48	44	43	36	31
Dentition	0	0	0	0	0	0	1	0

A2

CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

BC

SPECIES Cutthroat LOCALITY Carmanah Creek below Falls

COLLECTED BY F Berry, R Axford DATE 23 Sept 1980

Cat. # _____ Measurements by Eric Wagner DATE 10 April 1981

Specimen #	2	3	17	15	16	14	7	9	11
Total L.	128	135	102	tail broken	75	83	118	103	tail broken
Standard L.	105	110	87	79	61	69	97	84	90
Body D									
Head L.									
Orbit L.									
Upper Jaw L									
Dors. Orig. to Snt. tip									
Dorsal fin basal L									
Dorsal fin depressed L									
Adip. fin depressed L									
Caudal peduncle D									
Caudal peduncle L									
Vertebrae									
1st Arch gillrakers (up)	6/10	7/10	7/10	6/10	-	7/10	9/0	7/0	6/10
(lower)	12/0	12/0	12/0	13/1	-	13/0	13/0	12/0	12/0
(total)	18	19	19	19	-	20	22	19	18
Branchiostegal rays right									
(left)									
Dorsal rays									
Anal rays									
Pectoral fin rays									
Scales in lateral line									
Scales above lateral line	28	29							
Scales 2 rows above lat.	127	127							
Pelvic fin rays	10	10							
Pyloric caeca	52	42	44						
Dentition	0	0	0	0	0	0	0	0	0

1 of 3

CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

BC

SPECIES cutthroat LOCALITY CARMANAH UPSTREAM above falls

COLLECTED BY F. Berry R. Axford DATE 24 Sept 1980

Cat. # _____ Measurements by Eric Wagner DATE April 10, '81

Specimen #	4	3	16	7	14	13	9	Tag missing Tail Broken
Total L.	127	136	129	122	130	124	119	
Standard L.	105	112	106	101	108	102	98	119
Body D								
Head L.								
Orbit L.								
Upper Jaw L								
Dors. Orig. to Snt. tip								
Dorsal fin basal L								
Dorsal fin depressed L								
Adip. fin depressed L								
Caudal peduncle D								
Caudal peduncle L								
Vertebrae								
1st Arch gillrakers (up)	7/0	7/0	8/0	8/0	7/0	7/0	7/0	8/0
(lower)	12/0	12/0	13/0	12/0	13/0	12/0	11/0	13/0
(total)	19	19	21	20	20	19	18	21
Branchiostegal rays right								
(left)								
Dorsal rays								
Anal rays								
Pectoral fin rays								
Scales in lateral line								
Scales above lateral line	28	30	27	30	29	27	28	31
Scales 2 rows above lat.	126	124	124	124	130	125	128	127
Pelvic fin rays	9	10	10	9	10	9	9	10
Pyloric caeca	40	40	40	41	44	42	41	46
Dentition	0	0	0	0	0	0	1	0
eggs in stomach	x						x	

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CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

SPECIES Cutthroat LOCALITY CARMANAH CR. UPSTREAM abv falls

COLLECTED BY F. Berry & R Axford DATE 24 Sept 1980

Cat. # _____ Measurements by Eric Wagner DATE 10 April 1981

Specimen #	5	17	10	15	6	19	8	12
Total L.	Tail Broken	120	120	105	107	134	141	121
Standard L.	111	99	99	88	89	110	118	99
Body D								
Head L								
Orbit L								
Upper Jaw L								
Dors. Orig. to Snt. tip								
Dorsal fin basal L								
Dorsal fin depressed L								
Adip. fin depressed L								
Caudal peduncle D								
Caudal peduncle L								
Vertebrae								
1st Arch gillrakers (up)	7 | 0	6 | 0	7 | 0	7 | 0	7 | 0	7 | 0	7 |	6 | 0
(lower)	12 | 0	12 | 0	12 | 0	12 | 0	12 | 0	11 | 0	11 |	11 | 0
(total)	19	18	19	19	19	18	18	17
Branchiostegal rays right								
(left)								
Dorsal rays								
Anal rays								
Pectoral fin rays								
Scales in lateral line								
Scales above lateral line	32	26						
Scales 2 rows above lat.	125	123						
Pelvic fin rays	10	9						
Pyloric caeca	52	145						
Dentition	0	0	0	0	0	0	0	0

3 of 3

CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

SPECIES Cutthroat LOCALITY CARMANAH CR UPSTREAM above falls

COLLECTED BY F Berry R. Axford DATE 24 Sept 1980

Cat. # _____ Measurements by Eric Wagner DATE 10 April 1981

Specimen #	no tag	20	1	11				
Total L.	108	120	130	131				
Standard L.	89	98	110	109				
Body D								
Head L								
Orbit L								
Upper Jaw L								
Dors. Orig. to Snt. tip								
Dorsal fin basal L								
Dorsal fin depressed L								
Adip. fin depressed L								
Caudal peduncle D								
Caudal peduncle L								
Vertebrae								
1st Arch gillrakers (up)	7/0	7/0	7/0	6/0				
(lower)	11/0	13/0	11/0	11/6				
(total)	18	20	18	17				
Branchiostegal rays right								
(left)								
Dorsal rays								
Anal rays								
Pectoral fin rays								
Scales in lateral line								
Scales above lateral line								
Scales 2 rows above lat.								
Pelvic fin rays								
Pyloric caeca								
Dentition	0	0	0	0				

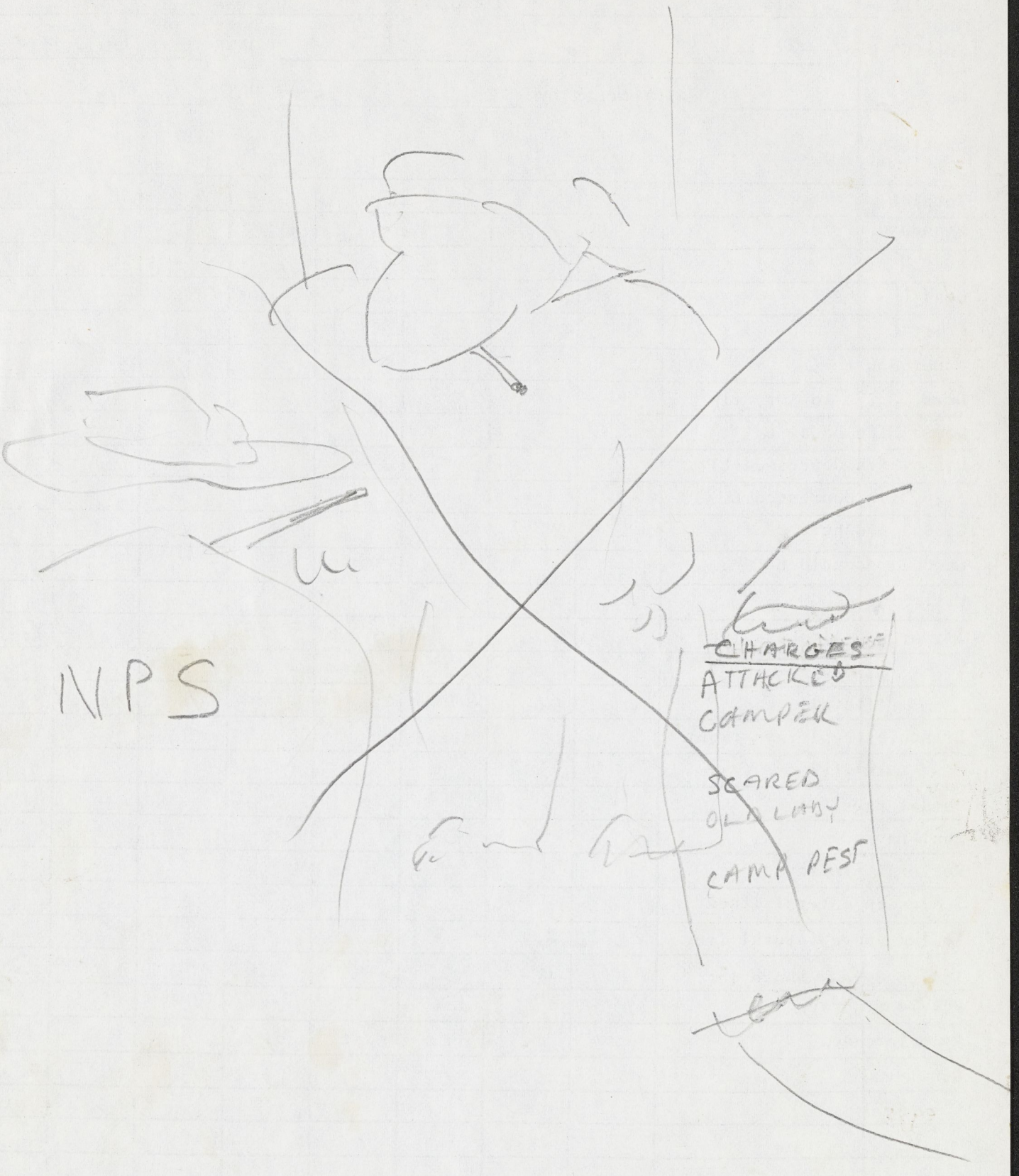
1 of 3 CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

SPECIES Cutthroat BC LOCALITY Walbran Creek upstream

COLLECTED BY F. Berry R. Axford DATE 23 Sept 1980

Cat. # _____ Measurements by Eric Wagner DATE 7 April 1981

Specimen #	3	1	15	2	4	6	8	19
Total L.	143	129	124	144	127	112	136	113
Standard L.	118	107	101	118	105	93	114	94
Body D								
Head L.								
Orbit L.								
Upper Jaw L								
Dors. Orig. to Snt. tip								
Dorsal fin basal L								
Dorsal fin depressed L								
Adip. fin depressed L								
Caudal peduncle D								
Caudal peduncle L								
Vertebrae								
1st Arch gillrakers (up)	5/0	7/0	7/0	7/0	7/0	6/0	7/0	6/0
(lower)	13/1	12/0	12/2	12/0	12/0	11/0	12/0	12/0
(total)	18	19	19	19	19	17	19	18
Branchiostegal rays right								
(left)								
Dorsal rays								
Anal rays								
Pectoral fin rays								
Scales in lateral line								
Scales above lateral line	25	27	28	32	26	23	26	28
Scales 2 rows above lat.	139	131	131	141	125	122	141	128
Pelvic fin rays	10	10	10	9	10	10	10	10
Pyloric caeca	49	35	41	44	33	46	38	44
Dentition	0	0	2	0	0	0	0	0
eggs in stomach	x	x				x	x	x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2013

CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

BC

SPECIES Cutthroat LOCALITY Walbran Creek upstream

COLLECTED BY F. Berry R. Axford DATE 23 Sept 1980

Cat. # _____ Measurements by Eric Wagner DATE 7 April 1981

Specimen #	14	tag missing	11	7	5	17	12	10
Total L.	143	142	137	135	116	113	125	134
Standard L.	118	117	114	112	95	93	105	109
Body D								
Head L								
Orbit L								
Upper Jaw L								
Dors. Orig. to Snt. tip								
Dorsal fin basal L								
Dorsal fin depressed L								
Adip. fin depressed L								
Caudal peduncle D								
Caudal peduncle L								
Vertebrae								
1st Arch gillrakers (up)	7/0	7/0	7/0	6/0	9/0	7/0	7/0	5/0
(lower)	11/0	12/0	12/0	11/0	13/0	11/0	11/0	10/0
(total)	18	19	19	17	21	18	18	15
Branchiostegal rays right								
(left)								
Dorsal rays								
Anal rays								
Pectoral fin rays								
Scales in lateral line								
Scales above lateral line	25	28						
Scales 2 rows above lat.	139	134						
Pelvic fin rays	10	10						
Pyloric caeca	45	55						
Dentition	0	0	0	0	0	0	0	0
eggs in Stomach	x	x	?	x	x	x		

3 of 3

CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

BC

SPECIES Cutthroat LOCALITY Walbian Creek Upstream

COLLECTED BY F Berry, R. Axford DATE 23 Sept 1980

Cat. # _____ Measurements by Eric Wagner DATE 7 April 1981

Specimen #	20	9	18	16				
Total L.	98	136	114	110				
Standard L.	80	112	94	91				
Body D								
Head L.								
Orbit L.								
Upper Jaw L								
Dors. Orig. to Snt. tip								
Dorsal fin basal L								
Dorsal fin depressed L								
Adip. fin depressed L								
Caudal peduncle D								
Caudal peduncle L								
Vertebrae								
1st Arch gillrakers (up)	6 / 0	7 / 0	6 / 0	6 / 0				
(lower)	11 / 0	13 / 0	11 / 0	11 / 0				
(total)	17	20	17	17				
Branchiostegal rays right								
(left)								
Dorsal rays								
Anal rays								
Pectoral fin rays								
Scales in lateral line								
Scales above lateral line								
Scales 2 rows above lat.								
Pelvic fin rays								
Pyloric caeca								
Dentition	0	0	0	0				

CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

142

SPECIES Salmo Clarki LOCALITY Walbran Creek below falls

COLLECTED BY F. Berry, R. Axford DATE 23 Sept. 1980

Cat. # _____ Measurements by Eric Wagner DATE 6 April 1981

Specimen #	10	4	missing tag	14	13	11	5	15
Total L.	117	111	130	107	Tail broken	116	121	106
Standard L.	95	92	106	87	87	95	100	86
Body D								
Head L.								
Orbit L.								
Upper Jaw L								
Dors. Orig. to Snt. tip								
Dorsal fin basal L								
Dorsal fin depressed L								
Adip. fin depressed L								
Caudal peduncle D								
Caudal peduncle L								
Vertebrae								
1st Arch gillrakers (up)	8/0	7/0	7/0	7/0	7/0	7/0	7/0	8/0
(lower)	13/0	13/0	12/0	12/0	11/0	12/4 tiny	12/0	12/0
(total)	21	20	19	19	18	19	19	20
Branchiostegal rays right								
(left)								
Dorsal rays								
Anal rays								
Pectoral fin rays								
Scales in lateral line								
Scales above lateral line	24	27	29	32	26	30	29	24
Scales ? rows above lat.	131	121	125	127	119	122	125	124
Pelvic fin rays	9	9	9	11	10	10	10	10
Pyloric caeca	37	36	44	40	34	43	39	41
Dentition	0	0	0	0	0	0	0	0
eggs in stomach		x	x	x	x	x	x	x

CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

2d2

SPECIES Salmo clarki LOCALITY Walbran Creek below falls

COLLECTED BY F. Berry, R. Axford DATE 23 Sept 1980

Cat. # _____ Measurements by Eric Wagner DATE 6 April 1981

Specimen #	3	12	2	6	1	missing tag	7	
Total L.	121	113	91	115	124	114	100	
Standard L.	98	92	74	95	101	94	81	
Body D								
Head L.								
Orbit L.								
Upper Jaw L								
Dors. Orig. to Snt. tip								
Dorsal fin basal L								
Dorsal fin depressed L								
Adip. fin depressed L								
Caudal peduncle D								
Caudal peduncle L								
Vertebrae								
1st Arch gillrakers (up)	8/0	7/0	7/0	7/0	6/0	7/0	6/0	
(lower)	12/0	12/0	11/0	11/1	11/0	12/0	13/0	
(total)	20	19	18	18	17	19	19	
Branchiostegal rays right								
(left)								
Dorsal rays								
Anal rays								
Pectoral fin rays								
Scales in lateral line								
Scales above lateral line	25	27	32					
Scales 2 rows above lat.	124	130	119					
Pelvic fin rays	10	9	10					
Pyloric caeca	42	41	48					
Dentition	0	0	0	0	0	0	0	
eggs in stomach	x		x	x	x	x		

10/3

CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

BC

SPECIES Salmo clarki LOCALITY CCU

COLLECTED BY _____ DATE _____

Cat. # _____ Measurements by Eric Wagner DATE 4 April 1981

Specimen #	5	1	15	9		10	19	11
Total L.	155	148	118	141	142	139	110	116
Standard L.	128	121	98	117	114	115	90	95
Body D								
Head L.								
Orbit L.								
Upper Jaw L								
Dors. Orig. to Snt. tip								
Dorsal fin basal L								
Dorsal fin depressed L								
Adip. fin depressed L								
Caudal peduncle D								
Caudal peduncle L								
Vertebrae								
1st Arch gillrakers (up)	8 | 0	6 | 0	7 | 0	7 | 0	7 | 0	7 | 0	7 | 0	7 | 0
(lower)	12 | 0	12 | 0	12 | 0	12 | 0	12 | 0	12 | 0	11 | 0	12 | 0
(total)	20	18	19	19	19	19	18	19
Branchiostegal rays right								
(left)								
Dorsal rays								
Anal rays								
Pectoral fin rays								
Scales in lateral line								
Scales above lateral line	24	29	27	29	29	28	30	25
Scales 2 rows above lat.	125	131	134	130	135	128	139	131
Pelvic fin rays	9	10	10	9	10	10	10	10
Pyloric caeca	47	47	44	57	45	53	55	49
Dentition	0	0	0	0	0	0	0	1

303 CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

BC

SPECIES Salmo clarki LOCALITY CCU

COLLECTED BY _____ DATE _____

Cat. # _____ Measurements by Eric Wagner DATE 4 April 1981

Specimen #	16	12	7	20	21			
Total L.	124	93	93	88	92			
Standard L.	103	76	76	72	76			
Body D								
Head L.								
Orbit L.								
Upper Jaw L								
Dors. Orig. to Snt. tip								
Dorsal fin basal L								
Dorsal fin depressed L								
Adip. fin depressed L								
Caudal peduncle D								
Caudal peduncle L								
Vertebrae								
1st Arch gillrakers (up)	7 | 0	7 | 0	7 | 0	7 | 0	7 | 0			
(lower)	13 | 0	12 | 0	12 | 0	11 | 0	10 | 1			
(total)	21	19	19	18	17			
Branchiostegal rays right								
(left)								
Dorsal rays								
Anal rays								
Pectoral fin rays								
Scales in lateral line								
Scales above lateral line								
Scales 2 rows above lat.								
Pelvic fin rays								
Pyloric caeca								
Dentition	0	0	0	0	0			

2d3

CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

BC

SPECIES Salmo clarki LOCALITY CCU

COLLECTED BY _____ DATE _____

Cat. # _____ Measurements by Eric Wagner DATE 4 April 1981

Specimen #	18	8	13	17	6	3	2	14
Total L.	133	134	137	113	106	118	96	92
Standard L.	109	111	114	93	88	98	80	75
Body D								
Head L								
Orbit L								
Upper Jaw L								
Dors. Orig. to Snt. tip								
Dorsal fin basal L								
Dorsal fin depressed L								
Adip. fin depressed L								
Caudal peduncle D								
Caudal peduncle L								
Vertebrae								
1st Arch gillrakers (up)	8/0	8/0	8/0	8/0	7/0	7/0	6/0	6/0
(lower)	11/0	13/0	11/0	12/0	12/0	12/0	11/0	11/0
(total)	19	21	19	20	19	19	17	17
Branchiostegal rays right								
(left)								
Dorsal rays								
Anal rays								
Pectoral fin rays								
Scales in lateral line								
Scales above lateral line	32	26	25	26	27			
Scales 2 rows above lat.	126	147	131	125	128			
Pelvic fin rays	10	10	10	10	10			
Pyloric caeca	54	54	44	42	56			
Dentition	1	0	0	0	0	0	0	0

CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

2 of 2 BC

SPECIES Cutthroat LOCALITY Camper Creek below falls British Columbia

COLLECTED BY _____ DATE 3-17-80

Cat. # _____ Measurements by Eric Wagner DATE 23 Feb 1981

Specimen #	3	4	13	6	14	2	10	8	Numbers 1034 1?	5?
Total L.	124	117	104	112	100	95	105	93	111	104
Standard L.	101	97	86	93	83	78	87	77	88	85
Body D										
Head L.										
Orbit L.										
Upper Jaw L										
Dors. Orig. to Snt. tip										
Dorsal fin basal L										
Dorsal fin depressed L										
Adip. fin depressed L										
Caudal peduncle D										
Caudal peduncle L										
Vertebrae										
1st Arch gillrakers (up)	6/11	7/10	6/10	9/10	8/10	8/10	7/10	9/6	9/0	7/10
(lower)	11/0	12/6	12/0	13/0	12/2	12/0	13/0	13/0	13/6	13/0
(total)	17	19	18	22	20	20	20	22	22	20
Branchiostegal rays right										
(left)										
Dorsal rays										
Anal rays										
Pectoral fin rays										
Scales in lateral line										
Scales above lateral line	24	26	25	24	32	21	28	31	25	29
Scales 2 rows above lat.	124	135	142	126	125	125	125	124	130	134
Pelvic fin rays	10	9	10	10	10	10	10	10	9	10
Pyloric caeca	39	36	37	44	38	42	44	41	41	34
Dentition	0	0	0	0	0	0	0	0	0	0

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CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

BC

SPECIES Cutthroat LOCALITY Camper Creek below falls British Columbia

COLLECTED BY _____ DATE 3-17-80

Cat. # _____ Measurements by Eric Wagner DATE 21 Feb 1981

Specimen #	5	16	12	1	11	7	18	9
Total L.	102	128	133	109	119	99	128	Tail Broken
Standard L.	89	103	112	90	97	82	104	98
Body D								
Head L								
Orbit L								
Upper Jaw L								
Dors. Orig. to Snt. tip								
Dorsal fin basal L								
Dorsal fin depressed L								
Adip. fin depressed L								
Caudal peduncle D								
Caudal peduncle L								
Vertebrae								
1st Arch gillrakers (up)	8/0	8/0	8/1	8/0	8/0	7/0	7/0	8/0
(lower)	14/0	13/0	14/0	13/0	13/4	13/2	11/0	13/0
(total)	22	21	22	21	21	20	18	21
Branchiostegal rays right								
(left)								
Dorsal rays								
Anal rays								
Pectoral fin rays								
Scales in lateral line								
Scales above lateral line	29	32	26	26	25	25	29	24
Scales 2 rows above lat. ±5	132	130	140	118	125	134	124	115
Pelvic fin rays	10	10	10	10	10	10	10	10
Pyloric caeca ±2	35	—	44	—	37	49	46	39
Dentition	0	0	0	1	0	0	0	0

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CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

BC

SPECIES Salmo clarki LOCALITY Escalante R below falls

COLLECTED BY _____ DATE 16-10-80

Cat. # _____ Measurements by Eric Wagner DATE April 3, 1981

Specimen #	24	11	18	17	21	7	4	5
Total L.	142	117	tail broken	114	133	102	122	151
Standard L.	117	96	70	93	108	84	99	126
Body D								
Head L.								
Orbit L.								
Upper Jaw L								
Dors. Orig. to Snt. tip								
Dorsal fin basal L								
Dorsal fin depressed L								
Adip. fin depressed L								
Caudal peduncle D								
Caudal peduncle L								
Vertebrae								
1st Arch gillrakers (up)	7/0	8/0	7/0	6/0	7/0	8/0	7/0	7/0
(lower)	12/0	13/0	12/0	11/0	12/0	11/0	13/0	12/0
(total)	19	21	19	17	19	19	20	19
Branchiostegal rays right								
(left)								
Dorsal rays								
Anal rays								
Pectoral fin rays								
Scales in lateral line								
Scales above lateral line	27	32		37	27	29	30	36
Scales 2 rows above lat.	141	126		146	130	139	125	145
Pelvic fin rays	9	10		10	10	9	10	9
Pyloric caeca ±3	48	40		36	40	37	48	35
Dentition	0	0	0	13	0	1	0	33
				eggs (5-7mm)				
				in				
				stomachs of several specimens				

3 of 3

CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

BC

SPECIES Salmo clarki LOCALITY Escalante R. below falls

COLLECTED BY _____ DATE 16-10-80

Cat. # _____ Measurements by Eric Wagner DATE 4 April 1981

Specimen #	16	19	2	1	12	20	26	8	23	9
Total L.	113	136	Tail Broken	105	119	91	121	108	Broken Tail	135
Standard L.	92	111	112	85	91	91	99	89	99	112
Body D										
Head L.										
Orbit L.										
Upper Jaw L										
Dors. Orig. to Snt. tip										
Dorsal fin basal L										
Dorsal fin depressed L										
Adip. fin depressed L										
Caudal peduncle D										
Caudal peduncle L										
Vertebrae										
1st Arch gillrakers (up)	7 | 0	7 | 0	9 | 0	8 | 0	6 | 0	6 | 0	7 | 0	5 | 0	6 | 0	9 | 0
(lower)	11 | 0	12 | 0	12 | 0	12 | 0	13 | 0	11 | 0	12 | 0	12 | 0	11 | 0	13 | 0
(total)	18	19	21	20	19	17	19	17	17	22
Branchiostegal rays right										
(left)										
Dorsal rays										
Anal rays										
Pectoral fin rays										
Scales in lateral line										
Scales above lateral line										
Scales 2 rows above lat.										
Pelvic fin rays										
Pyloric caeca										
Dentition	0	0	0	1	12	16	22	0	24	0

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CHARACTER ANALYSIS SHEET - COLORADO COOPERATIVE FISHERY UNIT

BC

SPECIES Cutthroat LOCALITY Escalante R. below Falls

COLLECTED BY _____ DATE 16-10-80

Cat. # _____ Measurements by Eric Wagner DATE 3 April 1981

Specimen #	15	3	14	25	13	6	22	10
Total L.	115	125	161	143	127	105	118	112
Standard L.	93	102	136	119	104	87	95	91
Body D								
Head L.								
Orbit L.								
Upper Jaw L								
Dors. Orig. to Snt. tip								
Dorsal fin basal L								
Dorsal fin depressed L								
Adip. fin depressed L								
Caudal peduncle D								
Caudal peduncle L								
Vertebrae								
1st Arch gillrakers (up)	5 | 0	7 | 0	7 | 0	7 | 0	7 | 0	7 | 0	8 | 0	6 | 0
(lower)	12 | 0	14 | 0	10 | 0	12 | 0	12 | 0	12 | 0	12 | 0	11 | 0
(total)	17	21	17	19	19	19	20	17
Branchiostegal rays right								
(left)								
Dorsal rays								
Anal rays								
Pectoral fin rays								
Scales in lateral line								
Scales above lateral line	33	24	31	31	23	25	31	32
Scales 2 rows above lat.	137	122	147	140	120	124	123	141
Pelvic fin rays	9	10	9	9	9	10	10	9
Pyloric caeca	47	35	53	46	32	40	45	42
Dentition	5	0	22	19	0	0	0	19
Egg in Stomach	x	x	x	x	x		x	x