U.S. Fish & Wildlife Service

Arcata Fisheries Data Series Report Number DS 2010-18

2008 Mainstem Klamath River Coho Spawning Survey

Ryan Slezak

U.S. Fish and Wildlife Service
Arcata Fish and Wildlife Office
1655 Heindon Road
Arcata, CA 95521
(707) 882-7201

January 2009

The 2008 survey was funded by the Klamath River Habitat Assessment Program of the U.S Fish and Wildlife Service, Arcata Fish and Wildlife Field Office, Arcata, CA.

The Arcata Fish and Wildlife Office Fisheries Program reports its study findings through two publication series. The **Arcata Fisheries Data Series** was established to provide timely dissemination of data to local managers and for inclusion in agency databases. The **Arcata Fisheries Technical Reports** publishes scientific findings from single and multi-year studies that have undergone more extensive peer review and statistical testing. Additionally, some study results are published in a variety of professional fisheries journals.

Key words: Coho, spawner survey, Klamath, redd

The correct citation for this report is:

Slezak, R.R. 2009. 2008 Mainstem Klamath River Coho Spawning Survey. U. S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Arcata Fisheries Data Series Report DS 2010-18, Arcata, California.

Table of Contents

page

List of Tables

List of Figures

List of Appendices

Mainstem Klamath River Coho Spawning Survey

Ryan Slezak

U. S. Fish and Wildlife Service, Arcata Fish and Wildlife Office
1655 Heindon Road, Arcata, California
ryan_slezak@fws.gov

Abstract. This report describes observations and results of a coho salmon (*Oncorhynchus kisutch*) redd survey conducted on the mainstem Klamath River during the week of December 7, 2008. Results presented represent minimum counts as replicate surveys were not conducted over time and the entire mainstem river was not surveyed. Selected reaches were floated between Iron Gate Dam (rkm 310.3) and Chambers Flat (rkm 171.0). Coho salmon redds were counted, measured, and recorded. A total of nine coho salmon redds were observed during this survey. Eight of the nine redds (89%) were located in side channels or split channels of the mainstem Klamath River. The highest concentration of redds (n = 4) was found in a side channel near the confluence of Barkhouse Creek (rkm 256.7). The coho redd counts from this survey are comparable to the redd counts from 2002-2005, but are considerably lower than redd counts from 2001.

Introduction

The Klamath River Basin (Figure 1) historically supported large runs of Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), and steelhead trout (*O. mykiss*). These species contribute to economically and culturally important subsistence, sport, and commercial fisheries. Generations of Native Americans have fished in the drainage, with historic catches of salmon, steelhead, lamprey, and sturgeon providing the mainstay of the Native American economy in the area (Leidy and Leidy 1984).

Coho salmon historically inhabited most major river systems of the Pacific Rim from central California to northern Japan (Laufle et al. 1986). However, extinctions in local populations of coho salmon have been documented in Washington, Oregon, Idaho, and California (Nehlsen et al. 1991, Frissell 1993, Brown et al. 1994). A status review of coho salmon populations from Washington, Oregon, and California (Weitkamp et al. 1995) prompted the National Marine Fisheries Service (NMFS) to list coho salmon populations within the Southern Oregon Northern California (SONC) Evolutionary Significant Unit (ESU) as threatened under the Endangered Species Act (ESA) on 6 May, 1997.

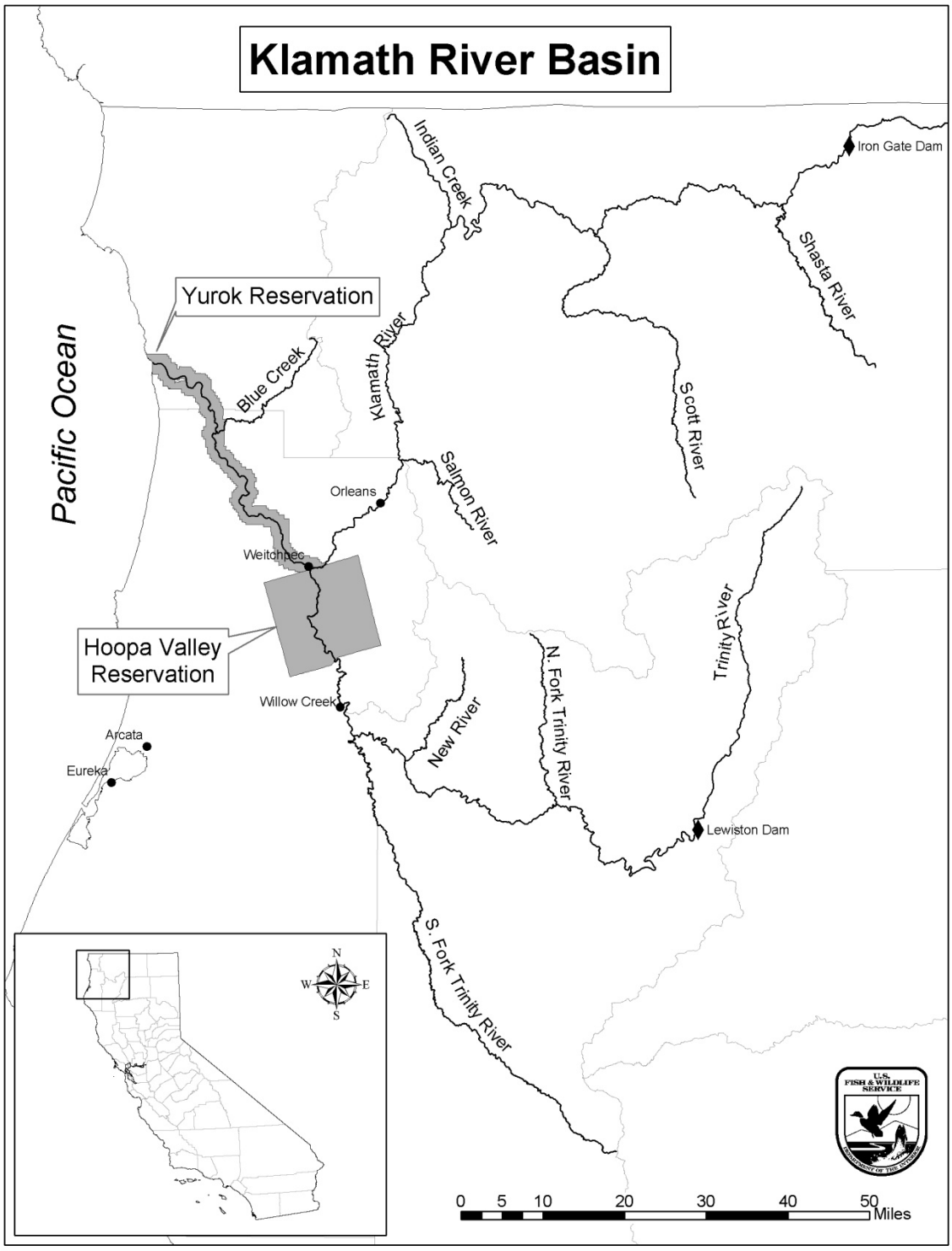

Figure 1. Overview map of the Klamath River Basin accessible to anadromous fish.

In consultation with the NMFS and the U.S. Fish and Wildlife Service (USFWS), the Bureau of Reclamation (BOR) developed a Ten Year Operations Plan that proposed to "divert, store and deliver (from storage) Klamath Project (Project) water consistent with applicable law" from the upper Klamath River Basin (NMFS 2002). In their 2002 Biological Opinion (BO), NMFS determined that the Project was likely to jeopardize the continued existence of coho salmon and result in the adverse modification of designated critical habitat of coho salmon.

In their reasonable and prudent alternative (RPA) to BOR's proposed action, NMFS required BOR to continue to refine RPA target flows by, in part, implementing various scientific studies to determine the effect of different IGD flow regimes have on coho salmon survival. In response to data uncertainties listed in the BO, BOR requested the USFWS to document the abundance and physical characteristics, and location of coho salmon redds within the mainstem Klamath River downstream of IGD. Surveys were performed for three consecutive weeks following the completion of fall Chinook salmon spawning surveys from 2001-2005. In an effort to monitor areas historically known for coho spawning activity on the mainstem Klamath, a condensed coho redd survey was conducted in 2008.

Materials and Methods

Survey Procedures

Employees of Arcata Fish and Wildlife Office of the USFWS and Karuk Tribe of California conducted coho salmon redd surveys from December 9 to December 11, 2008. Surveys were scheduled to be conducted during peak coho salmon spawning activity. Survey crews floated from IGD (rkm 310.6) to I-5 (rkm 292.6), from Gottville river access (rkm 266.45) to Brown Bear river access (rkm 243.75), and from Indian Creek (rkm 173.85) to Chambers Flat (Rkm 171.0). These reaches have historically contained the highest concentrations of coho redds in the mainstem Klamath River (Magneson 2006). Survey crews floated the Klamath mainstem focusing on known coho salmon spawning areas from previous surveys including side channels, stream margins, and tributary mouths.

Rafting Equipment

Two 4.3 m inflatable catarafts were used for direct observation of coho salmon redds. Catarafts were stacked on a flatbed trailer and deployed at selected access sites along the study area. Each raft was equipped with a rowing frame and a modified observation platform. Two personnel, a rower and an observer, operated each raft. Rafts floated each reach side by side, with the USFWS crew observing one half of the river and the Karuk Tribal Fisheries Department (KTFD) observing the other half of the river.

Collection of Redd Data

When redds were located, they were marked on laminated aerial orthophotos and location information was recorded on data forms. Information was also recorded on data forms and flagging. Waypoints were taken using handheld a Global Positioning System (GPS) unit to record the precise location of each redd or cluster of redds. All data points were taken using the World Geodetic System 1984 (WGS84) datum.

Data recorded on forms included: date, weather, crew members, Secchi disc depth, Universal Transverse Mercator (UTM) coordinates, rkm, mesohabitat number, mesohabitat type, number of complete redds, number of fish observed on redds, distance to escape habitat, dominant and subdominant substrate in redd and untouched substrate immediately adjacent to redd, escape cover type (1-6), object cover type and distance, canopy >18" (percent/type), out-of-water overhead (type/distance), in-water overhead (type/distance), distance of redd to shore, distance of redd to adjacent redds, depth of redd pit (center), depth of redd mound (center), depth of adjacent undisturbed substrate. In an effort to minimize human influence on spawning coho salmon, many measurements were not taken if fish were observed on redds or nearby redds.

Redd Location

Redd locations were recorded on laminated aerial orthophotos having overlays of UTM coordinates, 0.05 rkm increments (measured from Klamath River mouth to IGD), channel types, and mesohabitat types. Stream channel type, mesohabitat type and habitat unit number were recorded on data forms for each redd location. Mesohabitat habitat numbers were referenced from the orthophotos, which identify and sequentially number individual habitat units from IGD to the Klamath River mouth. Redd locations were categorized into three channel types: split channel (SPC), side channel (SC), and main channel (MC) and further segregated into four mesohabitat types: pool (P), low slope (LS, gradient < 0.3%), moderate slope (MS, gradient = 0.3 to 0.8%), and steep slope (SS, gradient > 0.8%). These categories were based on methods described by Hawkins et al. (1993) and later modified by USFWS, United States Geological Survey (USGS) and Utah State University (Hardy and Addley 2001).

Depths of pit, mound and adjacent substrate

Depths were measured using an incremented USGS stream flow rod and recorded to the nearest 0.02 m (0.05 ft). Depth of the redd pit was vertical distance from the stream surface to the substrate at the center of the pit. Depth of the redd mound was the vertical distance from the stream surface to substrate at the center of the mound. Adjacent depth was the vertical distance from the stream surface to the undisturbed substrate immediately adjacent to the center of the redd mound at 90° and 45° from the redd center line. These two measurements were averaged for adjacent depth.

Substrate, Vegetation, and Cover Type

Substrate codes were based on Wentworth's scale and modified by USFWS, CDFG, and USGS. Substrate size was visually estimated. Substrate, vegetation, and cover codes are located in Table 1.

Iron Gate Dam Discharge

Mean daily river flow was provided by the U.S. Geological Survey gauging station (Number 11516530; Lat 41º 55' 41", Long 122º26'35"; and downloaded from the USGS website, http://waterdata.usgs.gov/ca/nwis/current/?type=flow, located in the Klamath River just downstream of IGD. Mean daily river flow was recorded in cubic feet per second (cfs).

Table 1. Cover, vegetation, and substrate codes.

Cover Codes	Vegetation Codes	Substrate Codes
1. No cover	1. Filamentous Algae	18. Clay
2. Obj Only	2. Non Emergent Rooted Aquatic	19. Sand and/or Silt (<0.1")
3. Inwater ovh	3. Emergent Rooted Aquatic-bull rushes	20. Coarse Sand (0.1-0.2")
4. Out water ovh	4. Grass	21. Small Gravel (0.2-1")
5. Obj+inwater ovh	5. Sedges-cattails	22. Medium Gravel (1-2")
6. Obj+out water ovh	6. Cockle Burrs	23. Large Gravel (2-3")
	7. Grape Vines	24. Very Large Gravel (3-4")
	8. Willows	25. Small Cobble (4-6")
	9. Berry Vines	26. Medium Cobble (6-9")
	10. Trees < 4" dbh	27. Large Cobble (9-12")
	11. Trees > 4" dbh	28. Small Boulder (12-24")
	12. Rootwad	29. Medium Boulder (24-48")
	13. Aggregates of small veg dom (<4")	30. Large Boulder (>48")
	14. Aggregates of large veg dom (>4")	31. Bedrock
	15. Duff, leaf litter, organic debris	
	16.Small Woody Debris (SWD) <4"x12'	
	17. Large Woody Debris (LWD) > 4"x12'	

Results

A total of 9 coho salmon redds were observed during this survey. The largest congregation of redds (n=4) was observed in a side channel near the confluence of Barkhouse Creek (rkm 256.7). Eight of the nine redds observed were found in side channels or split channels of the Klamath mainstem. The remaining redd was located within 5m of the confluence with Cottonwood Creek (rkm 297.4), a known spawning tributary for coho salmon. Approximate locations of observed redds can be seen in Table 2.

Depth directly above redds ranged from 0.25m to 0.56m with an average depth of 0.38m (n=5). Depth of pit ranged from 0.40m to 0.68m with an average of 0.52m (n=5). Depth of mound measurements ranged from 0.16m to 0.43m with an average of 0.24m (n=5). Adjacent depth averaged 0.37m (n=5). All depth measurements can be viewed in Appendix A.

Pit substrate ranged from small cobble (4-6”) to small gravel (0.2-2”, n=7). The most common dominant substrate found in pits of redds was large gravel. The most common subdominant substrate found in pits of redds was medium gravel. Mound substrate ranged from large gravel (2-3”) to small gravel (.2-2”, n=7). The most common dominant substrate found in mounds of redds was medium gravel. The most common subdominant substrate found in mounds of redds was also medium gravel. All substrate data can be viewed in Appendix B.

Types of nearest cover/escape habitat included object cover with in-water overhang, object cover with out-of-water overhang, and no object cover with out-of-water overhang. Cover vegetation types included small woody debris, willows, sedges, and trees with a diameter at breast height (dbh) less than 4 inches (n=7). Average distance to cover was 4.03m (n=7). All cover data can be viewed in Appendix B.

Table 2. Location of redds and coho salmon.

Redd Location	Rkm	UTM Coordinates	# of Redds	# fish observed on Redds
Side Channel Across from R-Ranch	306.5	10 T 544714 4640127	2	1
5m above Cottonwood Cr.	297.3	10 T 514745 4634352	1	1
Across from Quigleys Store	261.0	10 T 512888 4631052	1	0
Barkhouse Side Channel	256.65	10 T 512767 4631046	1	0
Barkhouse Side Channel	256.60	10 T 512810 4631029	2	0
Barkhouse Side Channel	256.60	10 T 505152 4631740	1	0
Side Channel 250m Below Kohl Cr.	247.65	10 T 537847 4637481	1	0

Discussion

The 9 coho redds observed in the 2008 survey were slightly higher than the 6 coho redds counted in 2002, 2004, and 2005 and the 7 coho redds counted in 2003. In 2001, a total of 21 coho redds were counted, including 8 redds between Indian Creek and Chambers Flat (Magneson 2006). On December 11, 2008 the reach between Indian Creek and Chambers Flat was floated and no redds were observed. Substrate of critical spawning areas in this reach has changed in recent years, with cobble and aquatic vegetation replacing the small to large gravel (M. Polmateer, Karuk Tribal Fisheries Department, personal communication). Aside from the 2001 redd survey, the 2008 coho redd survey resulted in the highest concentration of redds above Indian Creek.

Although it is difficult to infer significance when dealing with small sample sizes, it appears that on average, the 2008 redds were not as deep as redds measured in 2001-2005 (Table 3). This could be a result of varying flows over the study area. Even though the 2008 redds were not as deep as in previous years, they still are considerably deeper than the mean adjacent depth reported in Briggs (1953). Hardin et al. (2005) found that Chinook salmon spawning in the mainstem Klamath River downstream of IGD also construct redds in deeper water compared to populations in other rivers.

The timing of the 2008 coho redd survey is probably at or very close to peak spawning time for coho salmon in the mainstem Klamath River. Based on 2004 weir operations by CDFG, peak Shasta River spawning occurs after the second week in December (Hampton 2005). Also, the

majority (63%) of redds in the 2001-2005 were observed in surveys on December 10 or December 11 (Magneson 2006).

Dominant pit and mound substrates for most redds included medium to large gravel (Appendix B). These results are similar to the preferred substrate range found by Briggs (1953; 3.9-13.7cm) and are also consistent with redd substrates in the 2001-2005 Klamath River coho redd surveys.

Table 3. Comparison of redd parameters from this report to previous reports..

	Klamath River		Other Systems	
Parameter	2008	2001-2005	Value	Source
Mean Adjacent Depth (m)	0.37	0.55	0.16[a]	Magneson (2006), Briggs (1953)
Mean Pit Depth (m)	0.52	0.61		Magneson (2006)
Mean Mound Depth (m)	0.24	0.38		Magneson (2006)

[a] "depth of water over redd"

Acknowledgements

The Arcata Fish and Wildlife Office wishes to acknowledge the Karuk Tribe of California, Department of Natural Resources, for providing support and personnel. Arcata Fish and Wildlife Office would like to thank Mike Polmateer, Ken Brink, and Amanda Piscitelli for their assistance in data collection.

Literature Cited

Briggs, J.C. 1953. The behavior and reproduction of salmonid fishes in a small coastal stream. Calif. Dep. Fish Game Fish. Bull. 94:62 p.

Brown, L. R., P. B. Moyle, and R. M. Yoshiyama. 1994. Historical decline and current status of coho salmon in California. North American Journal of Fisheries Management 14:237-261.

Burner, C.J. 1951. Characteristics of spawning nests of Columbia River salmon. U.S. Fish and Wildlife Service Fishery Bulletin 52(61):97-110

Crone, R.A., and C.E. Bond. 1976. Life history of coho salmon *Oncorhynchus kisutch*, in Sashin Creek, southeastern Alaska. Fish. Bull.(U.S.) 74:897-923

Frissell, C. A. 1993. Topology of extinction and endangerment of native fishes in the Pacific Northwest and California (U.S.A.). Conservation Biology 7:342-345.

Gribanov, V.I. 1948. The coho salmon (*Oncorhynchus kisutch* Walb.) - a biological sketch. Izv. Tikhookean. Nauchno-Issled. Inst. Rybn. Khoz. Okeanogr. 28:43-101. (Transl. from Russian; Fish. Res. Board Can. Transl. Ser. 370)

Groot, C., and L. Margolis. 1991. Pacific Salmon Life Histories. University of British Columbia Press, Vancouver, British Columbia.

Hampton, M. 2004. Shasta River Fish Counting Facility, Chinook and Coho Salmon Observations in 2004, Siskiyou County, CA. California Department of Fish and Game, Klamath River Project, 303 South Street, Yreka, CA 96097.

Hardin, T.S., R.T. Grost, M.B.Ward, and G.E. Smith. 2005. Habitat Suitability Criteria for Anadromous Salmonids in the Klamath River, Iron Gate Dam to Scott River, California. Department of Fish and Game Stream Evaluation Report No. 05-1. 73pp.

Hardy, T.B. and R.C. Addley. 2001. Evaluation of interim instream flow needs in the Klamath River: Phase II – Volume 1. Draft. November 21, 2001. 148 pp.

Hawkins, C.P., and 10 coauthors. 1993. A hierarchical approach to classifying stream habitat features. Fisheries 18(6):3-12

Laufle, J. C., G. B. Pauley, and M. F. Shepard. 1986. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Northwest) - - coho salmon. 82(11.48). U.S. Army Corps of Engineers, TR EL-82-4. 18 pp.

Leidy, R.A. and G.R. Leidy. 1984. Life stage periodicities of anadromous salmonids in the Klamath River Basin, northwestern California. U.S. Fish and Wildlife Service, Division of Ecological Services, Sacramento, CA. 21 pp.

Magneson, M.D., and S.A. Gough. 2006. Mainstem Klamath River Coho Salmon Redd Surveys 2001 to 2005. U. S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Arcata Fisheries Data Series Report DS 2006-07, Arcata, California.

Nehlsen, W., J. E. Williams, and J. A. Lichatowich. 1991. Pacific salmon at the crossroads: stocks at risk from California, Oregon, Idaho, and Washington. Fisheries 16:4-21.

Thompson, K. 1972. Determining stream flows for fish. Instream flow requirements workshop. Pacific Northwest River Basins commission, Vancouver, Washington.

Weitkamp, L. A., T. C. Wainwright, G. J. Bryant, G. B. Milner, D. J. Teel, R. G. Kope, and R. S. Waples. 1995. Status review of coho salmon from Washington, Oregon, and California. U.S. Department of Commerce., NOAA Technical Memo. NMFS-NWFSC-24:258p.

Appendix A. Mesohabitat, in-stream location, and depth measurements of individual redds.

		Mesohabitat		In-Stream Location		Depth measurements			
Redd Location	Rkm	Number	Type	Distance from Redd to shore (m)	Distance to Closest Redd (m)	Depth directly upstream of redd (m)	Average Adjacent Depth (m)	Pit Depth (m)	Mound Depth (m)
Side Channel Across from R-Ranch	306.5	20.2	P	1.86	0.93				
Side Channel Across from R-Ranch	306.5	20.2	P	0.93	0.93				
5m above Cottonwood Cr.	297.3	70	P		N/A				
Across from Quigleys Store	261.0	319.3	LS	3.16	N/A	0.47	0.55	0.68	0.43
Barkhouse Side Channel	256.65	342.50	LS	1.36	N/A	0.25	0.28	0.40	0.16
Barkhouse Side Channel	256.60	342.60	P	1.89	1.64	0.56	0.48	0.62	0.28
Barkhouse Side Channel	256.60	342.60	P	0.81	1.64	0.34	0.28	0.47	0.16
Barkhouse Side Channel	256.60	342.60	LS	1.52	N/A	0.31	0.25	0.43	0.19
Side Channel 250m Below Kohl Cr.	247.65	397.10	P		N/A				
Avg.				1.65	1.29	0.38	0.37	0.52	0.24
Min.				0.81	0.93	0.25	0.25	0.40	0.16
Max.				3.16	1.64	0.56	0.55	0.68	0.43

Appendix B. Substrate and cover measurements of individual redds.

		Substrate Measurements						Cover Measurements		
Redd Location	Rkm	Stream Substrate (Dominant)	Stream Substrate (Subdominant)	Pit Substrate (Dominant)	Pit Substrate (Subdominant)	Mound Substrate (Dominant)	Mound Substrate (Subdominant)	Distance to nearest cover (m)	Cover Code	Cover Type
Side Channel Across from R-Ranch	306.5	26	2	23	22	22	22	3.1	6	16
Side Channel Across from R-Ranch	306.5	26	2	23	22	22	22	2.48	6	16
5m above Cottonwood Cr.	297.3	22	24							
Across from Quigleys Store	261.0	23	25	22	23	22	22	1.49	4	8
Barkhouse Side Channel	256.65	25	23	25	23	23	22	1.27	5	5
Barkhouse Side Channel	256.60	25	23	21	22	22	21	2.48	4	10
Barkhouse Side Channel	256.60	25	23	23	22	23	21	4.03	4	10
Barkhouse Side Channel	256.60	24	21	24	22	22	21	1.27	4	8
Side Channel 250m Below Kohl Cr.	247.65									
Mode		25	23	23	22	22	22		4	8,10,16
Average								2.3		
Minimum								1.27		
Maximum								4.03		