

Mainstem Klamath River Fall Chinook Spawning Survey

Fiscal Year 1993

Prepared by:
Thomas A. Shaw

of

U.S. Fish and Wildlife Service
Coastal California Fishery Resource Office
Arcata, CA

January, 1994

AFF 1-FRO-94-1

Funded by:
Klamath River Fish and Wildlife Restoration Act (P.L. 99-552)

DISCLAIMER

Mention of trade names or commercial products in this report does not constitute endorsement by the U.S. Fish and Wildlife Service.

TABLE OF CONTENTS

LIST OF FIGURES ii

LIST OF TABLESiii

ACKNOWLEDGEMENTS iv

ABSTRACT 1

INTRODUCTION 2

MATERIALS AND METHODS 2

 Equipment 2

 Survey Reaches 3

 Fall Chinook Redd Counts 4

 Carcass Data 4

 Spawning Habitat Availability 4

RESULTS AND DISCUSSION 5

 Fall Chinook Redd Counts 5

 Redd Measurements12

 Spawning Habitat Availability12

 Carcass Surveys15

SUMMARY17

REFERENCES19

PERSONAL COMMUNICATIONS19

APPENDIX A20

APPENDIX B22

LIST OF FIGURES

<u>Figure</u>	<u>Page</u>
1. Redd locations on the mainstem Klamath River (Iron Gate Dam - Empire Creek)	6
2. Redd locations on the mainstem Klamath River (Vesa Creek - Scott River)	8
3. Redd locations on the mainstem Klamath River (Tom Martin Creek - Portuguese Creek)	9
4. Redd locations on the mainstem Klamath River (Fort Goff Creek - Indian Creek)	10
5. Redd area (m ²) frequency histogram of fall chinook redds observed on the mainstem Klamath River (Iron Gate Dam - Indian Creek), 1993 (n = sample size, S.D. = Standard Deviation)	13
6. Redd pit, depth, and mound depth frequency histograms for the mainstem Klamath River (Iron Gate Dam - Indian Creek), 1993 (n = sample size, S.D. = Standard Deviation)	14
7. Fork length frequency histogram of fall chinook collected on the mainstem Klamath River (October - November 1993), (n = sample size S.D. = Standard Deviation)	16

LIST OF TABLES

<u>Table</u>	<u>Page</u>
1. Summary of redd counts observed in the Klamath River from Iron Gate Dam to the confluence of Indian Creek	6
2. Natural fall chinook spawner escapement for the Klamath River (Excl. Trinity River), (from CDFG 1993 Klamath River Basin Fall Chinook Spawner Escapement summary).....	11
3. Estimated chinook spawning habitat in square meters (m ²) on the mainstem Klamath River (Iron Gate Dam - Indian Creek)	12

ACKNOWLEDGEMENTS

The U.S. Fish and Wildlife Service and the author acknowledges the field assistance by the Coastal California Fishery Resource Office personnel Jeffrey Chan, Charles Chamberlain, Richard Quihillalt, John Lang, and Greg Goldsmith. Tom Kisanuki for the conception of this project. Mark Pisano (California Department of Fish and Game) for information of historical surveys on the mainstem Klamath River.

Special thanks to Klamath River guides Tim Grenvik and Bob Claypole for assistance locating spawning locations and to Dennis Laurence for information regarding maneuvering through rapids located throughout the survey.

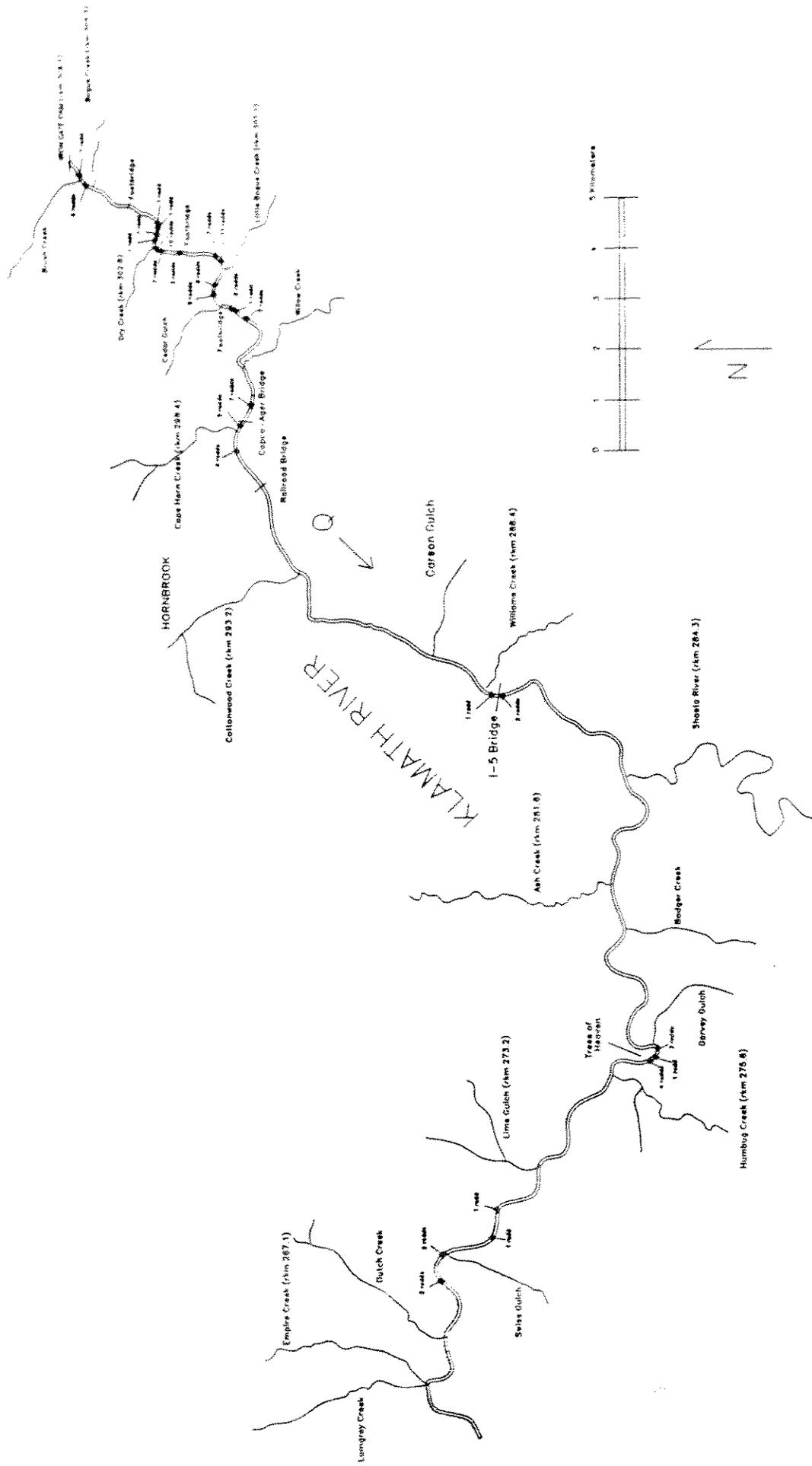


Figure 1. Redd locations on the mainstem Klamath River (Iron Gate Dam - Empire Creek).

Reach 2: Ash Creek River Access to Beaver Creek Riffle River Access (Figures 1 and 2).

A total of 38 redds were observed in this reach. As observed in Reach 1, peak spawning occurred during the first week of November and was concluded by the second week of November. Concentrations of redds were observed at the Trees of Heaven Campground (Humberg Point) with other redds observed at Swiss Bar (Swiss Gulch), Vesa Creek confluence area, and a few redds just upstream from the confluence of Beaver Creek. A majority of suitable spawning gravel areas had redds associated with them. Redds were again observed in side channels with suitable gravel.

Reach 3: Beaver Creek Riffle River Access to Blue Heron River Access (Figure 2).

A total of 56 redds were observed in this reach. Unlike Reaches 1 and 2, peak spawning in this reach occurred during the last week of October. Another influx of redds occurred in during the second week of November with four new redds observed on the final week (third week of November) of the survey (Table 1). Redd locations, as displayed in Figure 3, were located throughout this reach. Higher concentrations of redds were observed in the Kohl Creek confluence area (rkm 244.9), 1.5 rkm upstream from the Highway 96 bridge above Horse Creek, and the area upstream and downstream of the Horse Creek confluence.

Reach 4: Blue Heron River Access to Seiad Bar (Figure 2 and 3).

A total of 31 redds were observed in this reach. As observed in Reach 3, peak spawning occurred during the last week of October with an additional influx of redds during the second week of November. An additional 5 new redds were observed on the third week of November (Table 1). Redds were observed throughout this reach with higher concentrations observed in the Schutts Creek confluence area, Walker Creek confluence area. Several redds were observed in side channels where suitable gravel and velocities were present.

Reach 5: Seiad Bar to China Point River Access (Figures 3 and 4).

A total of 31 redds were observed in this reach. Peak spawning was observed during the last week of October through the first week of November. No new redds were observed after the first week of November. Concentrations of redds were located in sidechannel areas along Seiad Bar and the side channel at the confluence of Grider Creek. Redds were also observed below Fort Goff Creek and upstream of the China Point River Access. No redds were observed in the Thompson Creek confluence area (Figure 4).

Reach 6: China Point River Access to Indian Creek River Access (Figure 4).

A total of 87 redds were observed in this reach. Peak spawning occurred during the last week of October (81 redds). Redd counts tapered off with only 1 redd observed during the second week of November. Redd concentrations were observed along China Point, Williams Point, Morgan Point and 1-2 rkm upstream of Cade Creek (Figure 4). Redd observations decreased downstream of the Cade Creek confluence.

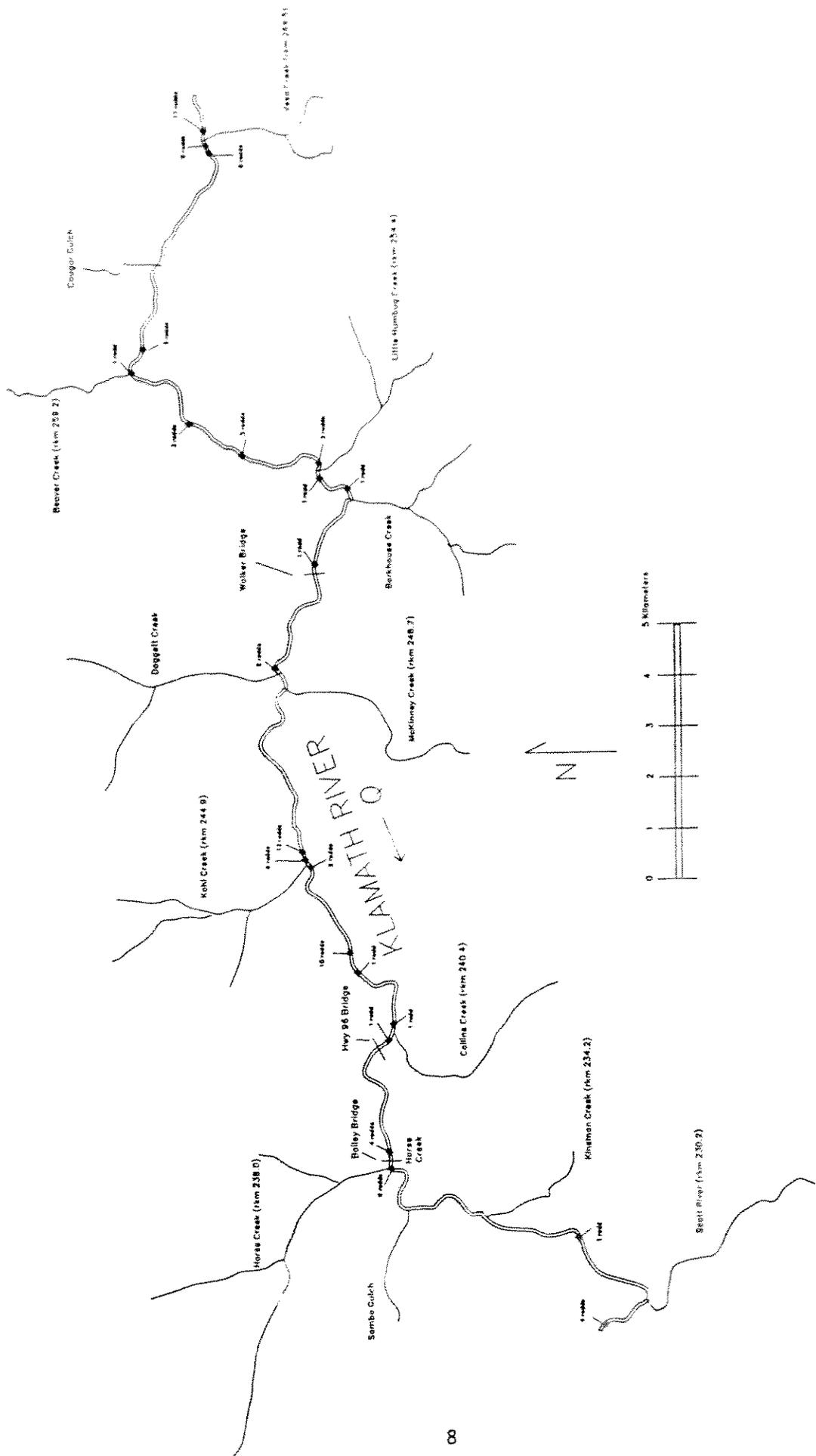


Figure 2. Redd locations on the mainstem Klamath River (Vesa Creek - Scott River).

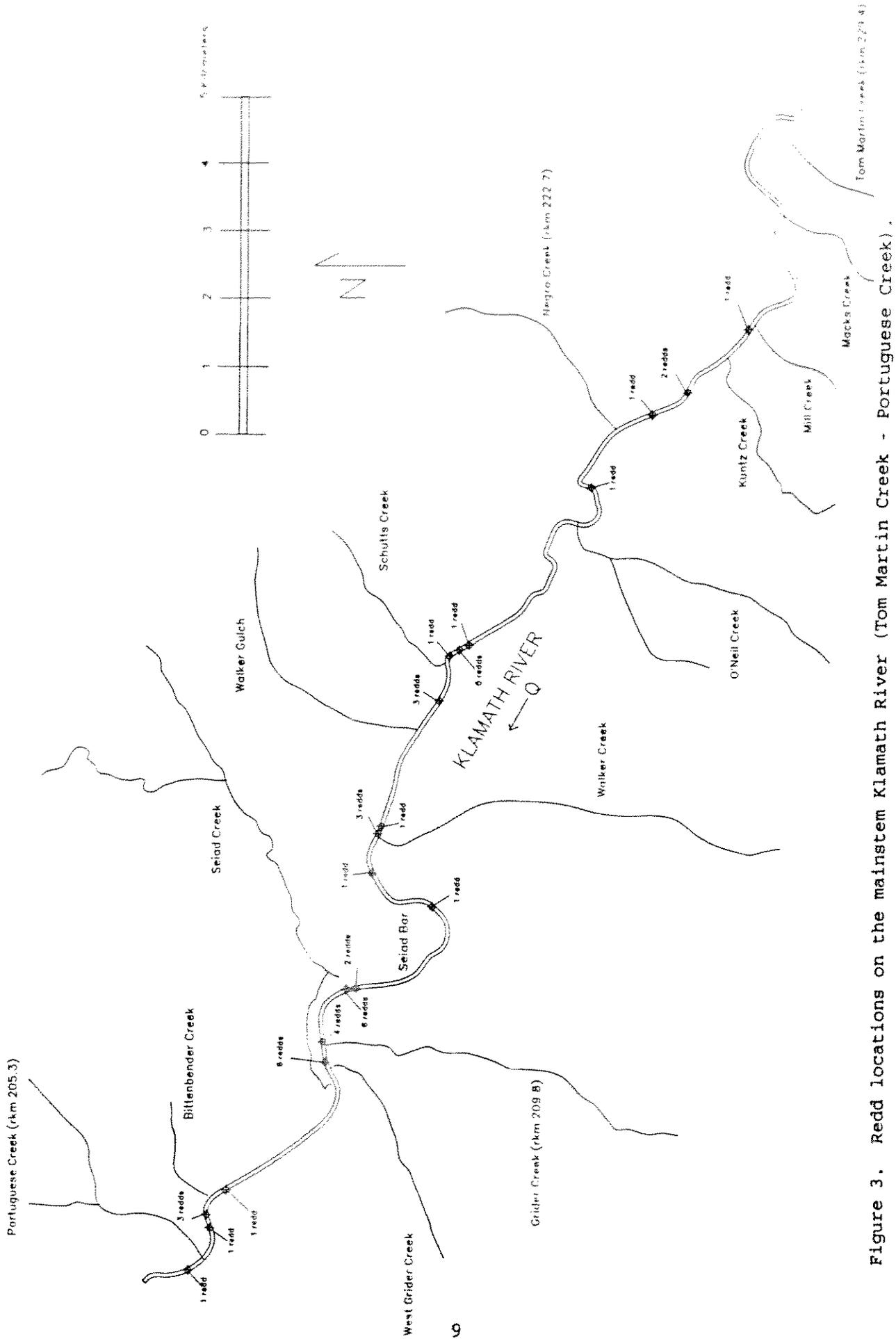


Figure 3. Redd locations on the mainstem Klamath River (Tom Martin Creek - Portuguese Creek).



Figure 4. Redd locations on the mainstem Klamath River (Fort Goff Creek - Indian Creek).

Spot Surveys:

Indian Creek confluence to Chamber Flat (168.8) had no spawning activity and was highly disturbed by suction dredge mining.

The river from Independence Creek River Access (rkm 151.3) to Coon Creek River Access (rkm 143.5) had little spawning habitat and redds were not observed.

The reach from Persido Bar River Access (rkm 131.7) to Green Riffle River Access (rkm 112.5) was surveyed on November 19 and nine redds were observed. Four redds were located in a side channel located just upstream of Irvin Creek (rkm 120.9) and five redds were observed in a side channel just upstream of Rogers Creek (rkm 116.4).

A majority of the observed redds were placed along the edge of the wetted channel where suitable spawning gravel and flows occurred. Numerous redds were also observed in side channels and point bars.

The total of 339 redds was expanded to 647 adult spawners by California Department of Fish and Game (CDFG, 1993, see Table 2). A total of 31 grilse was added to the estimate based on percentages of grilse observed in the major tributaries on the upper Klamath River.

Table 2. Natural fall chinook spawner escapement for the Klamath River (Excl. Trinity River), (from CDFG Klamath River Basin Fall Chinook Spawner Escapement summary).

Natural Spawning Areas	1992			1993		
	Grilse	Adults	Total	Grilse	Adults	Total
Salmon River Basin	547	778	1,325	171	3,548	3,719
Scott River Basin	985	1,873	2,838	159	3,299	3,458
Shasta River Basin	66	520	586	73	1,226	1,299
Bogus Creek Basin	556	598	1,154	175	3,628	3,803
Mainstem Klamath River (excluding Iron Gate Hatchery)	234	366	600	31	647	678
Misc. Klamath tributaries (above Hoopa Reservation)	153	280	433	94	1,943	2,037
Total Natural Spawner Escapement	2,521	4,415	6,936	703	14,291	14,994

Redd Measurements

Of the 339 total fall chinook redds observed, 135 redds (40%) were measured for length, width, substrate size, pit depth, mound depth, and adjacent depth.

The average substrate percentages used by fall chinook spawning during the 1993 survey were 4.1% large cobble, 19.4% small cobble, 46.3% large gravel, 24.5% small gravel, and 5.7% sand and silt. The average redd size calculated from 135 measured redds was 7.5 square meters with a standard deviation (S.D.) of 4.1 square meters (Figure 5). The mean stream depth of spawning, calculated by measuring the adjacent depth of 133 redds was 0.64 meters (S.D. = 0.16 meters). A mean depth 0.76 meters (S.D. = 0.18) of the redd pit was calculated for 135 measured redds and a mean mound depth of 0.52 meters (S.D. = 0.17) for 135 measured redds (Figure 6). Point velocities adjacent from observed redds (n = 11) ranged from a low of 0.41 meters/second (1.38 feet/second) to a high of 1.09 meters/second (3.58 feet/second).

Spawning Habitat Availability:

Estimated spawning habitat for the mainstem Klamath River based on all measured areas totaled 129,288 square meters (Table 2). Of the 150 measured spawning areas, 89 (59%) had associated redds. Spawning gravel above the Interstate 5 bridge was inundated with rooted aquatic vegetation.

Table 3. Estimated chinook spawning habitat in square meters (m²) on the mainstem Klamath River (Iron Gate Dam - Indian Creek).

Location	River Kilometer	Measured Spawning Habitat (m ²)	Number of Redds Observed
Iron Gate Dam to Ash Creek River Access	306.1 - 281.6	13,269	87
Ash Creek River Access to Beaver Creek Riffle River Access	281.6 - 257.1	14,590	38
Beaver Creek Riffle River Access to Blue Heron River Access	257.1 - 231.8	21,421	56
Blue Heron River Access to Seiad Bar	231.8 - 212.7	5,525	31
Seiad Bar to China Point River Access	212.7 - 189.8	39,840	31
China Point River Access to Indian Creek Confluence	189.8 - 171.1	34,643	87
	Total	129,288	330

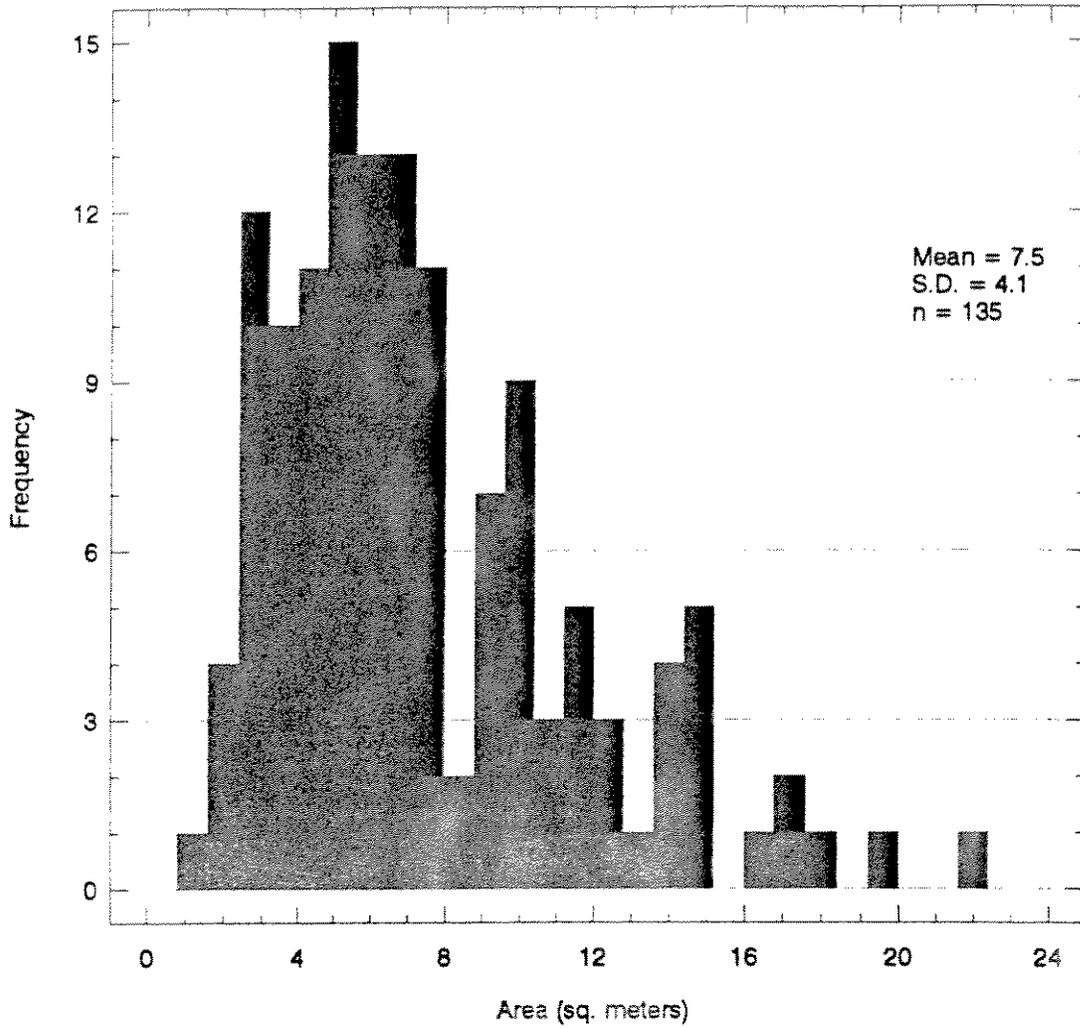


Figure 5. Redd area in (m²) frequency histogram of fall chinook redds observed on the mainstem Klamath River (Iron Gate Dam - Indian Creek), 1993 (S.D. = Standard Deviation, n = sample size).

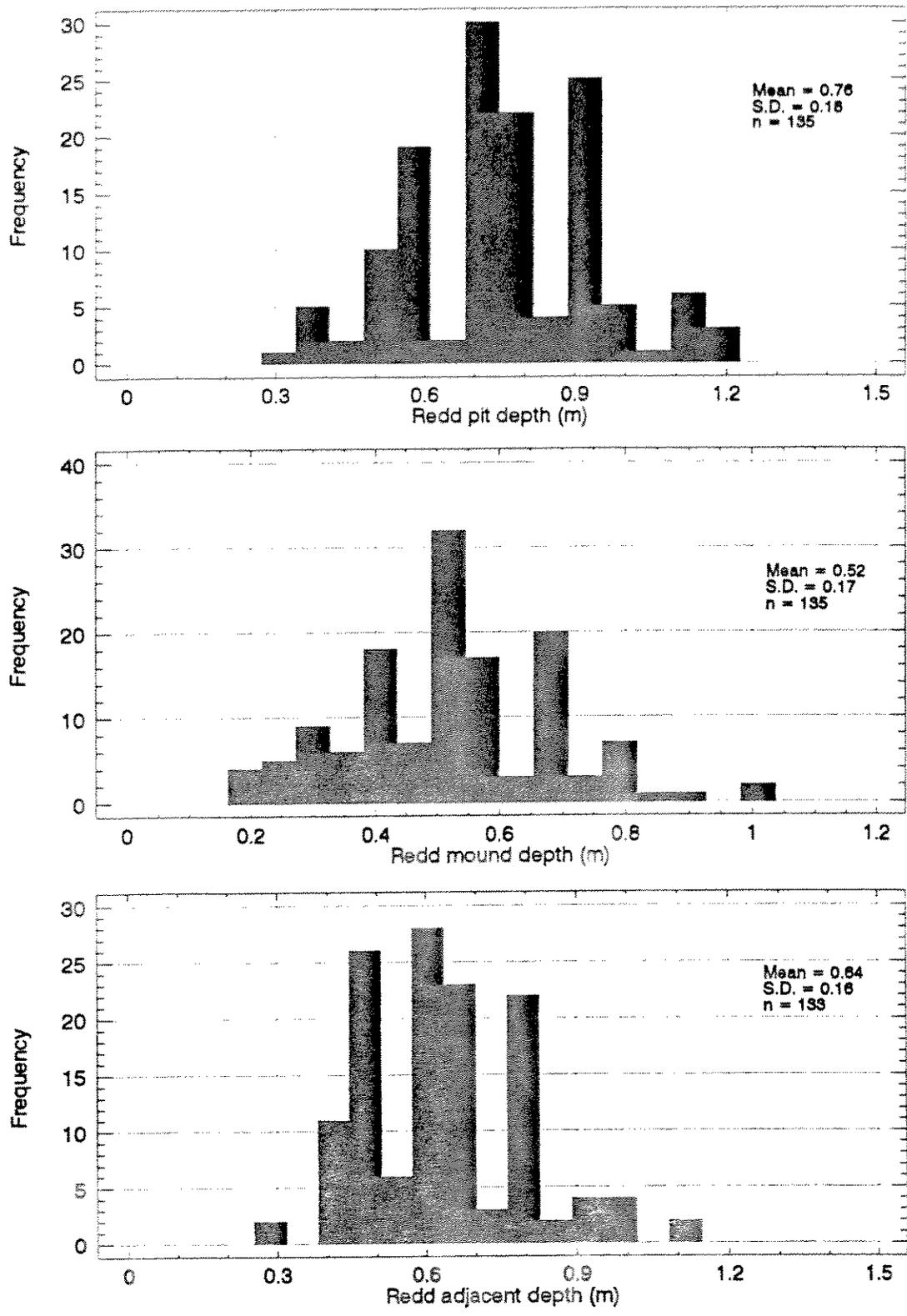


Figure 6. Redd pit, depth, and mound depth frequency histograms for the mainstem Klamath River (Iron Gate Dam - Indian Creek), 1993 (n = sample size, S.D. = Standard Deviation).

The substrate was angular and embedded in many areas. It appears that the recruitment of suitable gravel has been eliminated by the construction of Iron Gate Dam. Other than Bogus Creek, few large tributaries are present for the recruitment of quality spawning gravel until the confluence of Shasta River. Suitable spawning gravel was observed along the wetted channel margins and side channels, when present.

The average fall chinook redd size was 7.5 square meters for the mainstem Klamath River, derived by measuring 135 redds. Doubling this mean value to allow redd separation provides an estimate of 15.0 square meters of space required per chinook spawning pair. Using the estimate of measured spawning gravel of 129,288 square meters, this represents a theoretical total of 8,619 potential fall chinook spawning pairs for the mainstem Klamath River (Iron Gate Dam - Indian Creek confluence) if available habitat was used. A total of 1,013 square meters of spawning gravel was used in the 135 measured redds.

Increased levels of sand/silt was observed below suction dredge mining operations, along with uneven gravel tailing. Chinook were observed to use only even bottom substrate with an average depth of 0.6 meters. It is unknown what extent suction dredging tailings impact the incubation of fall chinook eggs. Excessive sand/silt was present in spawning gravel in the Happy Camp area. Interviews with local fishing guides indicated that entire spawning beds in the past have been dewatered during excessive dredging.

Carcass Surveys

A total of 155 fall chinook carcasses were collected during the survey. A length frequency histogram was derived (Figure 7) with mean fork length of 65 cm (S.D. = 6.36). Of the 155 measured chinook, 69 (44%) were males, 80 (52%) were females, and 6 were unknown. The majority of carcasses were collected above the confluence of Shasta River. Apparently, the Iron Gate Fish Hatchery was releasing chinook back in the stream and pulling adipose clipped fish before the releases (Pisano pers. comm., 1993). Adipose fin clipped carcasses were not observed during the survey. Of the 59 female carcasses examined for prespawning mortalities, 31 (53%) were observed with abdominal cavities full of eggs. No prespawning mortalities were observed below the Shasta River confluence. The carcass data collected during this survey was highly biased by the influx of Iron Gate Hatchery and Bogus Creek fish. Only 10 carcasses were collected below the confluence of Shasta River. Scales were collected from 47 adults and the information is currently being analyzed, and will be presented in a separate report.

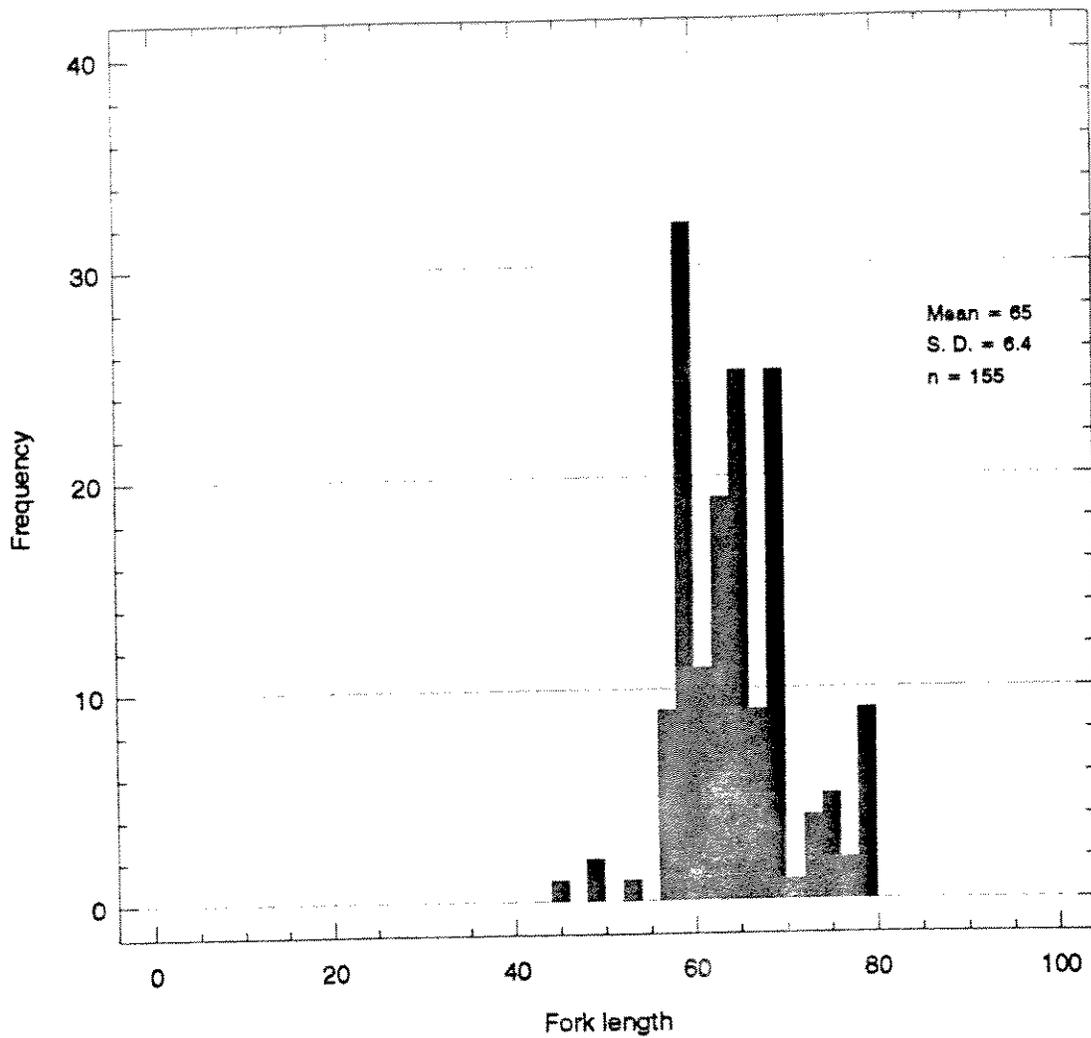


Figure 7. Fork length frequency histogram of fall chinook collected on the mainstem Klamath River (October - November 1993), (n = sample size, S.D. = Standard Deviation).

SUMMARY

The total of 339 fall chinook redds observed in the fall of 1993 is the first attempt to locate and enumerate the magnitude of spawners in mainstem Klamath River from Iron Gate Dam to the confluence of Indian Creek. Local fishing guides, who have drifted the mainstem Klamath River for decades, have expressed that this years spawning run on the mainstem is notably lower than past years; although, information reported by CDFG indicates this years run of 647 adults, based on the 339 redds observed, is the highest since 1989.

Redds were located throughout the mainstem from Iron Gate Dam downstream to the confluence of Indian Creek. A total of 87 (26%) redds were observed above the Shasta River confluence which was once believed to have the majority of spawning activity in the mainstem. An additional 9 redds were observed on a spot survey below the confluence of Dillon Creek (Persido Bar River Access (rkm 131.7) to Green Riffle River Access (rkm 112.5) indicating further spawning occurs below the confluence of Indian Creek. Peak spawning was observed during the last week of October in the lower reaches and the first week of November in the upper reaches. New redds were observed during the second week of November in reaches 3 and 4 (Table 1). Redds were observed primarily in the run habitat type along the channel margins and side channels. Very few redds were located in the mid-channel.

Use of carcasses as a method of estimating the natural run size of the mainstem Klamath River was found to be useless due to the addition of adults from Iron Gate Hatchery, Bogus Creek, and other major spawning tributaries, thereby biasing the count of true mainstem spawners. Relatively few carcasses were observed below the Interstate 5 Bridge making mark-recapture estimates ineffective; therefore, redd observations were determined to be the most effective method for determining the spawning success in the mainstem Klamath River.

The estimate of spawning gravel availability of 129,288 square meters was determined to support 8,619 spawning pairs if all available habitat was used from Iron Gate Dam to the confluence of Indian Creek. This estimate was based on the average redd size of 7.5 square meters (135 measured redds) and doubling this figure to allow for redd separation. This estimate was taken during November 8 - November 12 when flows for the Klamath River (Orleans, USGS station) was 2,633 cfs. This estimate would change depending of flow conditions where the measured gravel would become less suitable with higher flow, although other gravels would become available. Of the 150 suitable spawning gravel areas, 89 (59%) had associated redds.

Spawning gravel above the Interstate 5 bridge was observed to be inundated with rooted aquatic vegetation, the substrate was angular and embedded in many areas. It appears that the construction of Iron Gate Dam has eliminated the recruitment of quality spawning gravel. Other than Bogus Creek, few large tributaries are present for the recruitment and flushing of existing spawning gravel. Embedded gravel was noted below the confluence of Beaver Creek indicating this creek as an input source of sand and silt. Information gathered from fishing guides had indicated historically the gravel below the Beaver Creek confluence to have a high concentration of redds, but due to the embeddedness, only 1 redd was observed in this area this fall. West et al. 1990 reported that the Beaver Creek drainage is heavily roaded to provide logging access and its tributaries exhibit a high suspended sediment load during high flow events.

The impacts of dredging related substrate alterations were observed in numerous areas throughout the survey. The negative impact on spawning gravel was apparent due to the unevenness of tailing piles. Redds observed during this survey were located in even substrate of suitable size, depth and velocity. The uneven tailing piles would not become available until sufficient leveling flows (November/December), although, as observed in this survey, peak spawning occurred in the last week of October to the first week of November. Fishing guides had mentioned that entire spawning areas had been dewatered after sustained dredging. Dredging, if continued, should be confined to pool habitats and/or mid channel habitats to deter the impacts of spawning and incubation. Impacts on holding adults is unknown, but is potentially adverse.

The continuation of the fall chinook spawning surveys is imperative to provide the managers of Klamath River with reliable estimates of mainstem fall chinook spawner estimates.

REFERENCES

- Briggs, J.C. 1953. The behavior and reproduction of salmonid fishes in a small coastal stream. Calif. Dept. of Fish and Game, Marine Fisheries Branch, Fish Bulletin No. 94: 7-63.
- Hubbell, P.M. Calif. Dept. of Fish and Game. 1993. Memorandum. Klamath River Basin fall chinook salmon spawner escapement, in-river harvest and run-size estimates, 1978-1992. Sacramento, California.
- Reiser, D.W., and T.C. Bjornn. 1979. Habitat requirements of anadromous salmonids. General Tech. Report PNW-96. USDA Forest Service, Portland, OR. 56 p.
- U.S. Dept. of the Interior. 1985. Klamath River Basin Fisheries Resource Plan. Prepared by CH2M Hill for the Bureau of Indian Affairs, Redding, CA.
- West, J.R., O.J. Dix, A.D. Olson, M.V. Anderson, S.A., and J.H. Power. 1990. Evaluation of Fish Habitat Conditions and Utilization in Salmon, Scott, Shasta, and Mid-Klamath Sub-Basin Tributaries. Annual Report-1988/1989. For Interagency Agreement 14-16-0001-89508. U.S. Forest Service, Klamath National Forest 231 p.

PERSONAL COMMUNICATIONS

- Pisano, M. 1993. California Department of Fish and Game, Yreka, California.

Appendix A. Redd measurements from Iron Gate Dam - Indian Creek, 1983.

Location	Date	Length (m)	Width (m)	Area (sq. meters)	Pit depth (m)	Round depth (m)	Large cobble	Small Cobble (%)	Large gravel (%)	Small gravel (%)	Sand/silt/clay (%)	Adjacent Depth (m)	
Iron Gate Dam - Ash Creek	02-Nov-93	3.20	1.20	3.84	0.80	0.40	0.40	0	5	70	20	5	0.45
Iron Gate Dam - Ash Creek	02-Nov-93	2.00	1.20	2.40	0.40	0.40	0	0	70	20	5	0	0.45
Iron Gate Dam - Ash Creek	02-Nov-93	2.50	1.00	2.50	0.60	0.70	0	0	5	70	20	5	0.45
Iron Gate Dam - Ash Creek	02-Nov-93	2.50	1.50	3.75	0.40	0.40	0	0	5	70	20	5	0.55
Iron Gate Dam - Ash Creek	02-Nov-93	1.80	1.70	3.06	0.70	0.45	0	0	0	0	0	0	0.50
Iron Gate Dam - Ash Creek	02-Nov-93	4.00	2.00	8.00	0.80	0.50	5	20	0	60	15	5	0.70
Iron Gate Dam - Ash Creek	02-Nov-93	2.50	1.00	2.50	0.30	0.50	20	10	10	40	15	5	0.40
Iron Gate Dam - Ash Creek	02-Nov-93	2.70	1.10	2.97	0.40	0.40	5	55	25	25	25	5	0.40
Iron Gate Dam - Ash Creek	02-Nov-93	3.50	1.50	5.25	0.60	0.50	15	40	20	20	20	5	0.65
Iron Gate Dam - Ash Creek	02-Nov-93	5.00	2.00	10.00	0.80	0.50	10	45	45	20	20	5	0.70
Iron Gate Dam - Ash Creek	02-Nov-93	4.00	1.50	6.00	0.90	0.75	15	40	20	20	20	5	0.80
Iron Gate Dam - Ash Creek	02-Nov-93	5.50	2.50	13.75	0.55	0.35	5	10	40	35	10	10	0.45
Iron Gate Dam - Ash Creek	02-Nov-93	3.50	1.50	5.25	0.50	0.35	5	10	40	35	10	10	0.40
Iron Gate Dam - Ash Creek	02-Nov-93	3.50	1.00	3.50	0.75	0.20	15	25	25	25	10	10	0.40
Iron Gate Dam - Ash Creek	02-Nov-93	4.00	2.00	8.00	0.90	0.60	5	30	35	30	5	5	0.75
Iron Gate Dam - Ash Creek	02-Nov-93	3.50	1.50	5.25	0.85	0.65	10	25	25	25	10	10	0.70
Iron Gate Dam - Ash Creek	02-Nov-93	3.00	2.00	6.00	0.85	0.65	10	30	30	25	10	10	0.80
Iron Gate Dam - Ash Creek	02-Nov-93	3.00	1.50	4.50	0.90	0.70	0	40	40	40	20	20	0.70
Iron Gate Dam - Ash Creek	02-Nov-93	2.50	1.30	3.25	0.80	0.40	0	0	50	40	10	10	0.80
Iron Gate Dam - Ash Creek	02-Nov-93	4.80	1.50	7.20	0.60	0.50	0	40	40	40	20	20	0.80
Iron Gate Dam - Ash Creek	02-Nov-93	2.80	2.00	5.60	0.70	0.40	0	0	50	30	20	10	0.80
Iron Gate Dam - Ash Creek	02-Nov-93	4.50	1.50	6.75	0.60	0.30	0	0	50	30	20	10	0.80
Iron Gate Dam - Ash Creek	02-Nov-93	4.50	1.50	6.75	0.40	0.20	0	0	30	30	30	10	0.80
Iron Gate Dam - Ash Creek	02-Nov-93	4.80	1.50	7.20	0.80	0.40	0	0	60	30	10	10	0.80
Iron Gate Dam - Ash Creek	02-Nov-93	4.80	2.50	12.00	0.70	0.40	0	0	60	30	10	10	0.80
Iron Gate Dam - Ash Creek	02-Nov-93	5.00	2.00	10.00	0.90	0.35	5	20	50	50	20	0	0.80
Iron Gate Dam - Ash Creek	02-Nov-93	3.50	1.00	3.50	0.60	0.40	0	0	50	50	20	0	0.80
Iron Gate Dam - Ash Creek	02-Nov-93	3.50	2.00	7.00	0.90	0.80	15	25	50	50	10	10	0.80
Ash Creek - Beaver Riffe	28-Oct-93	3.50	3.00	10.50	0.70	0.55	10	10	65	15	5	5	0.85
Ash Creek - Beaver Riffe	28-Oct-93	2.80	1.50	4.20	0.45	0.45	30	35	35	35	5	5	0.85
Ash Creek - Beaver Riffe	28-Oct-93	2.10	1.10	2.31	0.80	0.45	10	10	30	35	5	5	0.80
Ash Creek - Beaver Riffe	28-Oct-93	3.00	1.50	4.50	0.60	0.40	0	0	40	40	25	5	0.80
Ash Creek - Beaver Riffe	28-Oct-93	4.00	2.50	10.00	0.80	0.45	5	25	40	40	25	5	0.80
Ash Creek - Beaver Riffe	28-Oct-93	2.50	2.50	6.25	0.70	0.50	5	40	40	40	10	5	0.80
Ash Creek - Beaver Riffe	28-Oct-93	4.00	2.50	10.00	0.60	0.50	5	40	40	40	10	5	0.80
Ash Creek - Beaver Riffe	28-Oct-93	4.00	2.50	10.00	0.70	0.45	5	40	40	40	15	5	0.80
Ash Creek - Beaver Riffe	03-Nov-93	3.50	3.00	10.50	0.90	0.70	20	20	35	35	15	5	0.80
Ash Creek - Beaver Riffe	03-Nov-93	5.00	2.00	10.00	1.05	0.70	5	20	35	35	5	5	0.80
Ash Creek - Beaver Riffe	03-Nov-93	2.30	1.70	3.91	0.70	0.50	5	20	35	35	5	5	0.80
Ash Creek - Beaver Riffe	03-Nov-93	3.50	1.70	5.95	0.80	0.60	15	40	35	35	10	10	0.80
Ash Creek - Beaver Riffe	03-Nov-93	1.80	1.00	1.80	0.90	0.70	0	20	20	20	5	5	0.80
Ash Creek - Beaver Riffe	03-Nov-93	3.00	1.00	3.00	0.80	0.70	0	20	20	20	5	5	0.80
Ash Creek - Beaver Riffe	03-Nov-93	4.00	1.00	4.00	0.90	0.80	0	20	20	20	5	5	0.80
Ash Creek - Beaver Riffe	03-Nov-93	4.50	1.70	7.65	0.90	0.70	40	20	20	20	5	5	0.80
Ash Creek - Beaver Riffe	03-Nov-93	2.50	1.80	4.50	0.95	0.65	15	10	90	10	5	5	0.80
Ash Creek - Beaver Riffe	03-Nov-93	1.50	1.00	1.50	1.00	0.60	0	70	0	0	0	0	0.80
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.80	5.40	0.40	0.40	6	85	30	30	0	0	0.80
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.80	5.40	0.70	0.20	6	85	30	30	0	0	0.80
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.80	5.40	0.50	0.20	6	85	30	30	0	0	0.80
Beaver Riffe - Blue Heron Access	08-Nov-93	2.60	1.80	4.68	0.45	0.30	5	20	55	20	0	0	0.40
Beaver Riffe - Blue Heron Access	08-Nov-93	3.70	1.80	6.66	1.00	0.70	5	15	50	30	0	0	0.80
Beaver Riffe - Blue Heron Access	08-Nov-93	2.50	1.20	3.00	0.90	0.40	0	40	40	40	20	0	0.50
Beaver Riffe - Blue Heron Access	08-Nov-93	4.50	2.00	9.00	0.90	0.30	0	0	50	30	20	10	0.40
Beaver Riffe - Blue Heron Access	08-Nov-93	4.00	1.50	6.00	0.80	0.40	0	10	50	30	10	10	0.50
Beaver Riffe - Blue Heron Access	08-Nov-93	4.50	1.70	7.65	1.10	1.00	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	4.00	1.00	4.00	0.60	0.60	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.90	0.80	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.60	0.60	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.90	0.80	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.60	0.60	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.90	0.80	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.60	0.60	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.90	0.80	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.60	0.60	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.90	0.80	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.60	0.60	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.90	0.80	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.60	0.60	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.90	0.80	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.60	0.60	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.90	0.80	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.60	0.60	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.90	0.80	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.60	0.60	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.90	0.80	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.60	0.60	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.90	0.80	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.60	0.60	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.90	0.80	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.60	0.60	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.90	0.80	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.60	0.60	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.90	0.80	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.60	0.60	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.90	0.80	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.60	0.60	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.90	0.80	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.60	0.60	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.90	0.80	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.60	0.60	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.90	0.80	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.60	0.60	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.90	0.80	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.60	0.60	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.90	0.80	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.60	0.60	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.90	0.80	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.60	0.60	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access	08-Nov-93	3.00	1.20	3.60	0.90	0.80	0	0	50	30	20	10	0.90
Beaver Riffe - Blue Heron Access													

Location	Date	Length (m)	Width (m)	Area (sq. meters)	Pit depth (m)	Mound depth (m)	Large cobble	Small Cobble (%)	Large gravel (%)	Small gravel (%)	Sand/silt/clay (%)	Adjacent Depth (m)
Blue Heron Access - Sealed Bar	11-Nov-93	4.00	1.00	4.00	4.00	0.95	5	10	40	40	5	0.85
Blue Heron Access - Sealed Bar	11-Nov-93	5.00	2.50	12.50	0.90	0.45	5	10	40	40	5	0.70
Blue Heron Access - Sealed Bar	11-Nov-93	3.00	1.00	3.00	1.00	0.80	15	30	25	25	5	0.90
Blue Heron Access - Sealed Bar	11-Nov-93	4.00	2.00	8.00	1.15	1.00	10	30	25	30	5	1.10
Blue Heron Access - Sealed Bar	27-Oct-93	3.50	1.80	6.30	0.90	0.40	0	10	50	50	0	0.50
Blue Heron Access - Sealed Bar	27-Oct-93	3.00	2.00	6.00	0.90	0.70	0	0	15	15	0	0.70
Blue Heron Access - Sealed Bar	27-Oct-93	3.00	2.50	7.50	0.90	0.30	0	0	0	0	0	0.80
Blue Heron Access - Sealed Bar	27-Oct-93	3.00	1.50	4.50	0.50	0.30	0	5	90	0	0	0.40
Blue Heron Access - Sealed Bar	27-Oct-93	3.50	1.50	5.25	0.60	0.30	5	30	40	25	0	0.50
Blue Heron Access - Sealed Bar	27-Oct-93	2.50	1.00	2.50	0.60	0.30	5	30	40	20	0	0.50
Blue Heron Access - Sealed Bar	27-Oct-93	3.00	1.50	4.50	0.60	0.50	0	50	40	10	0	0.50
Blue Heron Access - Sealed Bar	27-Oct-93	3.00	1.80	5.40	0.90	0.70	0	10	80	10	0	0.80
Blue Heron Access - Sealed Bar	27-Oct-93	4.00	2.50	10.00	0.70	0.50	0	15	75	10	0	0.50
Blue Heron Access - Sealed Bar	27-Oct-93	3.50	2.00	7.00	0.70	0.50	0	30	60	10	0	0.60
Blue Heron Access - Sealed Bar	27-Oct-93	4.00	1.50	6.00	0.90	0.50	0	30	50	20	0	0.60
Blue Heron Access - Sealed Bar	27-Oct-93	5.00	3.50	17.50	0.80	0.50	0	30	60	10	0	0.60
Blue Heron Access - Sealed Bar	27-Oct-93	3.50	2.00	7.00	0.70	0.50	0	15	60	25	0	0.60
Sealed Bar - China Point	04-Nov-93	3.20	1.30	4.16	0.70	0.35	10	20	25	20	5	0.30
Sealed Bar - China Point	04-Nov-93	4.30	1.40	6.02	0.45	0.20	15	20	40	20	10	0.40
Sealed Bar - China Point	04-Nov-93	5.00	1.50	7.50	1.15	0.85	10	25	40	15	5	0.45
Sealed Bar - China Point	04-Nov-93	2.50	1.00	2.50	0.85	0.65	10	35	25	25	5	1.10
Sealed Bar - China Point	28-Oct-93	4.50	2.50	11.25	0.90	0.80	10	40	25	25	5	0.70
Sealed Bar - China Point	28-Oct-93	6.50	3.00	19.50	0.70	0.45	5	10	50	30	5	0.80
Sealed Bar - China Point	28-Oct-93	4.50	2.00	9.00	0.60	0.35	5	10	50	30	5	0.50
Sealed Bar - China Point	28-Oct-93	3.00	1.50	4.50	0.80	0.75	15	40	25	15	5	0.75
Sealed Bar - China Point	28-Oct-93	3.00	3.50	10.50	0.75	0.40	5	50	20	20	5	0.85
China Point - Indian Creek	28-Oct-93	5.00	1.50	7.50	1.10	0.70	10	40	25	20	0	0.50
China Point - Indian Creek	28-Oct-93	3.50	1.50	5.25	0.65	0.50	0	75	25	25	0	0.70
China Point - Indian Creek	28-Oct-93	2.00	1.20	2.40	0.90	0.70	0	20	60	20	0	0.80
China Point - Indian Creek	28-Oct-93	4.00	1.50	6.00	0.80	0.70	0	5	75	20	0	0.80
China Point - Indian Creek	28-Oct-93	3.50	1.50	5.25	0.80	0.60	0	5	80	30	5	0.60
China Point - Indian Creek	28-Oct-93	4.50	2.00	9.00	0.90	0.70	0	25	50	25	0	0.70
China Point - Indian Creek	28-Oct-93	4.00	2.00	8.00	0.90	0.60	0	25	50	25	0	0.70
China Point - Indian Creek	28-Oct-93	3.00	1.50	4.50	0.80	0.70	0	25	50	25	0	0.70
China Point - Indian Creek	28-Oct-93	3.00	1.50	4.50	0.90	0.70	0	25	50	25	0	0.70
China Point - Indian Creek	28-Oct-93	4.50	3.00	13.50	0.90	0.70	0	25	50	25	0	0.70
China Point - Indian Creek	28-Oct-93	5.00	3.00	15.00	0.80	0.70	0	25	50	20	5	0.70
China Point - Indian Creek	28-Oct-93	5.00	2.00	10.00	0.80	0.60	0	25	50	25	0	0.60
China Point - Indian Creek	28-Oct-93	5.00	3.50	17.50	0.80	0.90	0	25	50	25	0	0.60
China Point - Indian Creek	28-Oct-93	3.50	2.50	8.75	0.70	0.50	0	5	40	40	5	0.60
China Point - Indian Creek	28-Oct-93	3.00	1.50	4.50	0.90	0.80	0	5	75	20	0	0.60
China Point - Indian Creek	28-Oct-93	4.00	1.50	6.00	0.90	0.90	0	10	80	10	0	0.60
China Point - Indian Creek	28-Oct-93	4.00	2.50	10.00	0.50	0.30	0	10	80	10	0	0.60
China Point - Indian Creek	28-Oct-93	3.50	2.00	7.00	0.90	0.50	0	10	80	10	0	0.60
China Point - Indian Creek	28-Oct-93	5.00	3.00	15.00	1.20	0.70	0	10	80	10	0	0.60
China Point - Indian Creek	28-Oct-93	4.50	2.00	9.00	0.80	0.60	0	10	80	10	0	0.60
China Point - Indian Creek	28-Oct-93	4.00	4.50	18.00	0.90	0.70	0	10	80	10	0	0.60
China Point - Indian Creek	28-Oct-93	6.00	2.50	15.00	0.90	0.60	0	5	90	5	0	0.70
China Point - Indian Creek	28-Oct-93	5.50	3.00	16.50	0.80	0.60	0	5	90	5	0	0.60
China Point - Indian Creek	28-Oct-93	5.50	4.00	22.00	0.80	0.50	5	30	60	5	0	0.60
China Point - Indian Creek	28-Oct-93	3.50	1.50	5.25	0.80	0.60	5	30	60	5	0	0.60
China Point - Indian Creek	28-Oct-93	3.50	1.50	5.25	0.70	0.50	5	30	60	5	0	0.60
China Point - Indian Creek	28-Oct-93	5.00	2.50	12.50	0.70	0.50	10	20	60	10	0	0.60
China Point - Indian Creek	28-Oct-93	4.00	2.00	8.00	0.70	0.50	10	20	60	10	0	0.60

Appendix B Spawning gravel availability measurements

Date	Reach	Map location	Length (m)	Width (m)	Area (sq meters)
09-Nov-93	Iron Gate Dam - Ash Creek		5	3	15.0
09-Nov-93	Iron Gate Dam - Ash Creek		51	12	612.0
09-Nov-93	Iron Gate Dam - Ash Creek	SITE #3 WK 2	15	5	75.0
09-Nov-93	Iron Gate Dam - Ash Creek		45	10	450.0
09-Nov-93	Iron Gate Dam - Ash Creek	SITE 1 WK 4	10	3	30.0
09-Nov-93	Iron Gate Dam - Ash Creek	SITE 5 WK 2	6	8	48.0
09-Nov-93	Iron Gate Dam - Ash Creek	SITE 5 WK 2	3	8	24.0
09-Nov-93	Iron Gate Dam - Ash Creek	SITE 5 WK 2	5	4	20.0
09-Nov-93	Iron Gate Dam - Ash Creek	SITE 5 WK 2	60	55	3300.0
09-Nov-93	Iron Gate Dam - Ash Creek	SITE 6 WK 2	32	10	320.0
09-Nov-93	Iron Gate Dam - Ash Creek	SITE 4 WK 1	65	20	1300.0
09-Nov-93	Iron Gate Dam - Ash Creek	DUCK BOX 3	30	15	450.0
09-Nov-93	Iron Gate Dam - Ash Creek	1 REDD 11/2	9	5	45.0
09-Nov-93	Iron Gate Dam - Ash Creek		30	10	300.0
09-Nov-93	Iron Gate Dam - Ash Creek	DB10 D/S TRAILER PARK SC/RB	40	25	1000.0
09-Nov-93	Iron Gate Dam - Ash Creek	DEER ISLAND	25	7	175.0
09-Nov-93	Iron Gate Dam - Ash Creek	D/S DEER ISLAND	10	10	100.0
09-Nov-93	Iron Gate Dam - Ash Creek	RB JUST ABOVE SC	20	10	200.0
09-Nov-93	Iron Gate Dam - Ash Creek	RB SC	10	5	50.0
09-Nov-93	Iron Gate Dam - Ash Creek	RB ABOVE BRIDGE	10	10	100.0
09-Nov-93	Iron Gate Dam - Ash Creek	RB ABOVE BRIDGE	5	3	15.0
09-Nov-93	Iron Gate Dam - Ash Creek	RB D/S WALKING BRIDGE	5	3	15.0
09-Nov-93	Iron Gate Dam - Ash Creek	RB D/S TRAILERS	10	5	50.0
09-Nov-93	Iron Gate Dam - Ash Creek	RB D/S GULCH	25	10	250.0
09-Nov-93	Iron Gate Dam - Ash Creek	D/S GULCH	25	5	125.0
09-Nov-93	Iron Gate Dam - Ash Creek	PARALLEL TO ISLAND 1/2 TO BRID	20	5	100.0
09-Nov-93	Iron Gate Dam - Ash Creek	RB SC D/S I5 BRIDGE	15	10	150.0
09-Nov-93	Iron Gate Dam - Ash Creek	RB	10	5	50.0
09-Nov-93	Iron Gate Dam - Ash Creek	NEAR HOUSE US SHASTA BRIDGE	30	10	300.0
09-Nov-93	Iron Gate Dam - Ash Creek	D/S COPCO BRIDGE LB	30	20	600.0
09-Nov-93	Iron Gate Dam - Ash Creek	U/S I5 BRIDGE	60	50	3000.0
10-Nov-93	Ash Creek - Beaver Riffle	LB GRAVEL BAR	15	5	75.0
10-Nov-93	Ash Creek - Beaver Riffle	LB GRAVEL BAR	15	5	75.0
10-Nov-93	Ash Creek - Beaver Riffle	HUMBUG POINT	67	9	603.0
10-Nov-93	Ash Creek - Beaver Riffle	HUMBUG POINT	60	24	1440.0
10-Nov-93	Ash Creek - Beaver Riffle	BETWEEN HUMBUG - TREES OF HEAVEN	23	7	161.0
10-Nov-93	Ash Creek - Beaver Riffle	TREES OF HEAVEN CAMPGROUND	86	11	946.0
10-Nov-93	Ash Creek - Beaver Riffle	TREES OF HEAVEN CAMPGROUND	106	26	2756.0
10-Nov-93	Ash Creek - Beaver Riffle	TREES OF HEAVEN CAMPGROUND	30	13	390.0
10-Nov-93	Ash Creek - Beaver Riffle	TREES OF HEAVEN CAMPGROUND	90	17	1530.0
10-Nov-93	Ash Creek - Beaver Riffle	D/S TREES OF HEAVEN CAMPGROUND	45	9	405.0
10-Nov-93	Ash Creek - Beaver Riffle	MC CONNELL BAR D/S SC	10	3	30.0
10-Nov-93	Ash Creek - Beaver Riffle	UPPER SKEHANS	25	10	250.0
10-Nov-93	Ash Creek - Beaver Riffle	SKEHAN BAR	110	15	1650.0
10-Nov-93	Ash Creek - Beaver Riffle	SWISS GULCH RIGHT SC	58	10	580.0
10-Nov-93	Ash Creek - Beaver Riffle	D/S VESA CREEK	90	17	1530.0
10-Nov-93	Ash Creek - Beaver Riffle	SPLIT CHAN D/S VESA CREEK	15	5	75.0
10-Nov-93	Ash Creek - Beaver Riffle	BETWEEN VESA AND COUGAR SC	45	10	450.0
10-Nov-93	Ash Creek - Beaver Riffle	U/S COUGAR GULCH	10	5	50.0
10-Nov-93	Ash Creek - Beaver Riffle	U/S BEAVER CR D/S BEAVER LODGE	20	15	300.0
10-Nov-93	Ash Creek - Beaver Riffle	U/S BEAVER CR	50	20	1000.0
10-Nov-93	Ash Creek - Beaver Riffle	JUST U/S BEAVER CR	42	7	294.0
10-Nov-93	Beaver Riffle - Blue Heron Access	U/S HOOVER RIFFLE	30	20	600.0
10-Nov-93	Beaver Riffle - Blue Heron Access	D/S HOOVER RIFFLE	20	20	400.0
10-Nov-93	Beaver Riffle - Blue Heron Access	KOKEL POOL	17	6	102.0
10-Nov-93	Beaver Riffle - Blue Heron Access	D/S OF KOKEL POOL	15	25	375.0
10-Nov-93	Beaver Riffle - Blue Heron Access	OLD AIRPORT RIFFLE	20	35	700.0
10-Nov-93	Beaver Riffle - Blue Heron Access	TOP OF SIDECHAN AT GOLF COURSE	15	7	105.0
10-Nov-93	Beaver Riffle - Blue Heron Access	TOP OF SC LOWER GOLF COURSE	15	15	225.0
10-Nov-93	Beaver Riffle - Blue Heron Access	SC LB D/S OF GOLF COURSE	15	15	225.0
10-Nov-93	Beaver Riffle - Blue Heron Access	D/S G.C. RB OF LB SC	70	10	700.0
10-Nov-93	Beaver Riffle - Blue Heron Access		35	50	1750.0
10-Nov-93	Beaver Riffle - Blue Heron Access	JUST D/S FROM WALKER BRIDGE	15	30	450.0
10-Nov-93	Beaver Riffle - Blue Heron Access	JUST D/S FROM WALKER BRIDGE	20	10	200.0
10-Nov-93	Beaver Riffle - Blue Heron Access	U/S DOGGETT CR DOGGETT HOLE	20	8	160.0
10-Nov-93	Beaver Riffle - Blue Heron Access	U/S DOGGETT CR DOGGETT HOLE	80	30	2400.0
10-Nov-93	Beaver Riffle - Blue Heron Access	MCKINEY CR	15	10	150.0
10-Nov-93	Beaver Riffle - Blue Heron Access	U/S KOHL CREEK	90	40	2400.0
10-Nov-93	Beaver Riffle - Blue Heron Access	U/S KOHL CREEK	15	10	150.0
10-Nov-93	Beaver Riffle - Blue Heron Access	U/S KOHL CREEK	20	45	900.0
10-Nov-93	Beaver Riffle - Blue Heron Access	KOHL CREEK	50	40	2000.0
10-Nov-93	Beaver Riffle - Blue Heron Access	D/S KOHL CREEK	30	15	450.0
10-Nov-93	Beaver Riffle - Blue Heron Access	JUST U/S FRENCH GULCH	40	25	1000.0
10-Nov-93	Beaver Riffle - Blue Heron Access	KLAMATH SCHOOL BRAIDED AREA DS	43	28	1204.0
10-Nov-93	Beaver Riffle - Blue Heron Access	HWY 96 BRIDGE (HORSE CREEK)	150	15	2250.0
10-Nov-93	Beaver Riffle - Blue Heron Access	RB US HORSE CREEK BRIDGE	15	15	225.0
10-Nov-93	Beaver Riffle - Blue Heron Access	RB US HORSE CREEK BRIDGE	20	30	600.0
10-Nov-93	Beaver Riffle - Blue Heron Access	20M DS HORSE CREEK BRIDGE	20	15	300.0
10-Nov-93	Beaver Riffle - Blue Heron Access	OPOSITE HORSE CR	40	20	800.0
10-Nov-93	Beaver Riffle - Blue Heron Access		40	15	600.0

Appendix B cont

Date	Reach	Map location	Length (m)	Width (m)	Area (sq meters)
11-Nov-93	Blue Heron Access - Seiad Bar	JUST D/S BLUE HERON	5	5	25.0
11-Nov-93	Blue Heron Access - Seiad Bar	JUST D/S BLUE HERON	15	10	150.0
11-Nov-93	Blue Heron Access - Seiad Bar	JUST D/S BLUE HERON	5	5	25.0
11-Nov-93	Blue Heron Access - Seiad Bar	TEEPEE HOLE	15	20	300.0
11-Nov-93	Blue Heron Access - Seiad Bar	JUST ABOVE SCOTT RIVER	30	20	600.0
11-Nov-93	Blue Heron Access - Seiad Bar	BELOW SCOTT 49ERS	10	15	150.0
11-Nov-93	Blue Heron Access - Seiad Bar	BETWEEN SCOTT RIF AND HAM FALL	15	5	75.0
11-Nov-93	Blue Heron Access - Seiad Bar	BETWEEN SCOTT RIF AND HAM FALL	20	10	200.0
11-Nov-93	Blue Heron Access - Seiad Bar	BETWEEN SCOTT RIF AND HAM FALL	10	10	100.0
11-Nov-93	Blue Heron Access - Seiad Bar	D/S MILL CREEK	50	25	1250.0
11-Nov-93	Blue Heron Access - Seiad Bar	D/S KUNTZ CREEK	5	5	25.0
11-Nov-93	Blue Heron Access - Seiad Bar	D/S KUNTZ CREEK	20	20	400.0
11-Nov-93	Blue Heron Access - Seiad Bar	D/S KUNTZ CREEK	35	10	350.0
11-Nov-93	Blue Heron Access - Seiad Bar	U/S NEGRO CR U/S BEND	60	10	600.0
11-Nov-93	Blue Heron Access - Seiad Bar	JUST DS 2+ RAPID BELOW NEGRO C	10	5	50.0
11-Nov-93	Blue Heron Access - Seiad Bar	ABOVE SCHULZ GULCH 1/4 MILE	35	10	350.0
11-Nov-93	Blue Heron Access - Seiad Bar	ABOVE SCHULZ GULCH 1/8 MILE	35	15	525.0
11-Nov-93	Blue Heron Access - Seiad Bar	REDD SITE 7	5	5	25.0
11-Nov-93	Blue Heron Access - Seiad Bar	REDD SITE 7	5	5	25.0
11-Nov-93	Blue Heron Access - Seiad Bar	ABOVE WALKER CR SC	10	5	50.0
11-Nov-93	Blue Heron Access - Seiad Bar	ABOVE WALKER CR BELOW SC	15	5	75.0
11-Nov-93	Blue Heron Access - Seiad Bar	D/S 96 BRIDGE SC	35	5	175.0
11-Nov-93	Seiad Bar - China Point	SEIAD BAR SPLIT CHANNEL	30	20	600.0
11-Nov-93	Seiad Bar - China Point	SEIAD BAR TAILING PILES	200	90	18000.0
11-Nov-93	Seiad Bar - China Point	SEIAD BAR TAILING PILES SC	75	20	1500.0
11-Nov-93	Seiad Bar - China Point	SEIAD BAR TAILING PILES SC	10	8	80.0
11-Nov-93	Seiad Bar - China Point	SEIAD BAR TAILING PILES SC BOT	10	10	100.0
11-Nov-93	Seiad Bar - China Point	3RD SEIAD BAR SC	10	8	80.0
11-Nov-93	Seiad Bar - China Point	3RD SEIAD BAR SC	25	25	625.0
11-Nov-93	Seiad Bar - China Point	3RD SEIAD BAR SC US GRIDER	50	12	600.0
11-Nov-93	Seiad Bar - China Point	CABLE CAR SLICK	80	50	4000.0
11-Nov-93	Seiad Bar - China Point	TOP SC BELOW CABLE CAR SLICK	50	60	3000.0
11-Nov-93	Seiad Bar - China Point	FORT GOFF CR	80	40	3200.0
11-Nov-93	Seiad Bar - China Point	FORT GOFF CR	15	15	225.0
11-Nov-93	Seiad Bar - China Point	D/S FORT GOFF CR	100	40	4000.0
11-Nov-93	Seiad Bar - China Point	MAIN CHAN U/S LADDS CREEK	50	50	2500.0
11-Nov-93	Seiad Bar - China Point	RB DS OF FT GOFF RAPIDS	35	20	700.0
11-Nov-93	Seiad Bar - China Point	MAIN CHANNEL BONETTA MINE	15	10	150.0
11-Nov-93	Seiad Bar - China Point	REDD SIT AT OAK HOLLOW CR	16	30	480.0
12-Nov-93	China Point - Gordon Ferry	CHINA PT ACCESS	90	70	6300.0
12-Nov-93	China Point - Gordon Ferry	D/S CHINA PT ACCESS	35	15	525.0
12-Nov-93	China Point - Gordon Ferry	D/S CHINA PT ACCESS RB SC	20	7	140.0
12-Nov-93	China Point - Gordon Ferry	D/S CHINA PT ACCESS LB IN LGR	40	10	400.0
12-Nov-93	China Point - Gordon Ferry	POOL TAIL OUT	20	35	700.0
12-Nov-93	China Point - Gordon Ferry	POOL TAIL OUT US WILLIAMS PT	20	20	400.0
12-Nov-93	China Point - Gordon Ferry	MAIN CHANNEL US WILLIAMS PT	40	30	1200.0
12-Nov-93	China Point - Gordon Ferry	LB POOLTAIL W/ SC AT RB	45	20	900.0
12-Nov-93	China Point - Gordon Ferry	RB SC BELOW POOL	2	2	4.0
12-Nov-93	China Point - Gordon Ferry	LONG TAILOUT AT COLD HOLE	120	95	11400.0
12-Nov-93	China Point - Gordon Ferry	RIFFLE US OF DOCS HOME	20	20	400.0
12-Nov-93	Gordon Ferry - Indian Creek	JUST D/S GORDON BELOW RIFFLE	15	5	75.0
12-Nov-93	Gordon Ferry - Indian Creek	JUST D/S GORDON BELOW RIFFLE	10	5	50.0
12-Nov-93	Gordon Ferry - Indian Creek	BELOW GORDON BEDROCK SC ADJAC	3	3	9.0
12-Nov-93	Gordon Ferry - Indian Creek	STRAIGHTAWAY BELOW GORDON	30	10	300.0
12-Nov-93	Gordon Ferry - Indian Creek	STRAIGHTAWAY BELOW GORDON	90	10	900.0
12-Nov-93	Gordon Ferry - Indian Creek	BELOW REDD SITE 7	40	20	800.0
12-Nov-93	Gordon Ferry - Indian Creek	U/S MUC A MUC RIFFLE	50	15	750.0
12-Nov-93	Gordon Ferry - Indian Creek	REDD SITE 9	15	3	45.0
12-Nov-93	Gordon Ferry - Indian Creek	U/S BACKPOCKET HOLE	10	5	50.0
12-Nov-93	Gordon Ferry - Indian Creek	BELOW SMITTY HOLE	50	80	4000.0
12-Nov-93	Gordon Ferry - Indian Creek	BELOW SMITTY HOLE	15	20	300.0
12-Nov-93	Gordon Ferry - Indian Creek	BOTTOM SC	10	10	100.0
12-Nov-93	Gordon Ferry - Indian Creek	1/8 MILE U/S CADDY CREEK LB	30	15	450.0
12-Nov-93	Gordon Ferry - Indian Creek	1/8 MILE U/S CADDY CREEK LB	20	5	100.0
12-Nov-93	Gordon Ferry - Indian Creek	JUST U/S CADDY CREEK	40	40	1600.0
12-Nov-93	Gordon Ferry - Indian Creek	AT CADDY CREEK	40	30	1200.0
12-Nov-93	Gordon Ferry - Indian Creek	U/S BULK TANK ACCESS	15	40	600.0
12-Nov-93	Gordon Ferry - Indian Creek	D/S BULK TANK ACCESS US MILL H	60	15	900.0
12-Nov-93	Gordon Ferry - Indian Creek	D/S MILL HOLE	10	2	20.0
12-Nov-93	Gordon Ferry - Indian Creek	1/4 MILE U/S INDIAN CR BRIDGE	5	5	25.0