

U.S. Fish & Wildlife Service

Arcata Fisheries Data Series Report DS 2006-05

Mainstem Klamath River Fall Chinook Salmon Spawning Survey 2005

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July 2006



Funding for this study was provided by the Klamath River Basin Conservation Area Restoration Program under Project Number 05-FP-13 and the Klamath River Habitat Assessment Study administered by the Arcata Fish and Wildlife Office.

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Key words: Chinook, Klamath, redd, spawning survey.

The correct citation for this report is:

Magneson, M. 2006. Mainstem Klamath River fall Chinook salmon spawning survey 2005. U. S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Arcata Fisheries Data Series Report Number DS 2006-05, Arcata, California.

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Abstract. Results of the thirteenth annual US Fish and Wildlife Service fall Chinook salmon *Oncorhynchus tshawytscha* spawning survey conducted on the mainstem Klamath River are summarized. The survey was conducted over a five-week period (October 18 to November 17, 2005), covering 111.9 river kilometers (rkm; 69.5 river miles) between Ash Creek river access (downstream of the Shasta River) and Indian Creek at Happy Camp. This was the first year since the survey was initiated in 1993 that redds were not counted between Iron Gate Dam (IGD) and the Shasta River (Reach 1). Escapement within this reach was estimated using carcass mark recapture methods. A total of 268 redds were observed during the 2005 survey, which was 3.6 times lower than the annual average from the preceding twelve years ($\bar{x}$ = 957 redds) for reaches 2 to 6. The 2005 count represents a 33% decrease from the 2004 redd count for reaches 2 to 6 and the third lowest (n = 243 in 1993; n = 266 in 1999) redd count since 1993. The highest redd density within 10 km river sections was between China Creek and Ottley Gulch (10.1 redds/rkm). The lowest redd density was between Portuguese and Shinar Creek (0.7 redds/rkm). Water clarity between IGD and Indian Creek ranged from 2.1 to 3.0 m and was similar to most other survey years. During 2005, no redds were observed on suction dredge tailings between Ash Creek river access and Indian Creek.

Introduction

The Klamath River drains approximately 14,000 km² in Oregon and 26,000 km² in California. The majority of the watershed in California is within the boundaries of the Six Rivers, Klamath and Shasta-Trinity National Forests. The Yurok Indian Reservation, comprising about 139 km² in Humboldt and Del Norte counties, borders the lower 68 km of the Klamath River (Figure 1). The most important anadromous salmonid spawning tributaries in the basin include the Trinity River (the largest tributary in the basin) draining approximately 7,690 km², and the Shasta, Scott and Salmon rivers, each draining about 2,070 km². Iron Gate Dam (IGD), located at river kilometer (rkm) 310.3 on the Klamath River and Lewiston Dam located at rkm 249 on the Trinity River, are

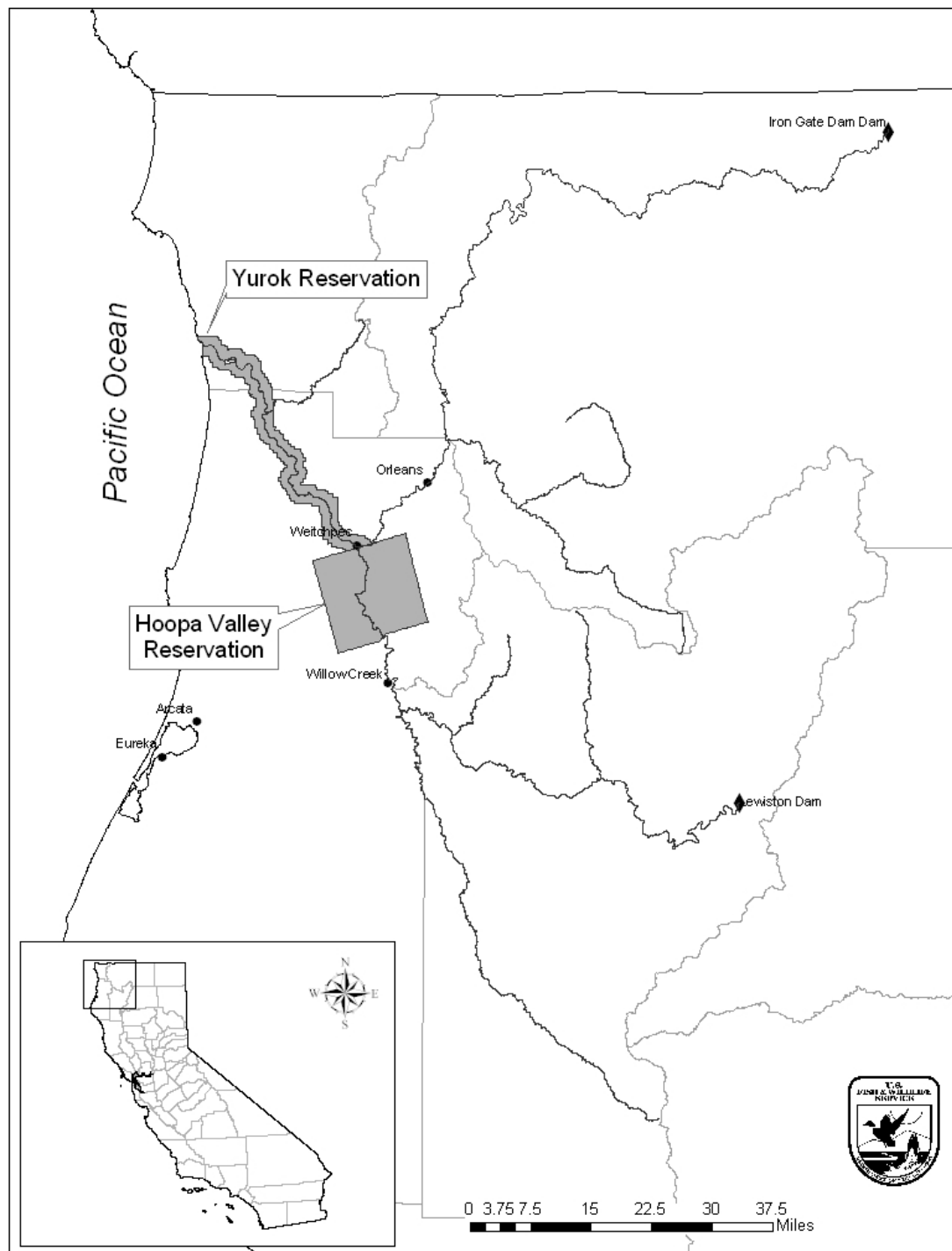


Figure 1. Overview map of the Klamath River Basin accessible to fall Chinook salmon.

barriers to upstream passage of anadromous salmonids. Iron Gate Hatchery (IGH) and Trinity River Hatchery, located near the base of each dam, were constructed to mitigate for losses in natural fish production that resulted from dam construction (USFWS 1991).

The Klamath River Basin historically supported large runs of Chinook *Oncorhynchus tshawytscha* and coho salmon *O. kisutch*, and steelhead trout *O. mykiss*, which contribute to economically and culturally important subsistence, sport and commercial fisheries (Leidy and Leidy 1984). Generations of Indians have fished in the drainage, with catches of salmon, steelhead, lamprey, and sturgeon historically providing the mainstay of the Indian economy in the area. Sport fishing for salmon and steelhead in the drainage may exceed 200,000 angler days annually. During the 1980's, the Klamath River stocks accounted for up to 30% of commercial Chinook salmon landings in northern California and Southern Oregon, averaging about 450,000 Chinook salmon per year (PFMC 1988).

Concern about the depletion of anadromous salmonid resources and associated habitat in the basin emerged around the turn of the century and has accelerated in recent decades, coincident with expanded logging and fishing operations, construction of dams, road construction, agricultural use, and other development. As in other river systems of the Pacific Northwest, Chinook salmon of the Klamath River Basin are adversely affected by habitat degradation and over-exploitation, as reflected by declining runs in recent decades (USFWS 1991).

On October 27, 1986, the US Congress enacted PL 99-552, the Klamath River Fish and Wildlife Restoration Act. This Act authorized the Secretary of the Interior to restore anadromous fish populations to optimum levels in the Klamath River Basin through the creation of the Klamath River Basin Conservation Area Restoration Program, functioning under the guidance of the Klamath River Fishery Management Council (USFWS 1991). The US Fish and Wildlife Service (USFWS) was funded through the Klamath River Basin Conservation Area Restoration Program to identify fall Chinook salmon spawning areas and collect information necessary to estimate the natural fall Chinook salmon spawning escapement on the mainstem Klamath River between IGD and the confluence of Indian Creek (rkm 173.8). This information is critical for monitoring long-term trends in escapement and for developing harvest management alternatives.

Methods

Survey Procedures

In past years, the Arcata Fish and Wildlife Office (AFWO) mainstem Klamath River redd survey protocol consisted of six mainstem reaches (Figure 2) covering 135.9 rkm (84.4 river miles). In 2005, only the lower five reaches (Ash Creek river access to Indian Creek) were surveyed over a five-week period (October 18 to November 17). No survey was conducted during the fourth week (November 8 to 10) due to high flows that limited water clarity. Two individual crews conducted the surveys. Each crew covered the same survey reaches each week to remain familiar with spawning areas and prior redd locations.

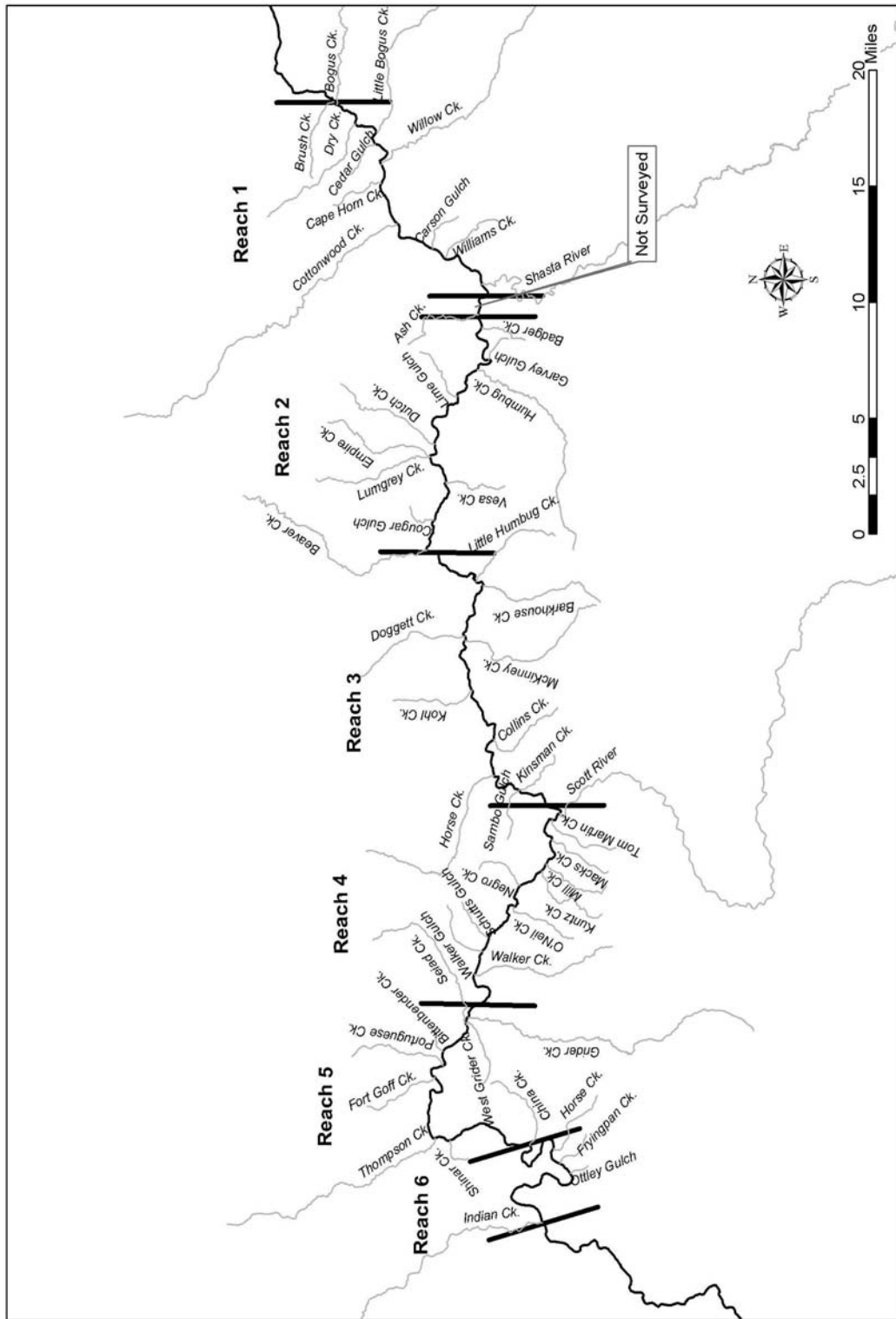


Figure 2. Mainstem Klamath River Chinook salmon spawning survey project location including individual study reaches (1 to 6).

Rafting Equipment

Two 4.3 m (14 foot) inflatable Wing Cataracts were used for direct observation of fall Chinook salmon redds. These rafts are commonly used in whitewater rescue due to their stability and maneuverability in fast water. Rafts were stacked on a flat bed trailer and deployed at selected access sites along the study area. Each raft was equipped with a rowing frame, a modified observation platform, and anchoring system. Two personnel operated each raft (rower and observer).

Individual Reaches

Reach 1: IGD river access (rkm 309.8) to Deliverance Camp river access (rkm 287.5). Reach 1 is approximately 22.3 rkm (13.8 miles) in length (Figure 2). This was the first year since 1993 that redds were not surveyed in this reach. Mark recapture carcass estimators are now used to derive the number of natural fall Chinook salmon that spawn within Reach 1. The section of river between Deliverance Camp river access and Ash Creek river access was not surveyed because past surveys revealed a lack of available spawning habitat in this area.

Reach 2: Ash Creek river access (rkm 285.7) to Beaver Creek riffle river access (rkm 261.9). Reach 2 is about 23.8 rkm (14.7 miles) in length (Figure 2). The Ash Creek river access is located on the south bank of the Klamath River. The Beaver Creek riffle river access is located along the north bank on a large gravel bar downstream from Beaver Creek Bridge, just off Highway 96. One crew surveyed this reach on the first survey day (Tuesday) of each week in about 7 hrs, depending on flows.

Reach 3: Beaver Creek riffle river access to Blue Heron river access (rkm 234.3). Reach 3 is approximately 27.6 rkm (17.1 miles) in length (Figure 2). The Blue Heron river access is about 2 rkm upstream from the Scott River confluence on the south bank of the Klamath River just off Highway 96. One crew surveyed this reach on the first survey day (Tuesday) of each week, taking about 8 hrs to complete.

Reach 4: Blue Heron river access to Seiad Bar river access (rkm 213.6). Reach 4 is approximately 20.8 rkm (12.9 miles) in length (Figure 2). The Seiad Bar river access is located along the north bank of the Klamath River on Wally Johnson's property. Access to the river is reached from Highway 96 and turning onto Diamond J road and then turning right onto an unmarked road located near the California Department of Transportation compound. Reach boundaries remained the same as in previous years. This reach was surveyed on the second day (Wednesday) of each survey week by one crew, taking an average of about 8 hrs to complete.

Reach 5: Seiad Bar river access to China Point river access (rkm 192.4). Reach 5 is approximately 21.2 rkm (13.2 miles) in length (Figure 2). China Point river access is located along the north bank of the river at a US Forest Service (USFS) site just off Highway 96. One crew surveyed this reach on the second day (Wednesday) of each survey week, taking about 7 hrs to complete.

Reach 6: China Point river access to the Indian Creek (rkm 173.8). Reach 6 is approximately 18.6 rkm (11.6 miles) in length (Figure 2). Due to the high concentration of redds in this area, this reach was split at Gordons Ferry river access (rkm 185). China

Point river access to Gordons Ferry river access is about 7.4 rkm (4.6 miles). Gordons Ferry river access to Indian Creek confluence is about 11.3 rkm (7 miles). The Gordons Ferry river access is located just off Highway 96. This reach was split into two sections and covered by two crews on the third day (Thursday) of each survey week, with each section taking approximately 5 hrs to complete.

Redd Densities

The mainstem Klamath River between IGD and the confluence of Indian Creek was segregated into fourteen approximately 10-rkm long sections to describe longitudinal patterns in redd abundance within the survey reach. In 2005, the upper two river 10-km sections (IGD to Cape Horn Creek and Cape Horn Creek to Shasta River) between IGD and the Shasta River were not surveyed.

Collection of Redd Data

A length of plastic flagging was attached to vegetation on the riverbank nearest to the position of each redd observation. Different colored flagging was used each week to ensure that redds were not double counted during the subsequent surveys. Date, number of redds per site, location in channel, and redd site number were recorded on flags. Redd locations were also recorded on river maps and on data forms. River reach, flag location, GPS mark number, tally number, location in channel (left or right bank, mid-channel, side channel, split channel, and pool tail-out), distance from bank, presence and number of adults and/or grilse occupying the redd, and age of redd were also recorded on data forms. Estimated redd ages were recorded as Redd Age Code 1, 2 or 3 depending on appearance. Fresh redds with bright substrate, little or no periphyton, and well-developed mounds were classified as Redd Age Code 1. Redds two to four weeks old with slightly flattened mounds and dulled substrate due to periphyton growth were classified as Redd Age Code 2. Redds older than four weeks, identifiable only by the presence of a pit and/or mound, were classified as Redd Age Code 3. The brightness of substrate on these redds was typically not distinguishable from that of surrounding materials. Only completed redds including both a pit and mound were included in daily counts. Test redds and small ($<1.0 \text{ m}^2$) redds were not counted, but were noted on data forms.

Water Temperature

Water temperature was recorded using an Optic Stowaway Tidbit on an hourly basis throughout the survey period at the Iron Gate Hatchery Bridge (rkm 309.8). Hourly data were used to calculate mean daily water temperatures.

Discharge

Mean daily river flow was obtained from the US Geological Survey gauging station (Number 11516530; Latitude 41° 55' 41", Longitude 122°26'35" NAD 27; <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 ft^3/s .

Water Clarity

Water clarity was measured each survey week by lowering a 20-cm diameter Secchi disc vertically into the water column. The disc was lowered until the black and white pattern was not discernable. The disc was then raised until the pattern became visible, and this depth was recorded in meters.

Adult and Grilse Expansion

The total number of redds counted in this survey was used by California Department of Fish and Game (CDFG) to estimate adult and grilse (two year old) spawning abundance (CDFG 2006). Adult numbers were calculated by multiplying the total redd count by two. This estimate assumes one male and female salmon per redd. The adult age breaks for the mainstem Klamath River from IGD to Indian Creek were derived from scales and fork length data collected during carcass surveys in Reach 1. Grilse apportionment was derived from surrogate data collected from Bogus Creek and Shasta River (KRTAT 2006).

Results and Discussion

A total of 268 Chinook salmon redds were counted between Ash Creek and the confluence of Indian Creek in 2005, representing a 33 % decrease from the 2004 count of 403 (Table 1). The highest number of Chinook salmon redds/rkm was in Reach 6 (Figure 3), and the lowest was in Reach 5, consistent with the findings of previous survey years. Combined redd counts for the five reaches surveyed in 2005 were the third lowest recorded since 1993 (Figure 4). Based on GPS coordinates, field maps and notes from the survey, locations of redds for all reaches surveyed were mapped as shown in Figures 5 to 9.

Individual Reaches

Reach 1: IGD to Deliverance Camp river access. A redd survey was not conducted in this reach in 2005.

Reach 2: Ash Creek river access to Beaver Creek riffle river access. A total of 39 redds were observed in this reach during the 2005 survey (Table 1; Figure 5). The 39 redds represent 15% of the total redd count for 2005. Redd density was 1.6 redds/rkm (Figure 3). Peak spawning ($n = 12$) was observed during the first week (October 18 to October 20) of the survey (Table 1). The 39 redds counted in this reach represent the second lowest count since the project started in 1993 (Table 1).

Reach 3: Beaver Creek riffle river access to Blue Heron river access. A total of 40 redds were counted in this reach during the 2005 survey (Table 1; Figure 6), comprising 15% of the total redd count for the season. Redd density was 1.4 redds/rkm (Figure 3). Peak spawning ($n = 17$) in Reach 3 was observed during the second week (October 25 to 27) of the survey (Table 1). The 40 redds observed during the survey is the lowest count for this reach since the project started in 1993 (Table 1).

Table 1. Weekly summary and percent frequency of mainstem Klamath River fall Chinook salmon redd counts for Reaches 1 to 6, 1993 to 2005 (NS = No Survey, R1 = Iron Gate Dam to Ash Creek river access, R2 = R1 to Beaver Creek riffle river access, R3 = R2 to Blue Heron river access, R4 = R3 to Seiad Bar, R5 = R4 to China Point river access, R6 = R5 to Indian Creek river access).

Year	Week	Reach						Total
		R1	R2	R3	R4	R5	R6	
1993	Oct 25 to 29	15	13	30	18	16	81	173
	Nov 1 to 5	67	24	4	1	15	5	116
	Nov 8 to 12	5	1	18	7	0	1	32
	Nov 15 to 18	0	0	4	5	0	0	9
	Total	87	38	56	31	31	87	330
	% Frequency	26	12	17	9	9	26	
1994	Oct 17 to 21	89	28	48	Ns	Ns	98	263
	Oct 24 to 28	278	59	77	113	98	124	749
	Oct 31 to Nov 4	375	20	46	42	16	33	532
	Nov 7 to 11	86	Ns	Ns	Ns	Ns	Ns	86
	Nov 14 to 18	3	2	7	4	5	5	26
	Total	831	109	178	159	119	260	1,656
1995	Oct 16 to 20	138	12	70	26	30	139	415
	Oct 23 to 27	598	82	199	94	91	169	1,233
	Oct 30 to Nov 3	727	58	78	35	57	112	1,067
	Nov 6 to 10	277	26	49	13	25	50	440
	Nov 27 to Dec 1	39	9	14	4	12	3	81
	Total	1,779	187	410	172	215	473	3,236
1996	Oct 21 to 25	290	31	96	10	118	39	584
	Oct 28 to Nov 1	291	29	25	22	42	92	501
	Nov 4 to 8	83	4	24	8	33	59	211
	Nov 11 to 15	40	0	6	0	7	23	76
	Total	704	64	151	40	200	213	1,372
	% Frequency	51	5	11	3	15	16	
1997	Oct 16	272	Ns	Ns	Ns	Ns	Ns	272
	Oct 20 to 24	252	37	69	89	29	136	612
	Oct 27 to 31	424	18	76	52	22	76	668
	Nov 3 to 7	70	7	13	16	8	27	141
	Nov 10 to 14	2	14	4	5	3	18	46
	Total	1,020	76	162	162	62	257	1,739
1998	Oct 14 to 15	89	Ns	Ns	Ns	Ns	Ns	89
	Oct 19 to 23	180	45	67	15	20	45	372
	Oct 26 to 30	368	11	12	14	7	39	451
	Nov 2 to 6	226	22	33	10	9	28	328
	Nov 9 to 12	135	3	11	3	2	2	156
	Nov 15 to 19	12	1	3	0	1	2	19
1999	Total	1,010	82	126	42	39	116	1,415
	% Frequency	71	6	9	3	3	8	
	Oct 13 to 15	98	3	Ns	Ns	Ns	Ns	101
	Oct 18 to 22	200	27	31	17	23	39	337
	Oct 25 to 27	304	23	20	Ns	Ns	Ns	347
	Nov 1 to 5	83	12	9	8	8	19	139
1999	Nov 8 to 12	37	2	2	1	5	11	58
	Nov 15 to 19	1	2	0	2	2	0	7
	Total	723	69	62	28	38	69	989
	% Frequency	73	7	6	3	4	7	

Table 1. (Continued). Weekly summary and percent frequency of mainstem Klamath River fall Chinook salmon redd counts for Reaches 1 to 6, 1993 to 2005 (NS = No Survey, R1 = Iron Gate Dam to Ash Creek river access, R2 = R1 to Beaver Creek riffle river access, R3 = R2 to Blue Heron river access, R4 = R 3 to Seiad Bar, R5 = R4 to China Point river access, R6 = R5 to Indian Creek river access).

Year	Week	Reach						Total
		R1	R2	R3	R4	R5	R6	
2000	Oct 16 to 20	327	92	69	25	10	19	542
	Oct 23 to 27	146	62	34	52	10	53	357
	Oct 30 to Nov 3	254	42	69	54	20	86	525
	Nov 6 to 10	57	12	15	21	2	16	123
	Nov 13 to 17	4	0	9	12	0	6	30
	Nov 20 to 22	1	Ns	Ns	Ns	Ns	Ns	1
	Total	788	208	196	164	42	180	1,578
	% Frequency	50	13	12	10	3	11	
2001	Oct 15 to 19	92	24	28	21	2	23	190
	Oct 22 to 26	168	102	128	59	40	82	579
	Oct 29 to Nov 2	323	97	170	102	55	139	886
	Nov 5 to 9	155	10	40	12	31	29	277
	Nov 12 to 16	75	31	49	22	9	Ns	186
	Nov 26 to 30	17	Ns	Ns	Ns	Ns	Ns	17
	Dec 3 to 7	Ns	Ns	12	Ns	Ns	5	17
	Dec 10 to 14	Ns	5	8	4	3	Ns	20
2002	Total	830	269	435	220	140	278	2,172
	% Frequency	38	12	20	10	6	13	
	Oct 10	8	Ns	Ns	Ns	Ns	Ns	8
	Oct 15 to 18	124	90	120	71	61	146	612
	Oct 21 to 25	885	198	340	186	141	181	1,931
	Oct 29 to Nov 1	549	112	148	90	69	66	1,034
	Nov 4 to 8	335	90	62	38	20	21	566
	Nov 12 to 15	136	56	39	46	14	65	356
2003	Nov 19 to 22	76	20	10	10	5	15	136
	Dec 2 to 6	0	0	7	0	1	1	9
	Total	2,113	566	726	441	311	495	4,652
	% Frequency	45	12	16	9	7	11	
	Oct 14 to 17	0	Ns	38	22	19	48	127
	Oct 20 to 24	563	194	228	178	77	150	1,390
	Oct 27 to 31	553	73	103	18	119	99	965
	Nov 4 to 7	310	33	97	61	50	74	625
2004	Nov 12 to 15	44	43	14	11	15	48	175
	Nov 19 to 22	2	0	4	2	5	7	20
	Total	1,472	343	484	292	285	426	3,302
	% Frequency	45	10	15	9	8	13	
	Oct 11 to 15	Ns	0	6	1	3	0	10
	Oct 18 to 22	Ns	57	45	27	17	11	157
	Oct 25 to 29	Ns	22	37	9	17	25	110
	Nov 1 to 5	513	36	27	14	7	10	607
2005	Nov 8 to 12	Ns	2	10	4	4	3	23
	Nov 29 to Dec 3	Ns	0	9	0	0	0	9
	Total	513	117	134	55	48	49	916
	% Frequency	56	13	15	6	5	5	
	Oct 18 to 20	Ns	12	14	3	3	27	59
	Oct 25 to 27	Ns	10	17	15	17	37	96
	Nov 1 to 3	Ns	9	8	8	7	20	52
	Nov 8 to 10	Ns	Ns	Ns	Ns	Ns	Ns	0
2005	Nov 15 to 17	Ns	8	1	20	1	31	61
	Total	0	39	40	46	28	115	268
	% Frequency	0	15	15	17	10	43	

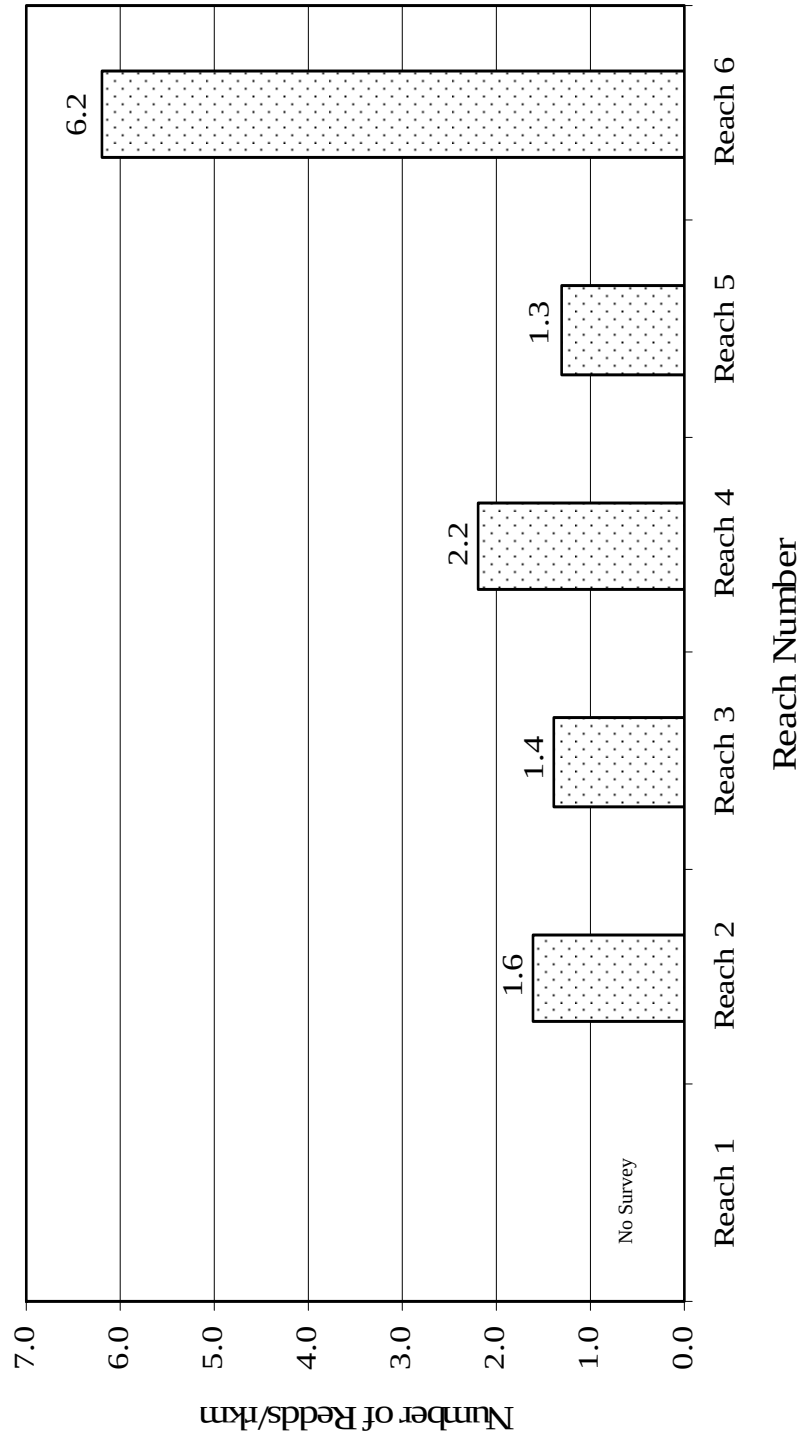


Figure 3. Mainstem Klamath River fall Chinook salmon redd density (redds/rkm) by reach, 2005.

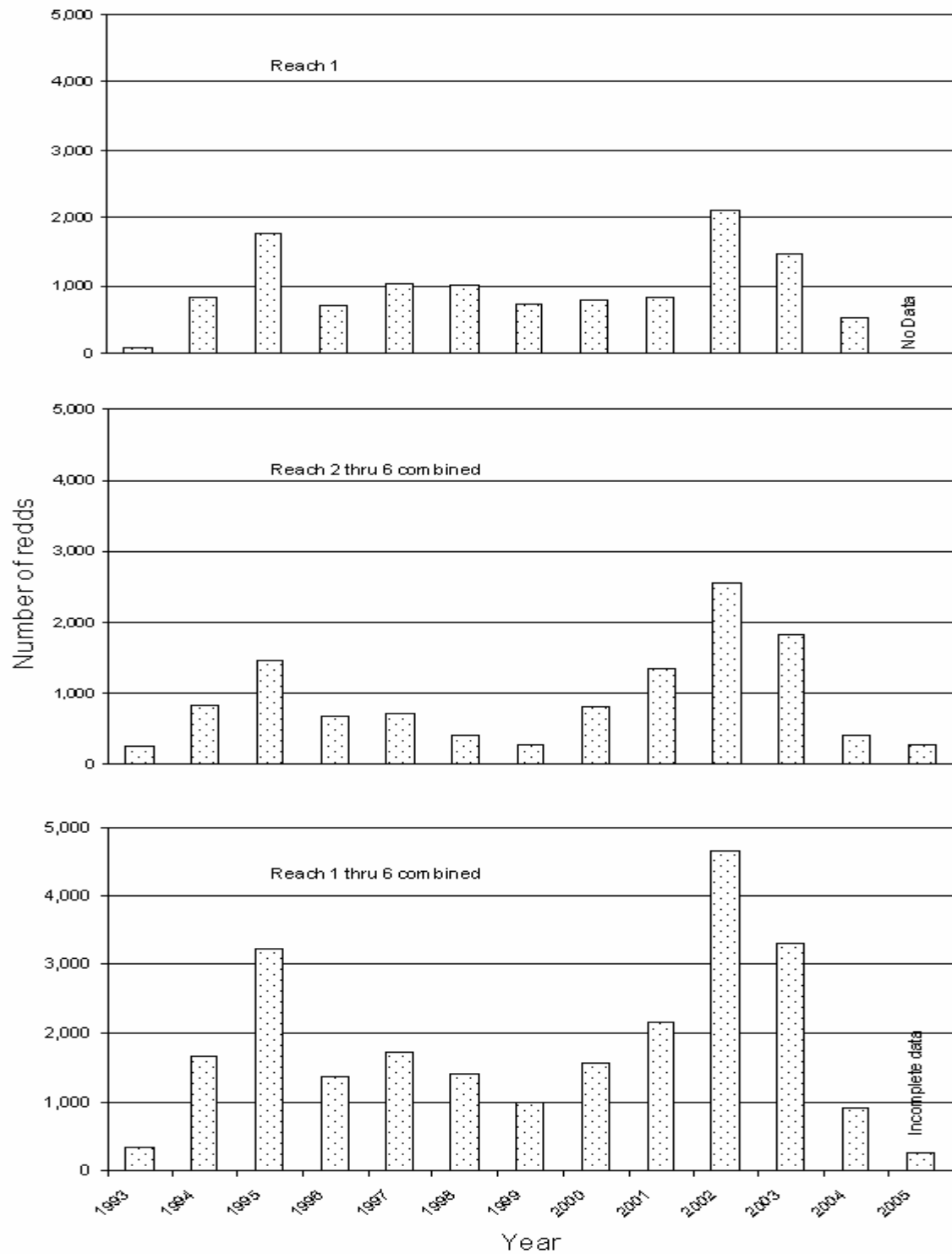


Figure 4. Yearly USFWS Chinook salmon redd counts by reach, 1993 to 2005.

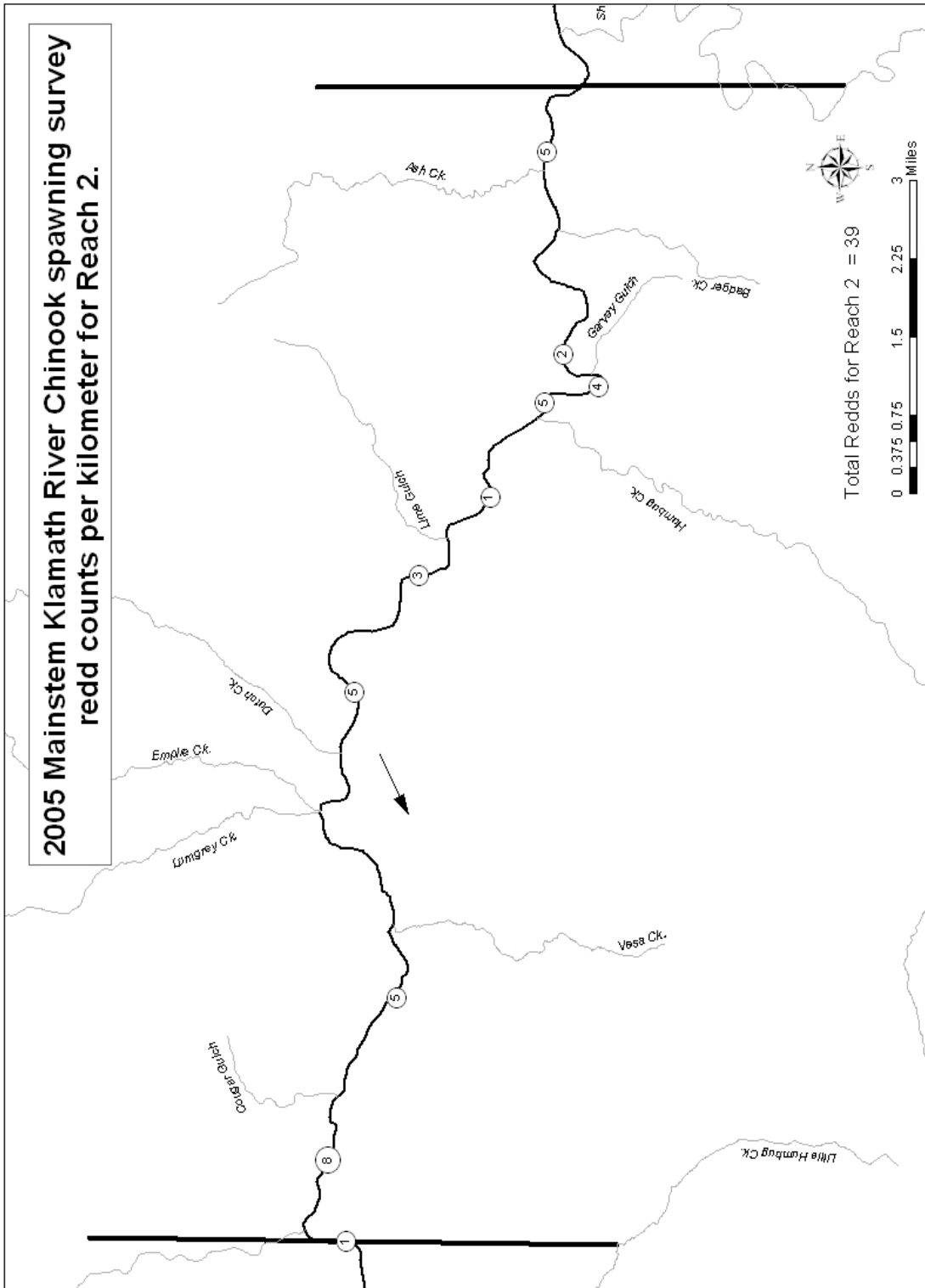


Figure 5. Redd distribution map for 2005, mainstem Klamath River, Ash Creek to Beaver Creek.

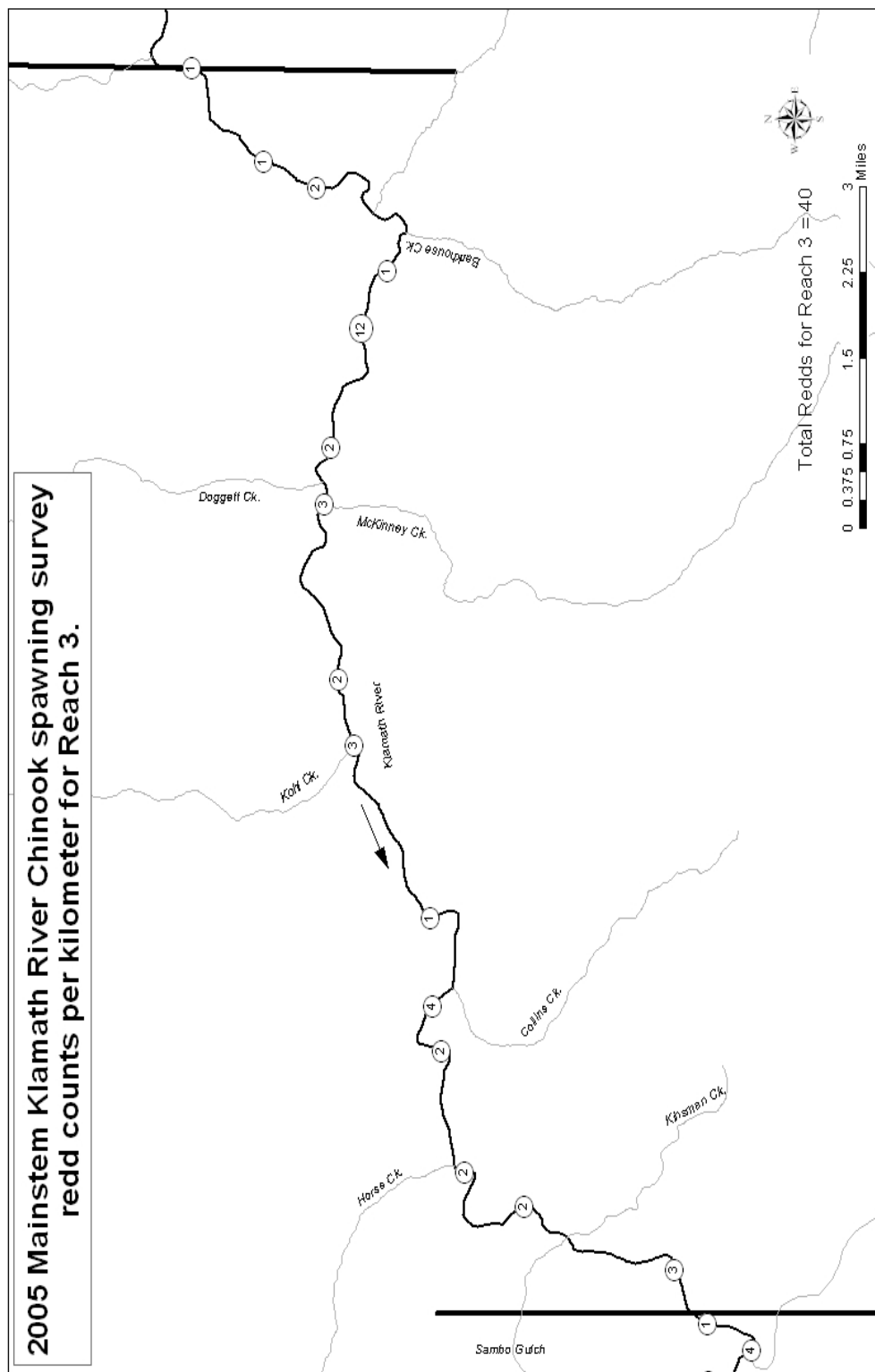


Figure 6. Redd distribution map for 2005, mainstem Klamath River, Beaver Creek to Blue Heron.

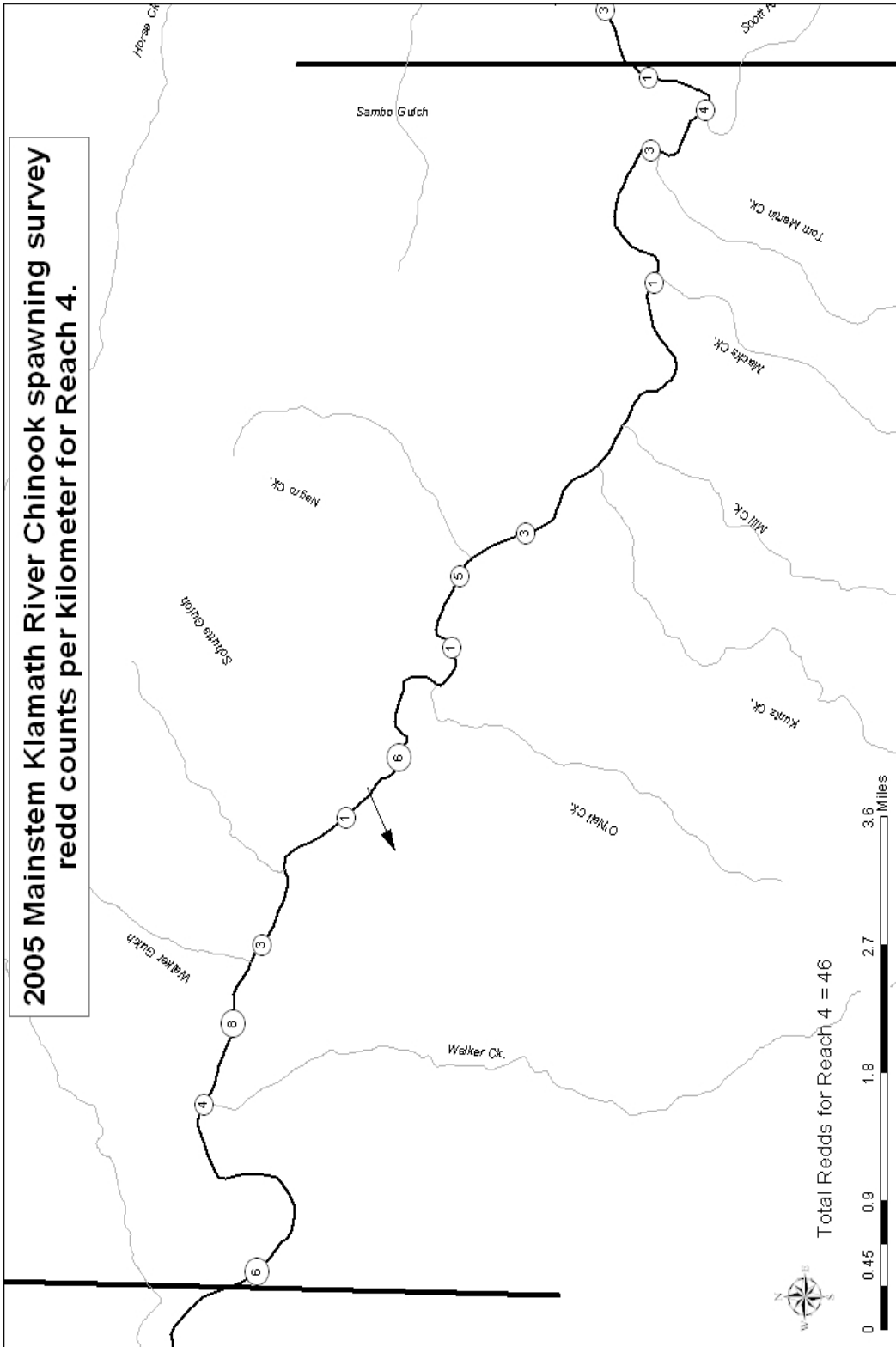


Figure 7. Redd distribution map for 2005, mainstem Klamath River, Blue Heron to Seiad Bar.

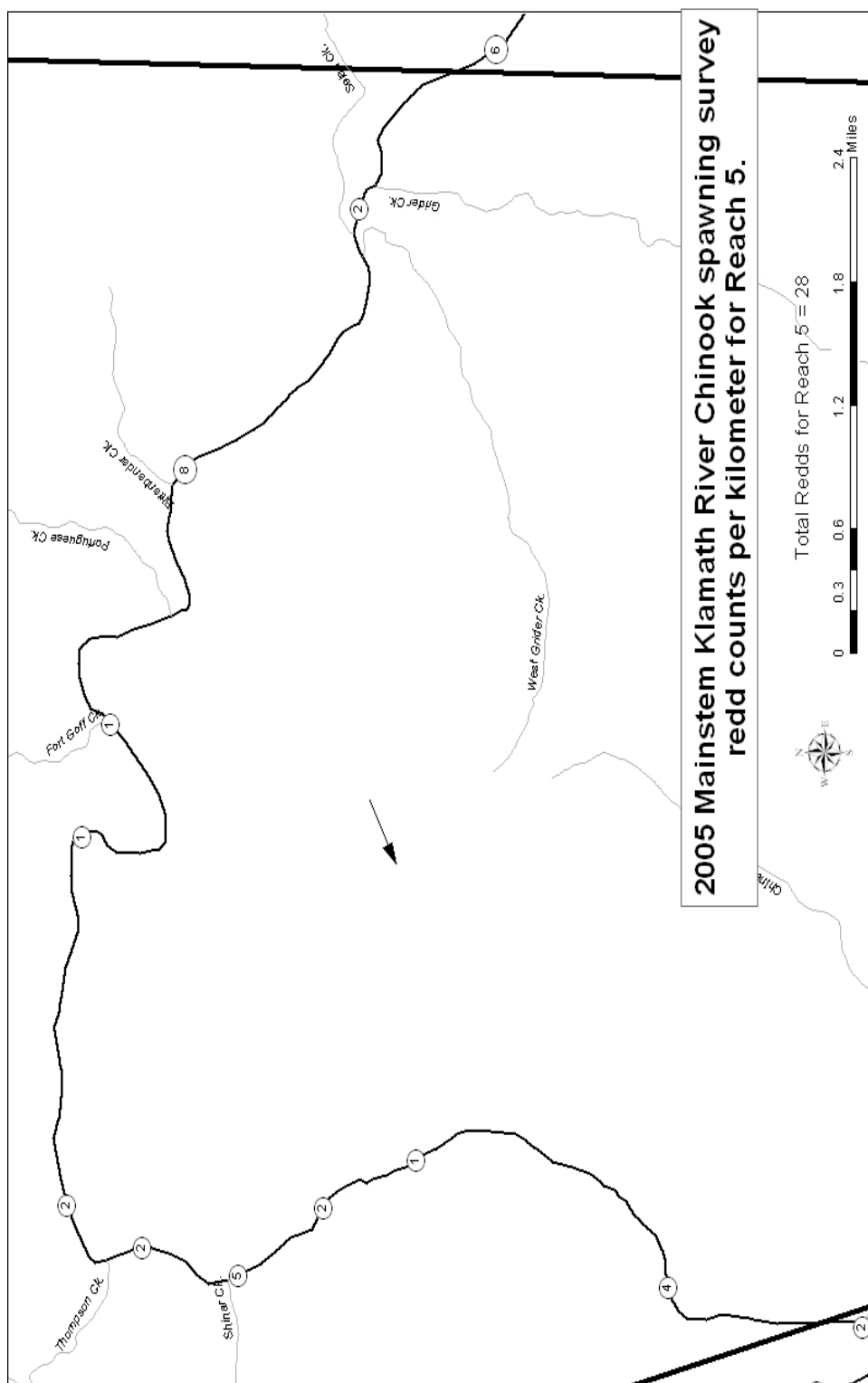


Figure 8. Redd distribution map for 2005, mainstem Klamath River, Seiad Bar to China Point.

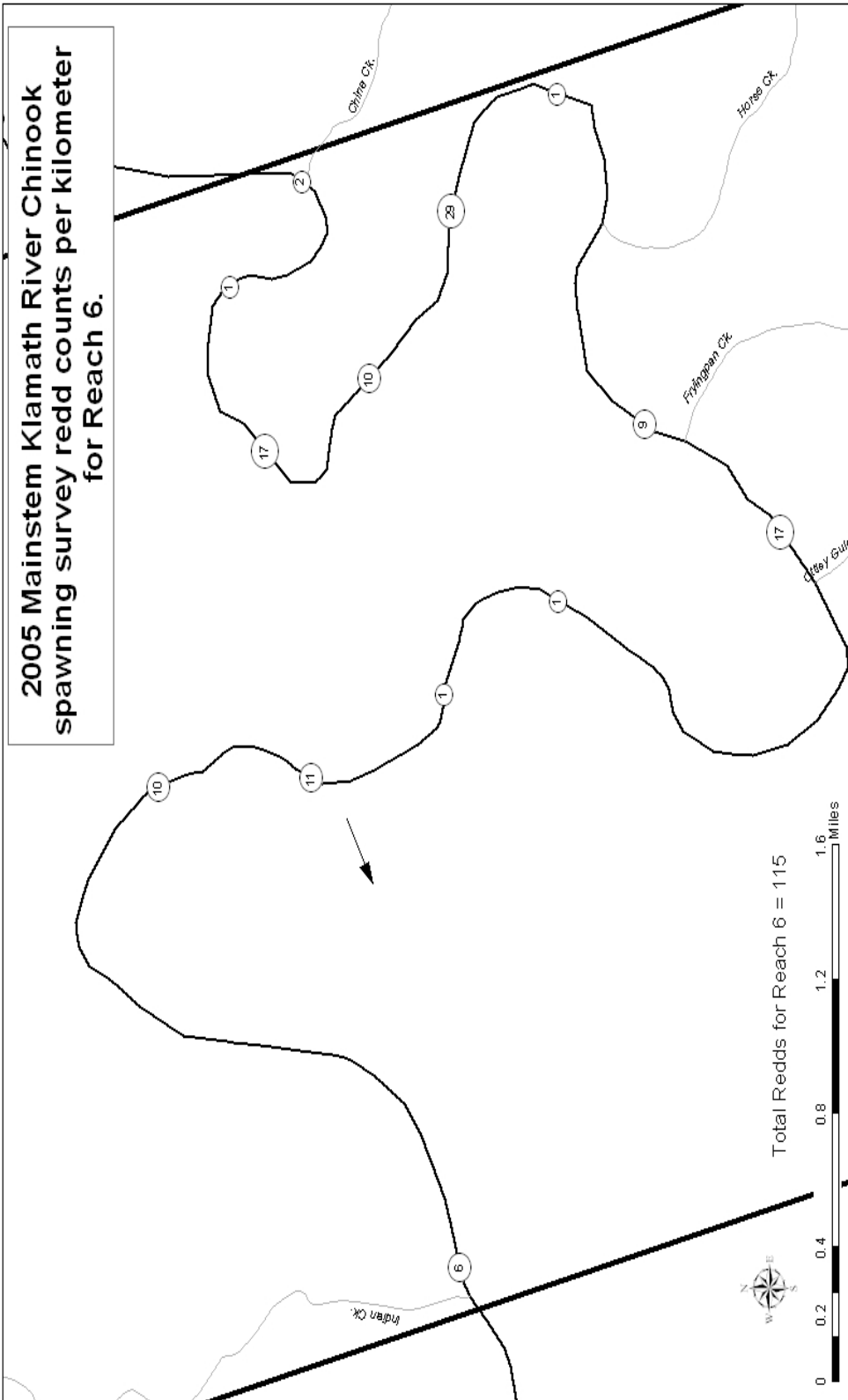


Figure 9. Redd distribution map for 2005, mainstem Klamath River, China Point to Indian Creek.

Reach 4: Blue Heron river access to Seiad Bar river access. A total of 46 redds were counted in Reach 4 during the 2005 survey (Table 1; Figure 7), representing 17 % of the total redd count for the season. Redd density was 2.2 redds/rkm (Figure 3). Peak spawning (n = 20) in Reach 4 occurred during the fifth week (November 15 to November 17) of the survey. The 46 redds observed during the survey is the fifth lowest count for this reach since the project started in 1993 (Table 1).

Reach 5: Seiad Bar river access to China Point river access. A total of 28 redds were counted in this reach during the 2005 survey (Table 1; Figure 8), accounting for 10 % of the season total. Redd density was 1.3 redds/rkm (Figure 3). Peak spawning (n = 17) occurred during the second week (October 25 to October 27) of the survey. Reach 5 had the lowest redd count (n = 28) of any reach sampled during 2005 and was the lowest count for the reach since the project started in 1993 (Table 1).

Reach 6: China Point river access to Indian Creek. A total of 115 redds were counted in Reach 6 (Table 1; Figure 9), representing 43 % of the total redd count for 2005. The estimated redd density was 6.2 redds/rkm (Figure 3), the fourth lowest for this reach since 1993. Peak spawning (n = 37) in Reach 6 occurred during the second week (October 25 to October 27) of this survey (Table 1).

All Reaches

Spawning was observed throughout the mainstem river from Ash Creek to Indian Creek and was consistent with previous survey data in that spatial distribution of redds was relatively lowest in Reach 5 (1.3 redds/rkm), highest in Reach 6 (6.2 redds/rkm) and intermediate for reaches 2, 3 and 4 (Table 1; Figure 3). The highest weekly redd count also occurred during late October, similar to most (11 of 13) survey years. Overall, the 2005 redd survey yielded the third lowest count for the five reaches surveyed during the period of record (1993 to 2005; Figure 4).

Redd Densities

Redd densities in 2005 were highest (10.1 redds/rkm) between China Creek and Ottley Gulch. Redd densities in 2005 were lower than in 2004 for all but the lower three 10 km Sections (Section 10, 11, and 12). In 2005, the lowest redd density (0.7 redds/rkm) was observed between Portuguese and Shinar Creek (Table 2; Figure 9).

Water Temperature

Mean daily water temperatures decreased from 14.5 to 10.1°C during this survey (October 18 to November 17, 2005). Water temperatures continued to decrease during the surveys, even though IGD flows remained fairly stable 1,320 to 1,430 cfs (Figure 10).

Discharge

Discharge during the 2005 survey period ranged from 1,320 to 1,430 cfs (Figure 10). Mean daily discharges were lowest (914 to 943 cfs) during the 2004 survey and the 2005 discharges were similar to those experienced in 2001 (1,300 to 1,410 cfs).

Table 2. Fall Chinook salmon redds per river kilometer (rkm) for 10 river kilometer (approximate) sections on the mainstem Klamath River, 1993 to 2005 (“Ns” = No survey).

Tributary Reach	Reach Length (rkm)	Year												
		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Iron Gate Dam to Cape Horn Creek	9.2	8.7	69.9	137.8	61.0	85.0	84.7	65.4	64.2	61.0	161.4	106.8	43.7	Ns
Cape Horn Creek to Shasta River	12.2	0.6	14.9	41.3	12.0	20.2	18.7	9.5	16.1	22.0	51.4	40.0	8.9	Ns
Shasta River to Humbug Creek	8.8	1.0	1.8	7.2	1.3	2.2	4.8	3.8	10.5	8.9	18.1	11.6	5.9	1.8
Humbug Creek to Vesa Creek	11.4	1.6	3.0	3.2	1.3	2.8	1.9	2.5	4.8	5.6	15.4	10.8	2.9	0.8
Vesa Creek to Little Humbug Creek	10.9	1.7	10.5	15.4	6.1	5.3	3.9	2.7	10.9	20.5	33.0	19.4	5.7	1.6
Little Humbug Creek to Kohl Creek	9.5	2.7	6.1	16.8	4.7	7.9	4.5	0.9	8.4	16.4	28.7	20.8	6.9	2.4
Kohl Creek to Kinsman Creek	11.0	2.4	4.0	14.5	5.3	3.6	5.5	3.0	5.2	13.2	22.6	14.2	3.2	1.0
Kinsman Creek to Kuntz Creek	9.8	0.8	6.8	3.9	3.4	1.6	0.6	1.2	3.4	9.3	20.1	10.2	1.4	1.2
Kuntz Creek to Walker Creek	10.3	2.0	8.8	12.0	2.3	14.6	3.5	1.8	10.5	15.0	29.8	21.7	4.1	2.8
Walker Creek to Portuguese Creek	9.4	2.7	9.0	13.4	8.0	1.9	1.4	2.2	4.1	8.1	12.1	10.7	2.6	1.9
Portuguese Creek to Shinar Creek	8.6	0.5	4.1	8.1	5.0	2.9	2.3	1.9	2.4	5.8	19.0	18.0	2.7	0.7
Shinar Creek to China Creek	7.2	3.1	10.6	19.9	11.4	4.3	0.8	0.4	0.8	4.3	9.4	7.8	0.8	1.9
China Creek to Otley Gulch	8.3	4.9	14.0	23.4	17.7	13.6	8.1	4.3	14.3	25.9	27.8	27.8	3.1	10.1
Otley Gulch to Indian Creek	9.9	2.4	9.1	18.9	6.7	13.4	4.9	3.1	6.2	6.4	24.5	17.8	2.2	2.9

Water Clarity

Vertical Secchi disc readings ranged from 2.1 to 3.0 m during this survey compared to 2.5 to 3.0 m in 2004. The 2.1 m reading was observed on November 16, 2005 in Reach 6. The 3.0 m reading was observed on October 25, 2005 in Reach 3. Water clarity for the 2005 survey decreased slightly from that experienced in 2004. Visibility generally decreased with higher river discharge, cloud cover, and precipitation.

Suction Dredge Mining

Recreational suction dredge mining was present throughout the survey from the Highway Ash Creek to Happy Camp. No redds observed in 2005 on suction dredge tailings. Studies have indicated that redds constructed on dredge tailings are more unstable in high flows than those constructed on naturally deposited substrate (Harvey and Lisle 1999).

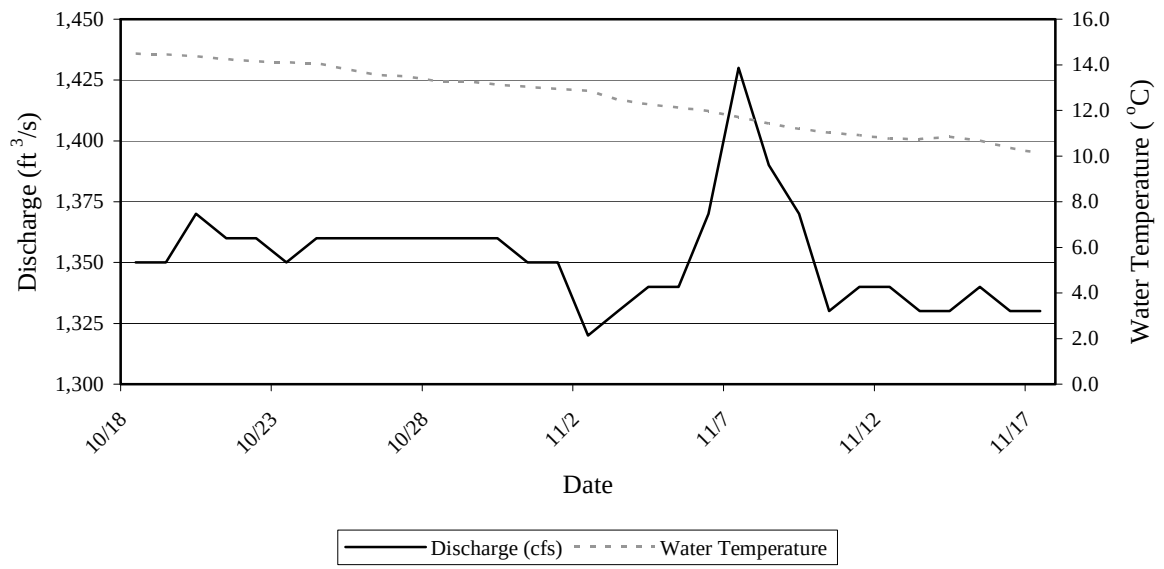


Figure 10. Water temperatures (°C) at river kilometer 309.8 and discharge (ft³/s) from Iron Gate Dam (October 18 to November 17, 2005).

Adult Grilse Expansion

The CDFG estimated the natural fall Chinook salmon spawner escapement for the mainstem Klamath River for 2005 at 13,554 adults and 398 grilse (Table 3). The adult/grilse estimates are based on male to female ratio and jack percentages observed at upper Klamath River tributary weirs (CDFG 2006). Based on spawning data from mainstem and tributary spawning surveys conducted by AFWO, USFS, CDFG, and Hoopa and Yurok tribes, the CDFG estimated that 55,004 adults spawned in-river or at hatcheries within the Klamath River Basin.

Summary

The fall Chinook salmon redd count of 268 was the third lowest combined total for the five reaches surveyed in 2005 since the initiation of these surveys in 1993. The highest redd count was 2,539 redds observed in 2002. In 2005, peak mainstem Chinook salmon spawning (36 %) occurred during the second survey week (October 25 to 27) in reaches 3, 5 and 6. In Reach 2, peak spawning occurred during the first survey week (October 18 to October 20) and in Reach 4 peak spawning occurred during the last survey week (November 15 to 17).

Typical water clarity experienced during the 2005 survey was similar to past survey years (2.1 to 3.0 m). A storm event during November 5, 2005 decreased water clarity to < 1.0 m causing the survey for the fourth week (November 8 to 10) to be cancelled

Table 3. Natural fall Chinook salmon spawning escapement adult and grilse expansion, Klamath River, 2005 (CDFG 2006).

Natural Spawning Area	Natural Spawners		Totals
	Grilse	Adults	
Mainstem Klamath River Iron Gate Dam to Indian Creek	32	4,622	4,654
Bogus Creek Basin	58	5,341	5,399
Shasta River Basin	37	2,018	2,055
Scott River Basin	58	698	756
Salmon River Basin	105	401	506
Misc. Klamath Tributaries upstream of Yurok Reservation	40	361	401
Yurok Reservation tributaries	68	113	181
Total Natural Spawners	398	13,544	13,952

Acknowledgements

The Arcata Fish and Wildlife Office wishes to acknowledge the Karuk Tribe of California, Department of Natural Resources, for providing support and the following personnel that assisted in conducting surveys: Mike Polmateer, Ike Hillman, Leaf Hillman Junior, and Alex Corum. We would also like to thank Wally Johnson for allowing us river access through his property at Seiad.

Literature Cited

- CDFG (California Department of Fish and Game). 2006. Klamath River basin fall Chinook salmon spawner escapement, in-river harvest and run-size estimates, 1978-2005a. Available from W. Sinnen, CDFG, 5341 Ericson Way, Arcata, CA 95521.
- Harvey, B.C. and T.E. Lisle. 1999. Scour of Chinook salmon Redds on Suction Dredge Tailings. North American Journal of Fisheries Management 19:613-617.
- KRTAT (Klamath River Technical Advisory Team). 2006. Klamath River fall Chinook age-specific escapement, river harvest, and run size estimates, 2005 run. Klamath Fishery Management Council, Yreka Fish and Wildlife Office, Yreka, California. 16 p.
- 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.
- PFMC (Pacific Fishery Management Council). 1988. Review of 1988 ocean salmon Fisheries. Portland, Oregon.
- USFWS 1991. Annual Report: Klamath River Fisheries Assessment Program, 1989. Coastal California Fishery Resource Office, Arcata, CA.