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Mainstem Klamath River Fall Chinook Salmon Spawning Survey 2007

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Key words: Chinook salmon, Klamath River, redd, escapement, spawning survey.

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Abstract. Results of the 2007 fall Chinook salmon *Oncorhynchus tshawytscha* spawning survey on the mainstem Klamath River are summarized. This survey is the fifteenth such summary provided by the Arcata Fish and Wildlife Office. The survey was conducted over a seven-week period (October 16 to November 29, 2007), covering 111.9 river kilometers (rkm; 69.5 river miles) between Ash Creek (rkm 285.7) and Indian Creek (rkm 173.8). In 2007, only Reaches 2 thru 6 were surveyed and are compared to past years counts for the same reaches. A total of 712 fall Chinook redds were counted in 2007, which represents the seventh lowest count since surveys began in 1993. The 2007 count was 3% lower than the 2006 count and 20% less than the previous fourteen year average ($\bar{x}$ = 892 redds). Redd densities, within 10 km river sections, was highest between China Creek and Ottley Gulch (rkm 191.9 to 183.7; 19.0 redds/rkm) and lowest between Shasta River and Humbug Creek (rkm 288.4 to 279.7; 1.1 redds/rkm).

Introduction

The Klamath River drains approximately 14,000 km^2 in Oregon and 26,000 km^2 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 km^2 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 km^2, and the Shasta, Scott and Salmon rivers, each draining about 2,070 km^2. 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 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 salmon (*Oncorhynchus tshawytcha)*, 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 (Leidy and Leidy 1984). 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 susceptible to 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 number of natural fall Chinook salmon spawning in the mainstem Klamath River between IGD and the confluence of Indian Creek. This information is critical for monitoring long-term trends in escapement and for developing harvest management alternatives.

Methods

Survey Procedures

Weekly visual redd counts, using 4.3 m inflatable rafts, were conducted on five mainstem reaches from Ash Creek to Indian Creek over a 7-week period (October 16 to November 29). No survey was conducted during the sixth week (November 21 to 23) due to high river flows that limited water clarity. A single crew surveyed the entire channel. Survey crews consisted of an oarsman and observer. Crew members wore polarized sunglasses and hats to reduce glare and enable them to see redds more clearly. To improve coverage of redd areas; boats were maneuvered in a zigzag pattern across the channel. Side and split channels were primarily surveyed by foot unless access was difficult, then they were floated on alternating weeks. Crews were assigned the same survey reaches through the sampling period with the belief that increased familiarity of redd locations would facilitate more accurate accounting of redds.

Survey Reaches

Reach 1: IGD (rkm 309.8) to Deliverance Camp (rkm 287.5). Reach 1 is approximately 22.3 rkm (13.8 miles) in length (Figure 2). This was the second year since 1993 that

redds were not surveyed in this reach because 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 and Ash Creek (rkm 285.7) was not surveyed because past surveys revealed a lack of available spawning habitat in this area.

Reach 2: Ash Creek to Beaver Creek (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 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 Tuesdays in about 7 hrs, depending on flows.

Reach 3: Beaver Creek to Blue Heron (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 Tuesdays and required 8 hrs to complete.

Reach 4: Blue Heron to Seiad Bar (rkm 213.6). Reach 4 is approximately 20.8 rkm (12.9 miles) in length (Figure 2). The Seiad Bar access is located along the north bank of the Klamath River and access was through Wally Johnson's property. Access to the river is reached by turning south from Highway 96 onto Diamond J road and then turning right onto an unmarked road located near the California Department of Transportation compound. This reach was surveyed on Wednesdays and required 8 hrs to complete.

Reach 5: Seiad Bar to China Point (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 Wednesdays, taking about 7 hrs to complete.

Reach 6: China Point 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 to Gordons Ferry is about 7.4 rkm (4.6 miles). Gordons Ferry to Indian Creek confluence is about 11.3 rkm (7 miles). To access Gordons Ferry, turn off Highway 96 onto Gordons Ferry Road. This reach was split into two sections and covered by two crews on Thursdays, with each section taking requiring 5 hrs to complete.

Data Collection

Redd Data

Vinyl flagging was used to mark redd locations in the field. 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. River reach, flag location, GPS coordinates, 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 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 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 41º 55' 41", Longitude 122º26'35" 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 in each survey reach each 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.

Data Analysis

Redd Densities

The density of redds per unit length of river was determined to examine the spatial distribution of redds in the area of study. Redd density was examined by the six primary survey reaches and 10 kilometer sections (sub reaches), the latter of which was completed to provide improved spatial resolution of locations of redds for future evaluations. Summarization of redd densities was facilitated through use of a database. Redd surveys in the upper two 10 rkm sections (IGD to Cape Horn Creek and Cape Horn Creek to Shasta River) did not take place in 2007.

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) spawner abundance between the Shasta River and Indian Creek (CDFG 2008). 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 and grilse apportionment for the mainstem Klamath River from IGD to Indian Creek was derived from scales and fork length data collected during carcass surveys in Reach 1 (KRTAT 2008).

Results and Discussion

A total of 712 Chinook salmon redds were counted between Ash Creek and Indian Creek (rkm 285.7 to 173.8) in 2007, representing a 3 % decrease from the 2006 redd count (n = 733; 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 2007 were the seventh lowest recorded since 1993 (Figure 4). Locations of redds for all reaches surveyed are shown in Figures 5 to 9.

Survey Reaches

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

Reach 2: Ash Creek to Beaver Creek. A total of 89 redds were observed in this reach representing 13% of the total redd count(Table 1; Figure 5). Redd density was 3.7 redds/rkm (Figure 3). Peak spawning (n = 27) was observed during the fourth survey week (November 5 to 8) (Table 1). The 89 redds counted in this reach represent the eighth lowest count since the project started in 1993 (Table 1).

Reach 3: Beaver Creek to Blue Heron. A total of 136 redds were counted in this reach comprising 19% of the total redd count for the season. (Table 1; Figure 6), Redd density was 4.9 redds/rkm (Figure 3). Peak spawning (n = 53) occurred during the second survey week (October 23 to 25) (Table 1). The 136 redds observed during the survey is the seventh lowest count for this reach since the project started in 1993 (Table 1).

Reach 4: Blue Heron to Seiad Bar. A total of 138 redds were counted in Reach 4 representing 19 % of the total redd count for the season. (Table 1; Figure 7), Redd density was 6.6 redds/rkm (Figure 3). Peak spawning (n = 47) in Reach 4 occurred during the third survey week (October 30 to November 1). The 138 redds observed during the survey is the seventh lowest count for this reach since the project started in 1993 (Table 1).

Reach 5: Seiad Bar to China Point. A total of 65 redds were counted in this reach (Table 1; Figure 8), accounting for 9 % of the season total. Redd density was 3.1 redds/rkm (Figure 3). Peak spawning (n = 25) occurred during the second survey week (October 23 to 25). Reach 5 had the lowest redd count (n = 65) of any reach sampled during 2007 and was the eighth lowest count for the reach since the project started in 1993 (Table 1).

Reach 6: China Point to Indian Creek. A total of 284 redds were counted in Reach 6 (Table 1; Figure 9), representing 40 % of the total redd count. Redd density was also

highest of all study reaches at15.2 redds/rkm (Figure 3). Reach 6 had the tenth lowest count for this reach since 1993. Peak spawning (n = 90) in Reach 6 occurred during the third survey week (October 30 to November 1; 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 (3.1 redds/rkm), highest in Reach 6 (15.2 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 15) survey years. Overall, the 2007 redd survey yielded the seventh lowest count for the five reaches surveyed during the period of record (1993 to 2007; Figure 4).

Water Temperature

Mean daily water temperatures decreased from 13.9 to 8.2ºC during this survey (October 16 to November 29, 2007). Water temperatures continued to decrease during the surveys, even though IGD flow remained stable (1,320 to 1,380 cfs; Figure 10).

Discharge

Discharge during the 2007 survey period ranged from 1,320 to 1,380 cfs (Figure 10). Mean daily discharges were lowest (914 to 943 cfs) during the 2004 survey and the 2007 discharges were similar to those experienced in 2001 (1,300 to 1,410 cfs), 2005 (1,320 to 1,430 cfs), and 2006 (1,280 to 1,330 cfs).

Water Clarity

Vertical Secchi disc readings ranged from 1.2 to 2.7 m during this survey compared to 0.6 to 3.0 m in 2006. The 1.2 m reading was observed on October 23, 2007 in Reach 3. The 2.7 m reading was observed on November 16, 2007 in Reach 3. Visibility generally decreased with higher river discharge, cloud cover, and precipitation.

Suction Dredge Mining

Recreational suction dredge mining was present throughout the survey from Ash Creek to Happy Camp. One redd was observed on a suction dredge tailing near Horse Creek. Studies have indicated that redds constructed on dredge tailings are more unstable in high flows than if constructed on naturally deposited substrate (Harvey and Lisle 1999).

10 rkm Section Redd Densities

Redd densities were highest (19.0 redds/rkm) between China Creek and Ottley Gulch. Redd densities in 2007 were lower than in 2006 for six of twelve reaches surveyed. In 2007, the lowest redd density (1.1 redds/rkm) was observed between Shasta River (rkm 288.5) and Humbug Creek (rkm 279.7; Table 2; Figure 5).

Adult Grilse Expansion

The CDFG estimated the natural fall Chinook salmon spawner escapement for the mainstem Klamath River for 2007 at 21,280 adults and 232 grilse (Table 3). A total of 16,969 adults and 180 grilse returned to Iron Gate Hatchery. Based on adult fall Chinook salmon spawning and carcass data from mainstem and tributary spawning surveys conducted by AFWO, USFS, CDFG, and Hoopa and Yurok tribes, the CDFG estimated that 94,723 adults spawned in-river or at hatcheries within the Klamath River Basin (KRTAT 2008).

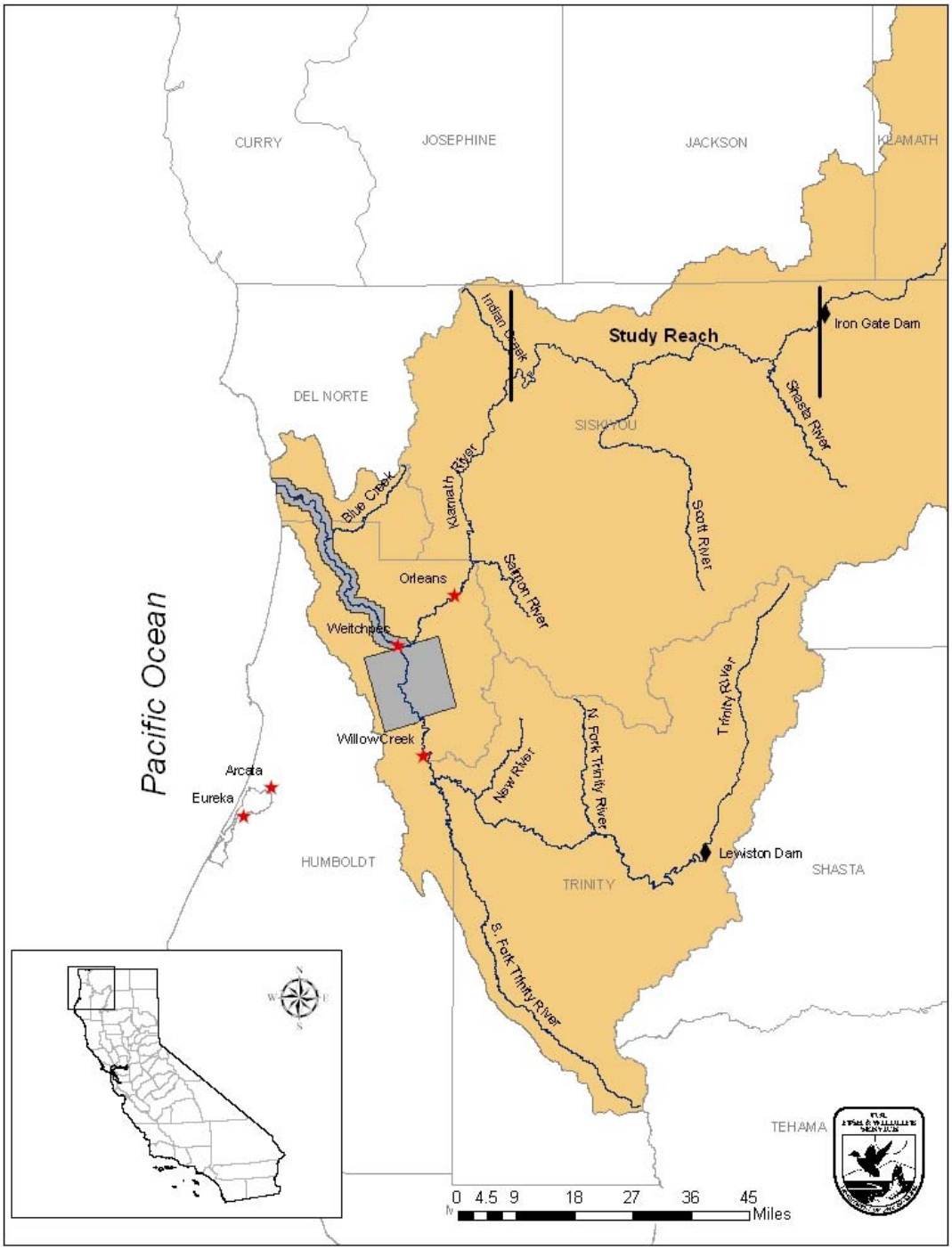

Figure 1. Overview map of the Klamath River Basin accessible to fall Chinook salmon.

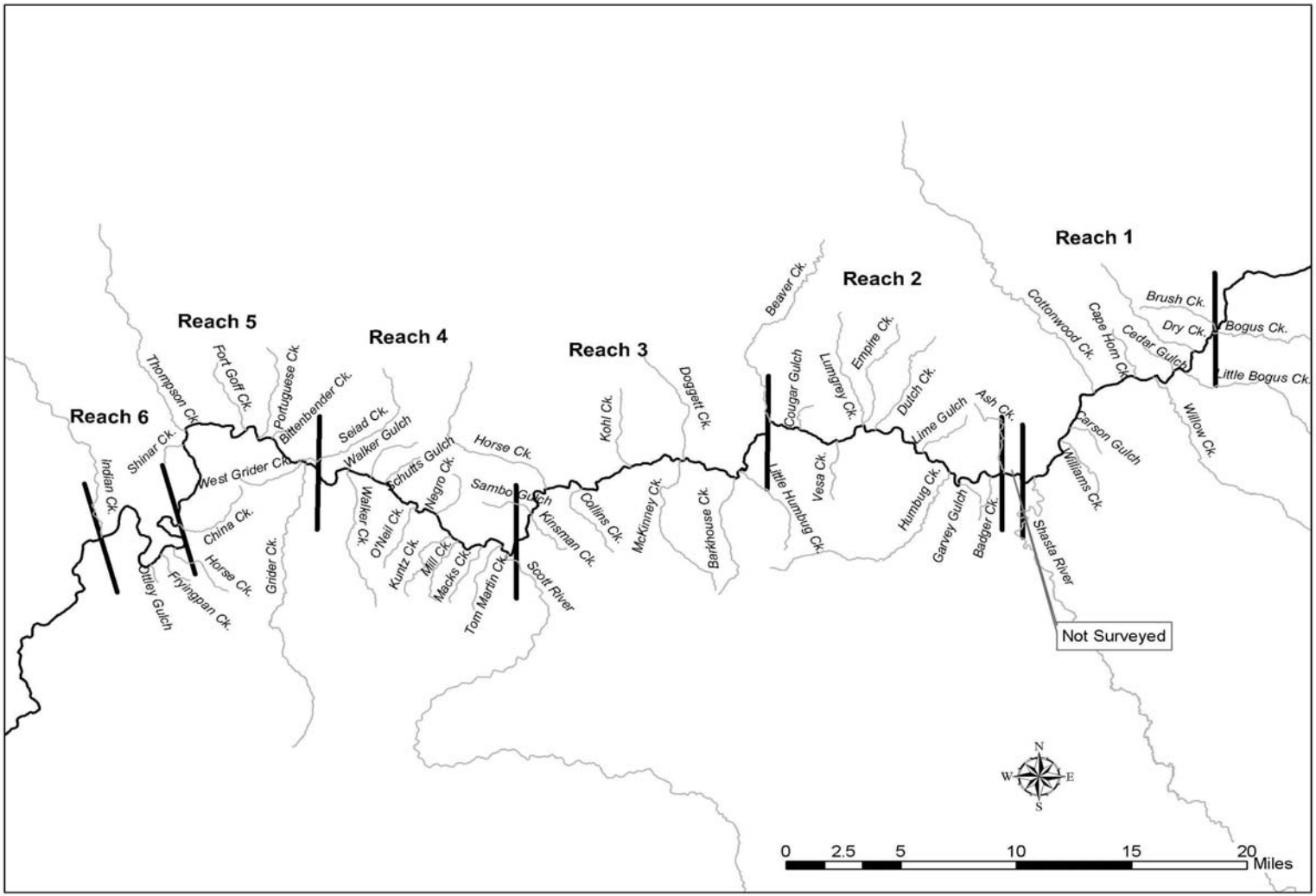

Figure 2. Mainstem Klamath River Chinook salmon spawning survey project location including individual study reaches (1 to 6).

Table 1. Weekly summary and percent frequency of mainstem Klamath River fall Chinook salmon redd counts for Reaches 1 to 6, 1993 to 2007 (NS = No Survey, R1 = Iron Gate Dam to Ash Creek, R2 = R1 to Beaver Creek, R3 = R2 to Blue Heron, R4 = R3 to Seiad Bar, R5 = R4 to China Point, R6 = R5 to Indian Creek).

		Reach						
Year	**Week**	**R1**	**R2**	**R3**	**R4**	**R5**	**R6**	**Total**
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**
	% Frequency	50	7	11	10	7	16	
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 13 to 17	Ns	Ns	Ns	Ns	Ns	Ns	0
	Nov 20 to 24	Ns	Ns	Ns	Ns	Ns	Ns	0
	Nov 27 to Dec 1	39	9	14	4	12	3	81
	Total	1,779	187	410	172	215	473	**3,236**
	% Frequency	55	6	13	5	7	15	
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**
	% Frequency	59	4	9	9	4	15	
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
	Total	1,010	82	126	42	39	116	**1,415**
	% Frequency	71	6	9	3	3	8	

Table 1. (Continued). Weekly summary and percent frequency of mainstem Klamath River fall Chinook salmon redd counts for Reaches 1 to 6, 1993 to 2007 (NS = No Survey, R1 = Iron Gate Dam to Ash Creek, R2 = R1 to Beaver Creek, R3 = R2 to Blue Heron, R4 = R 3 to Seiad Bar, R5 = R4 to China Point, R6 = R5 to Indian Creek).

		Reach						
Year	**Week**	**R1**	**R2**	**R3**	**R4**	**R5**	**R6**	**Total**
1999	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
	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	
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 19 to 23	Ns	Ns	Ns	Ns	Ns	Ns	0
	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
	Total	830	269	435	220	140	278	**2,172**
	% Frequency	38	12	20	10	6	13	
2002	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
	Nov 19 to 22	76	20	10	10	5	15	136
	Nov 26 to 29	Ns	Ns	Ns	Ns	Ns	Ns	0
	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	
2003	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
	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	

Table 1. (Continued). Weekly summary and percent frequency of mainstem Klamath River fall Chinook salmon redd counts for Reaches 1 to 6, 1993 to 2007 (NS = No Survey, R1 = Iron Gate Dam to Ash Creek, R2 = R1 to Beaver Creek, R3 = R2 to Blue Heron, R4 = R 3 to Seiad Bar, R5 = R4 to China Point, R6 = R5 to Indian Creek).

		Reach						
Year	**Week**	**R1**	**R2**	**R3**	**R4**	**R5**	**R6**	**Total**
2004	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
	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	
2005	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
	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	
2006	Oct 16 to 20	109	21	41	66	31	155	423
	Oct 23 to 27	167	17	30	61	21	55	351
	Oct 30 to Nov 3	96	10	33	12	Ns	6	157
	Nov 6 to 10	66	3	9	7	19	110	214
	Nov 13 to 15	15	6	4	Ns	Ns	Ns	25
	Nov 20 to 24	Ns	Ns	Ns	Ns	Ns	Ns	0
	Nov 29	Ns	Ns	Ns	Ns	Ns	16	16
	Total	453	57	117	146	71	342	**1,186**
	% Frequency	38	5	10	12	6	29	
2007	Oct 16 to 18	Ns	24	17	36	5	42	124
	Oct 23 to 25	Ns	12	53	15	25	67	172
	Oct 30 to Nov 1	Ns	25	32	47	21	90	215
	Nov 5 to 8	Ns	27	24	37	8	72	168
	Nov 14 to 16	Ns	1	7	3	5	9	25
	Nov 21 to 23	Ns	Ns	Ns	Ns	Ns	Ns	0
	Nov 28 to 29	Ns	Ns	3	Ns	1	4	8
	Total	0	89	136	138	65	284	**712**
	% Frequency	0	13	19	19	9	40	

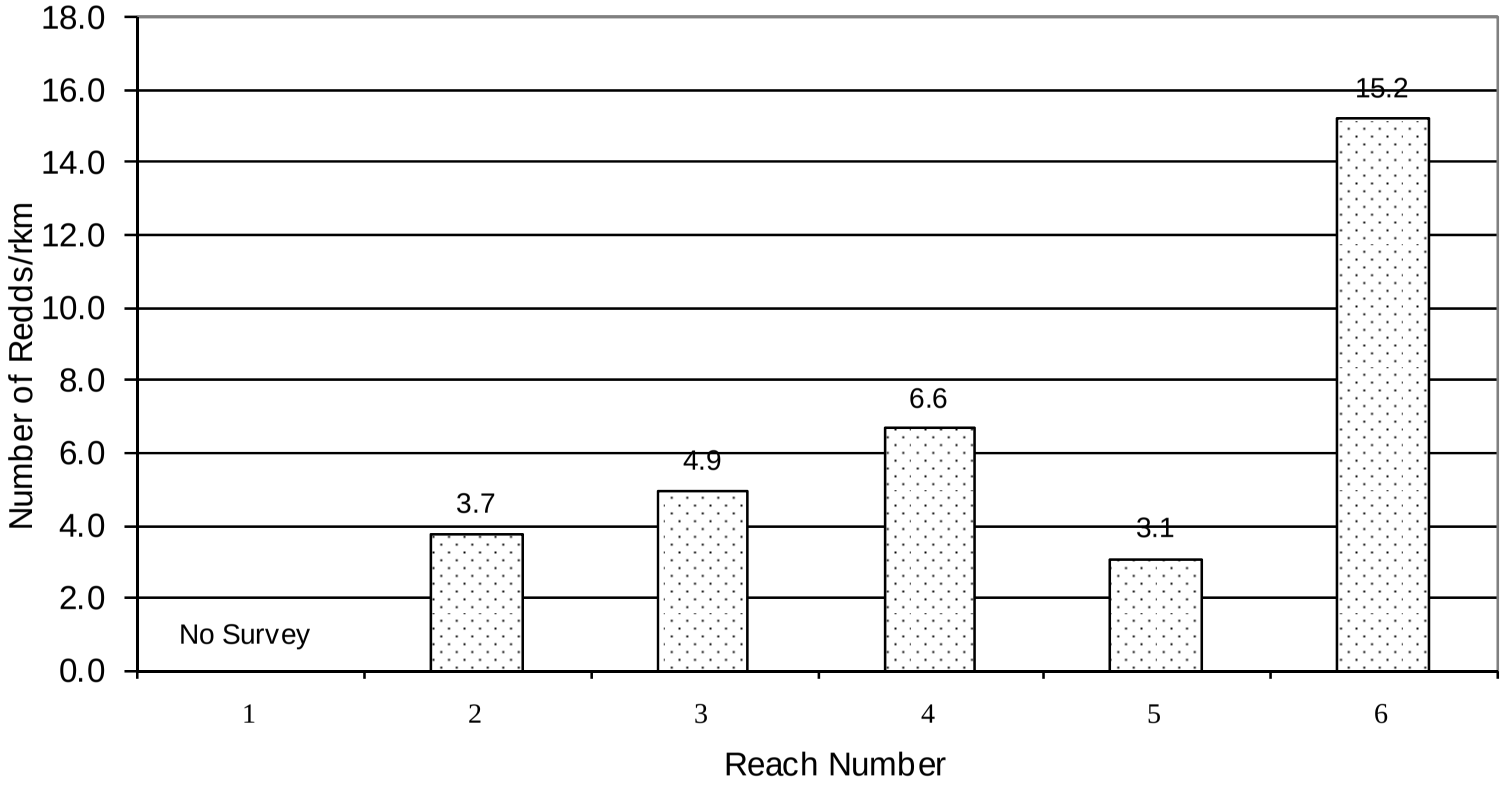

Figure 3. Mainstem Klamath River fall Chinook salmon redd density (redds/rkm) by reach, 2007.

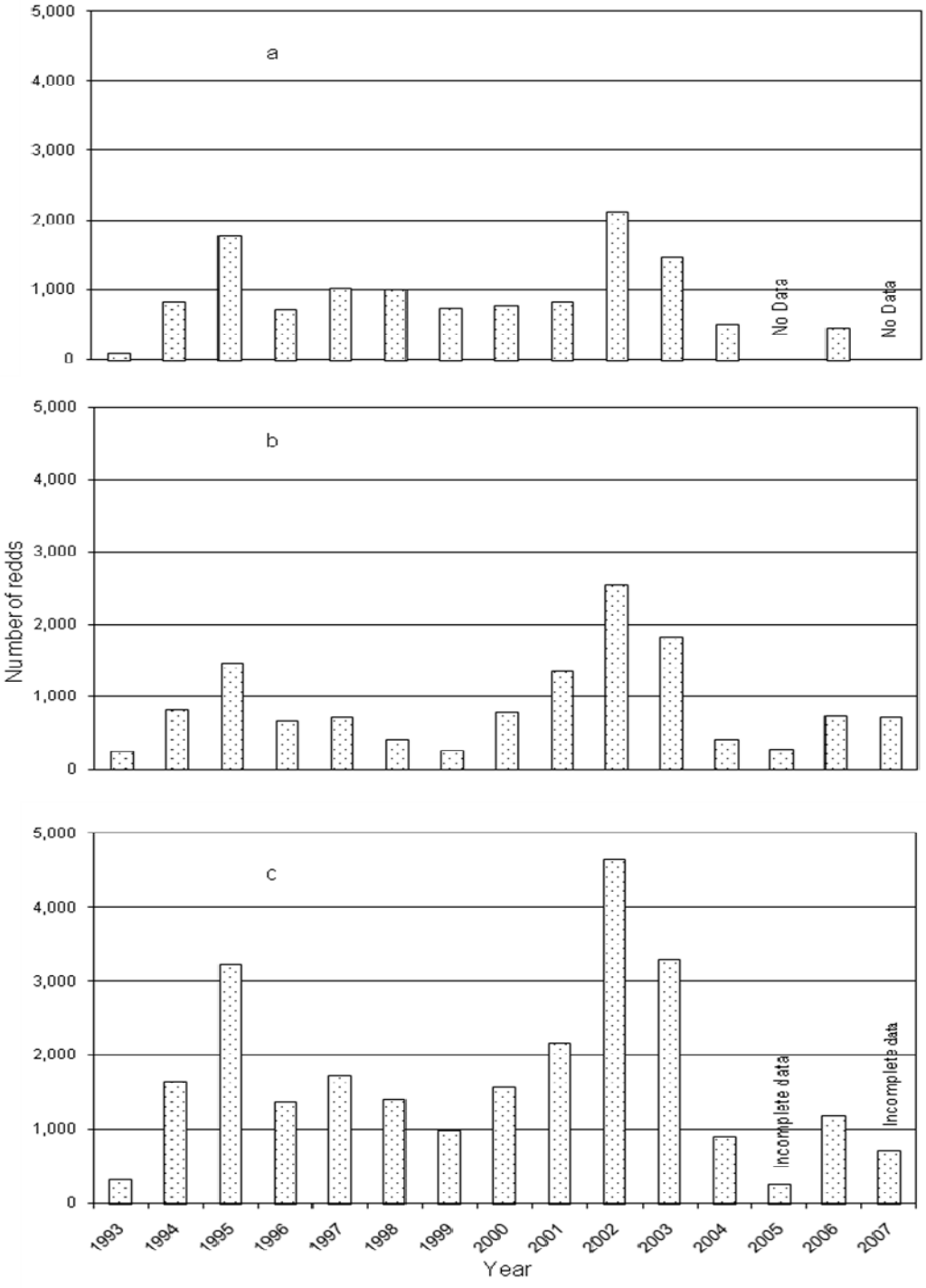

Figure 4. USFWS Chinook salmon redd counts 1993 to 2007 for a) Reach 1; b) Reaches 2 to 6; c) all reaches combined.

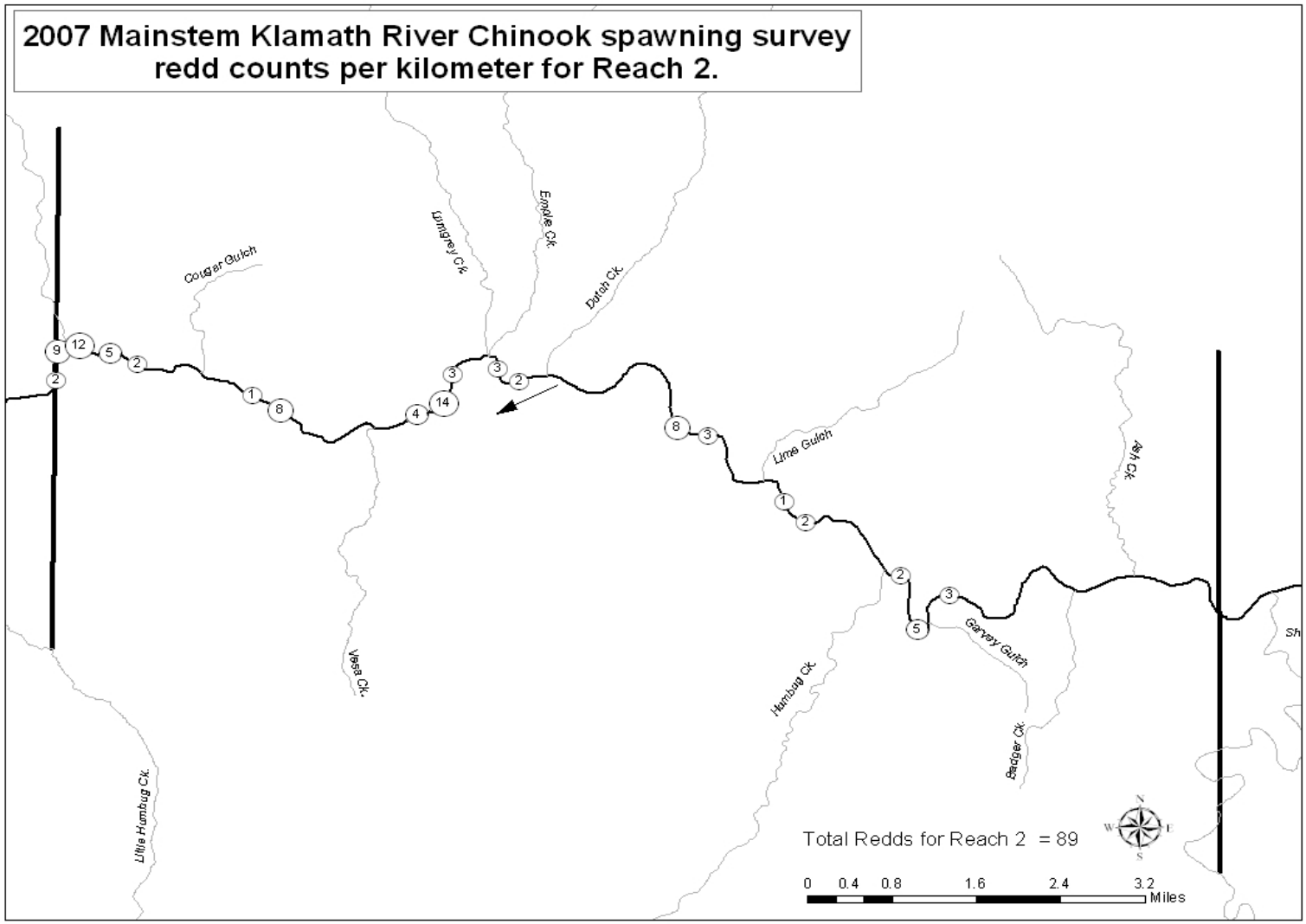

Figure 5. Redd distribution map for 2007, mainstem Klamath River, Ash Creek to Beaver Creek.

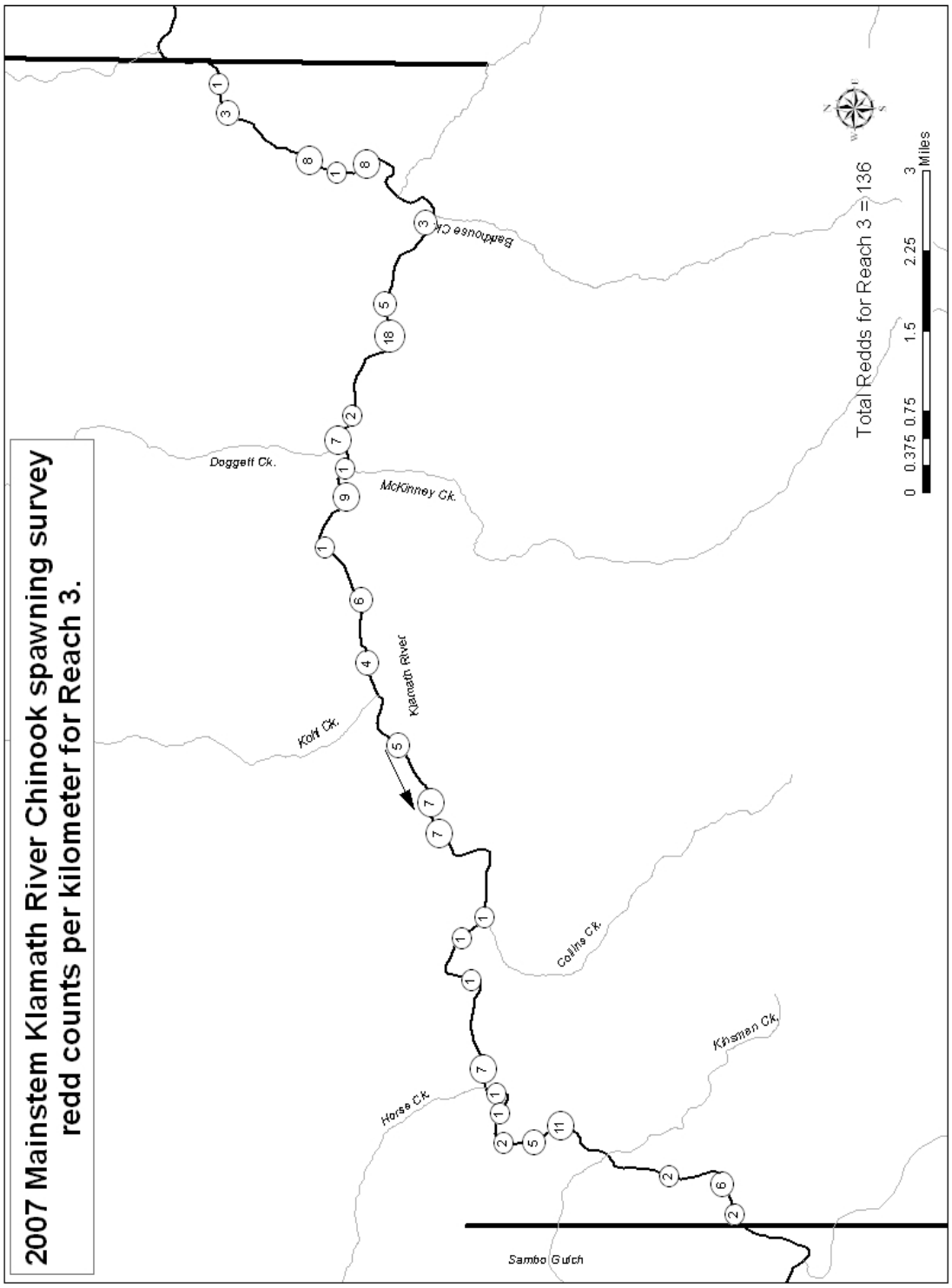

Figure 6. Redd distribution map for 2007, mainstem Klamath River, Beaver Creek to Blue Heron.

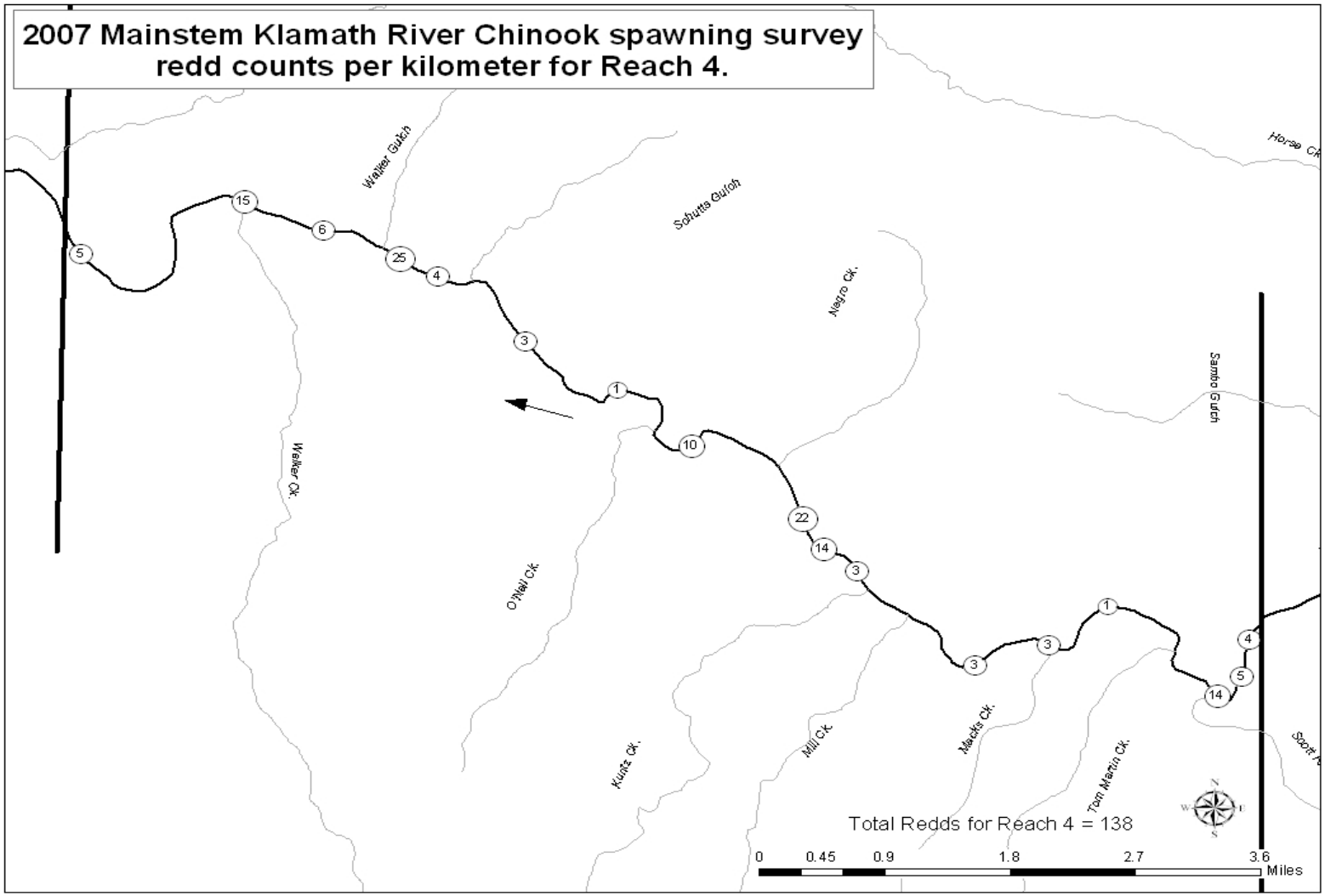

Figure 7. Redd distribution map for 2007, mainstem Klamath River, Blue Heron to Seiad.

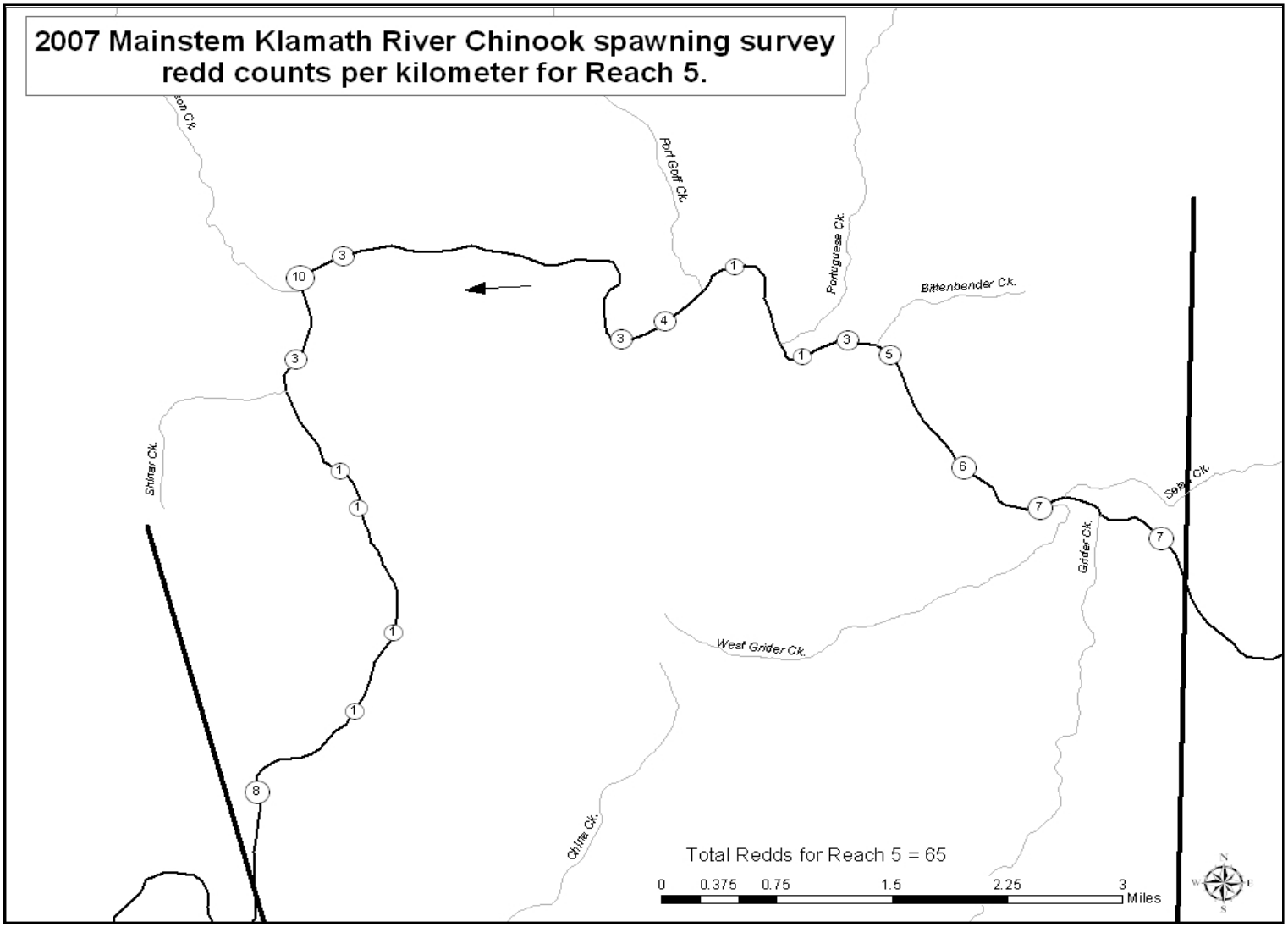

Figure 8. Redd distribution map for 2007, mainstem Klamath River, Seiad Bar to China Point.

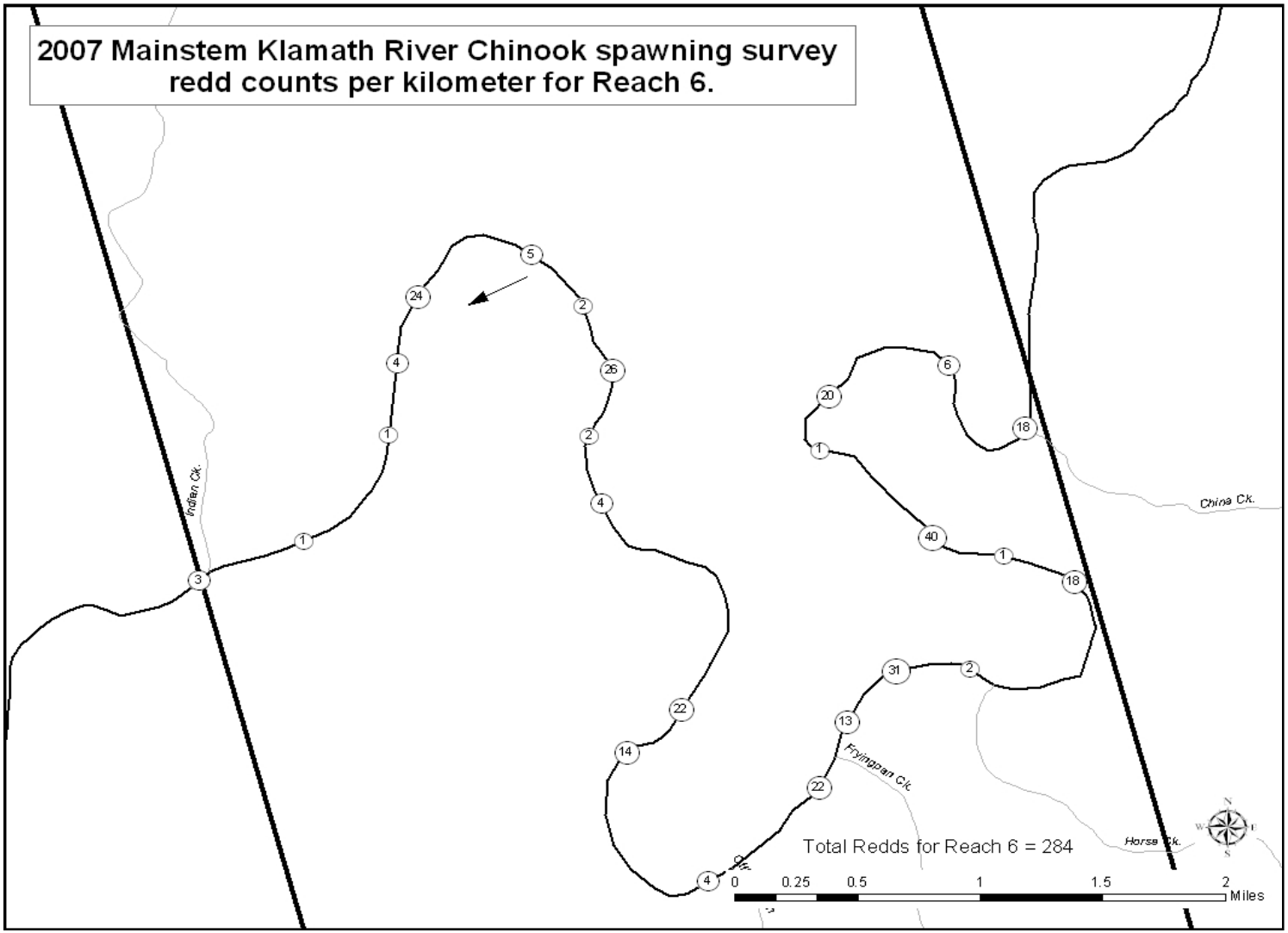

Figure 9. Redd distribution map for 2007, mainstem Klamath River, China Point to Indian Creek.

Table 2. Fall Chinook salmon redds per river kilometer (rkm) for 10 river kilometer (approximate) sections on the mainstem Klamath River, 1993 to 2007 ("Ns" = No survey).

Tributary Reach	Reach Length (rkm)	Year														
		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Iron Gate Dam (309.75) to Cape Horn Creek (300.6)	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	43.2	Ns
Cape Horn Creek (300.59) to Shasta River (288.45)	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	4.6	Ns
Shasta River (288.44) to Humbug Creek (279.7)	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	1.8	1.1
Humbug Creek (279.69) to Vesa Creek (268.3)	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	1.6	3.5
Vesa Creek (268.29) to Little Humbug Creek (257.45)	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	3.2	5.5
Little Humbug Creek (257.44) to Kohl Creek (248.0)	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	5.5	5.9
Kohl Creek to (247.99) Kinsman Creek (237.05)	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	4.0	4.5
Kinsman Creek (237.04) to Kuntz Creek (227.3)	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	1.9	4.2
Kuntz Creek (227.29) to Walker Creek (217.0)	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	10.6	9.9
Walker Creek (216.99) to Portuguese Creek (207.65)	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	3.8	3.6
Portuguese Creek to (207.64) Shinar Creek (199.1)	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	3.0	2.8
Shinar Creek (199.09) to China Creek (191.95)	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	8.3	4.2
China Creek (191.94) to Ottley Gulch (183.7)	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	17.3	19.0
Ottley Gulch (183.69) to Indian Creek (173.85)	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	17.6	10.9

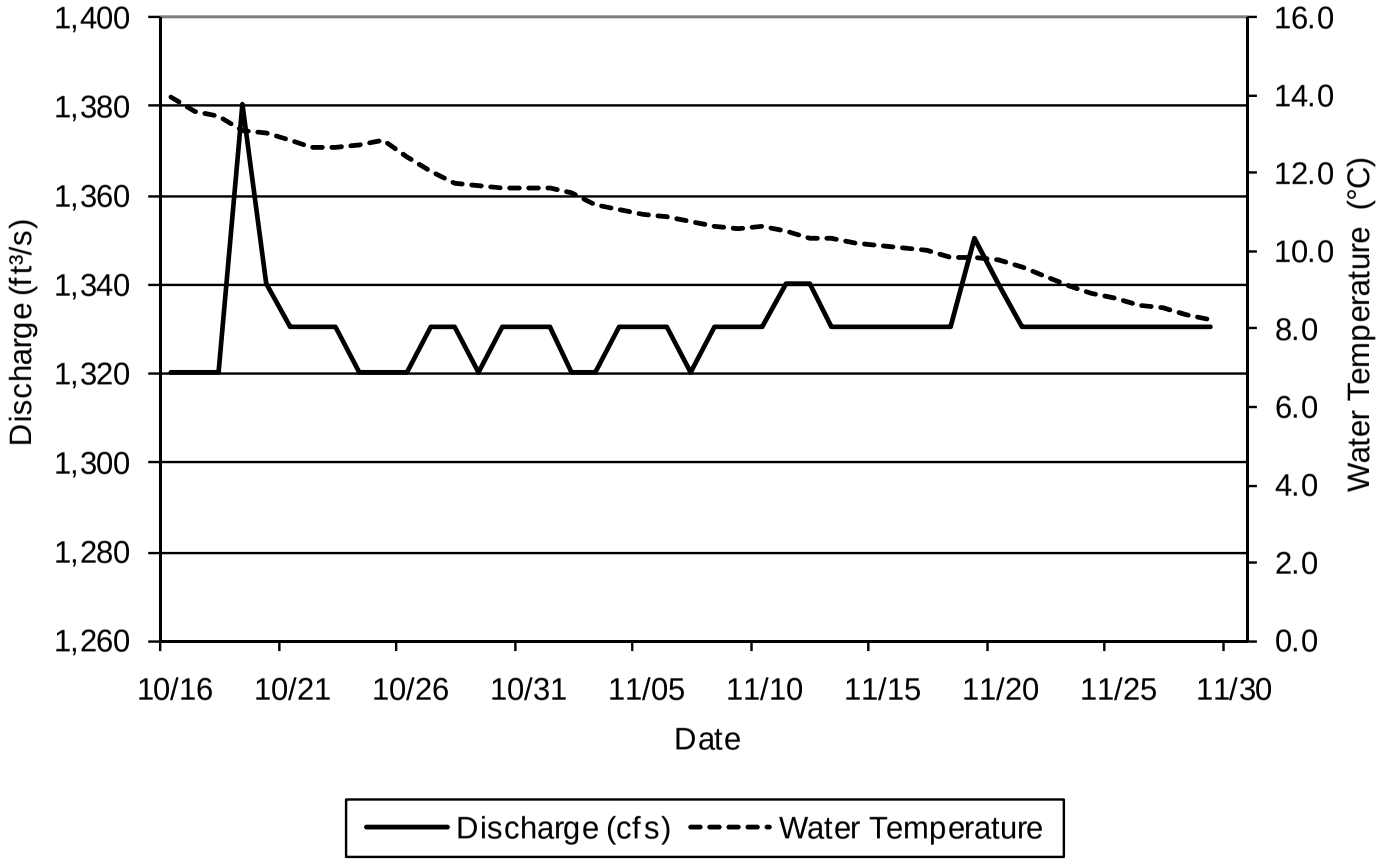

Figure 10. Water temperatures (°C) at river kilometer 309.8 and discharge (ft^3/s) from Iron Gate Dam (October 16 to November 29, 2007).

Table 3. Natural fall Chinook salmon spawning escapement and adult and grilse expansion, Klamath River, 2007 (CDFG 2008).

Natural Spawning Area	Natural Spawners		Totals
	Grilse	Adults	
Mainstem Klamath River Iron Gate Dam to Indian Creek	41	6,881	6,922
Bogus Creek Basin	64	4,677	4,741
Shasta River Basin	27	2,009	2,036
Scott River Basin	11	4,494	4,505
Salmon River Basin	55	1,377	1,432
Misc. Klamath Tributaries upstream of Yurok Reservation	26	1,414	1,440
Yurok Reservation Tributaries	8	428	436
Total Natural Spawners	232	21,280	21,512

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Literature Cited

CDFG (California Department of Fish and Game). 2008. Klamath River basin fall Chinook salmon spawner escapement, in-river harvest and run-size estimates, 1978-2007. 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). 2008. Klamath River fall Chinook age-specific escapement, river harvest, and run size estimates, 2007 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.