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Mainstem Klamath River Fall Chinook Salmon Spawning Survey 2002

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Key words: Chinook, Klamath, redd, spawning survey

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Abstract Results of the tenth 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 eight week period (October 10 to December 6, 2002), covering 135.9 river kilometers (rkm; 84.4 river miles) between Iron Gate Dam and the confluence of Indian Creek at Happy Camp. A total of 4,652 redds were observed during the 2002 survey, which is the highest number of redds recorded since the initiation of surveys in 1993. Redd counts in 2002 were 2.9 times higher than the preceding nine year average ($\bar{x}$ = 1,610 redds). The 2002 count represents a 114% increase from the 2001 count (n = 2,172). In 2002, as in past survey years, spawning was observed throughout the mainstem Klamath River from Iron Gate Dam to Indian Creek with the highest percentage of redds (n = 2,113) located between Iron Gate Dam and the Shasta River. The highest redd density within 10 km river sections was between Iron Gate Dam and Cape Horn Creek (161.4 redds/rkm). The lowest redd densities were between Shinar and China Creek (9.4 redds/rkm). Water clarity between Iron Gate Dam and Indian Creek ranged from 1.0 to 4.0 m, and was higher than most survey years. During 2002, only one redd was observed on dredge tailings.

Introduction

The Klamath River drains approximately 14,000 km^2 in Oregon and 26,000 km^2 in California. Most of the watershed in California is within the boundaries of the Six Rivers, Klamath and Shasta-Trinity National Forests. The Yurok Indian Reservation, comprising approximately 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 approximately 2,070 km^2. Iron Gate Dam (IGD; rkm 310.3) on the Klamath River and Lewiston Dam at rkm 249 on the Trinity River, are barriers to upstream

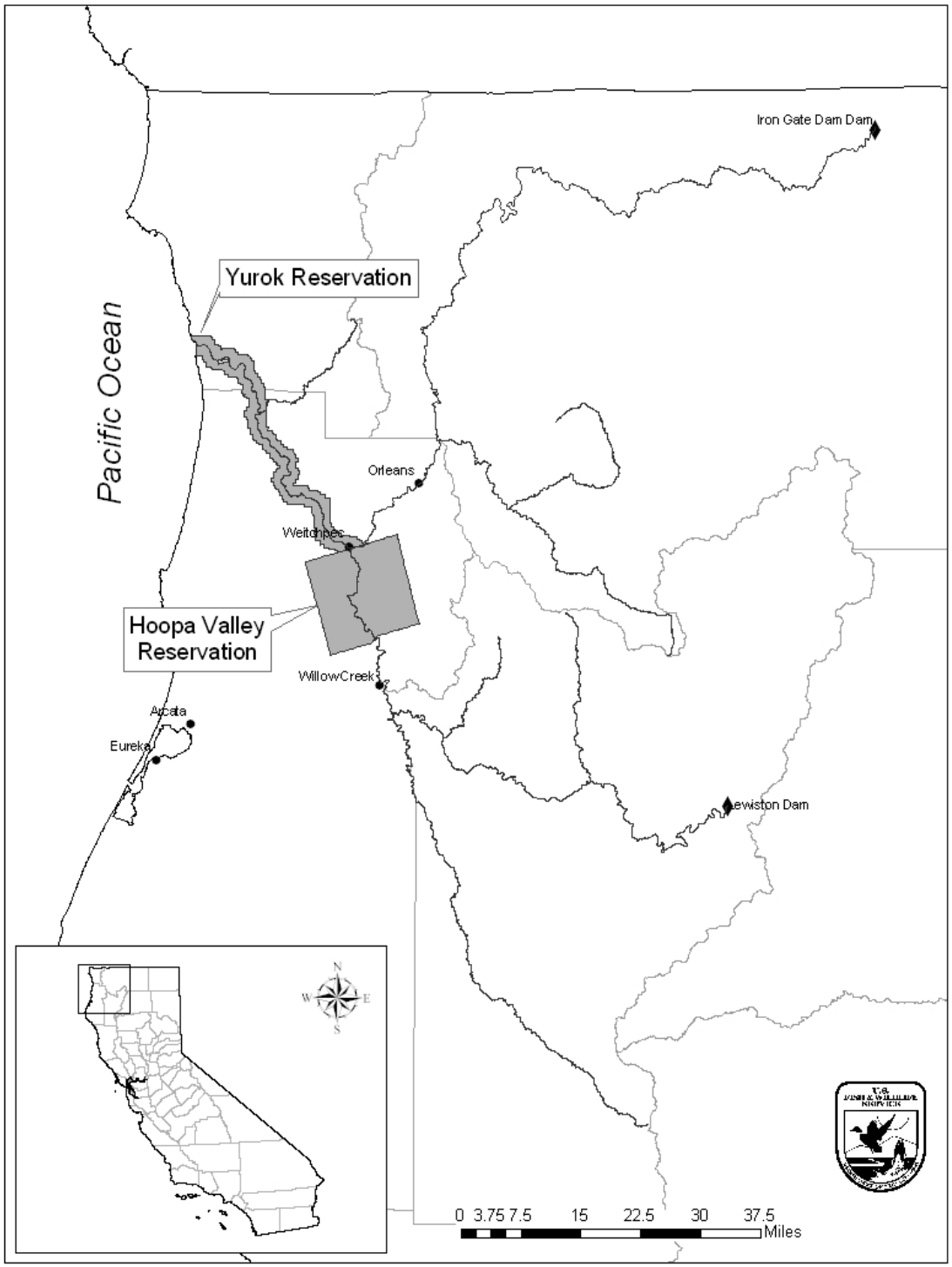

Figure 1. Overview map of the Klamath River Basin accessible to fall Chinook salmon.

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 tshawytcha* 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 have been 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

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). The six reaches were surveyed weekly from IGD to the confluence of Indian Creek, unless adverse weather limited the visibility of the water to less than one meter in depth. The reaches were surveyed for eight consecutive weeks from October 10 to December 6, 2002. 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.

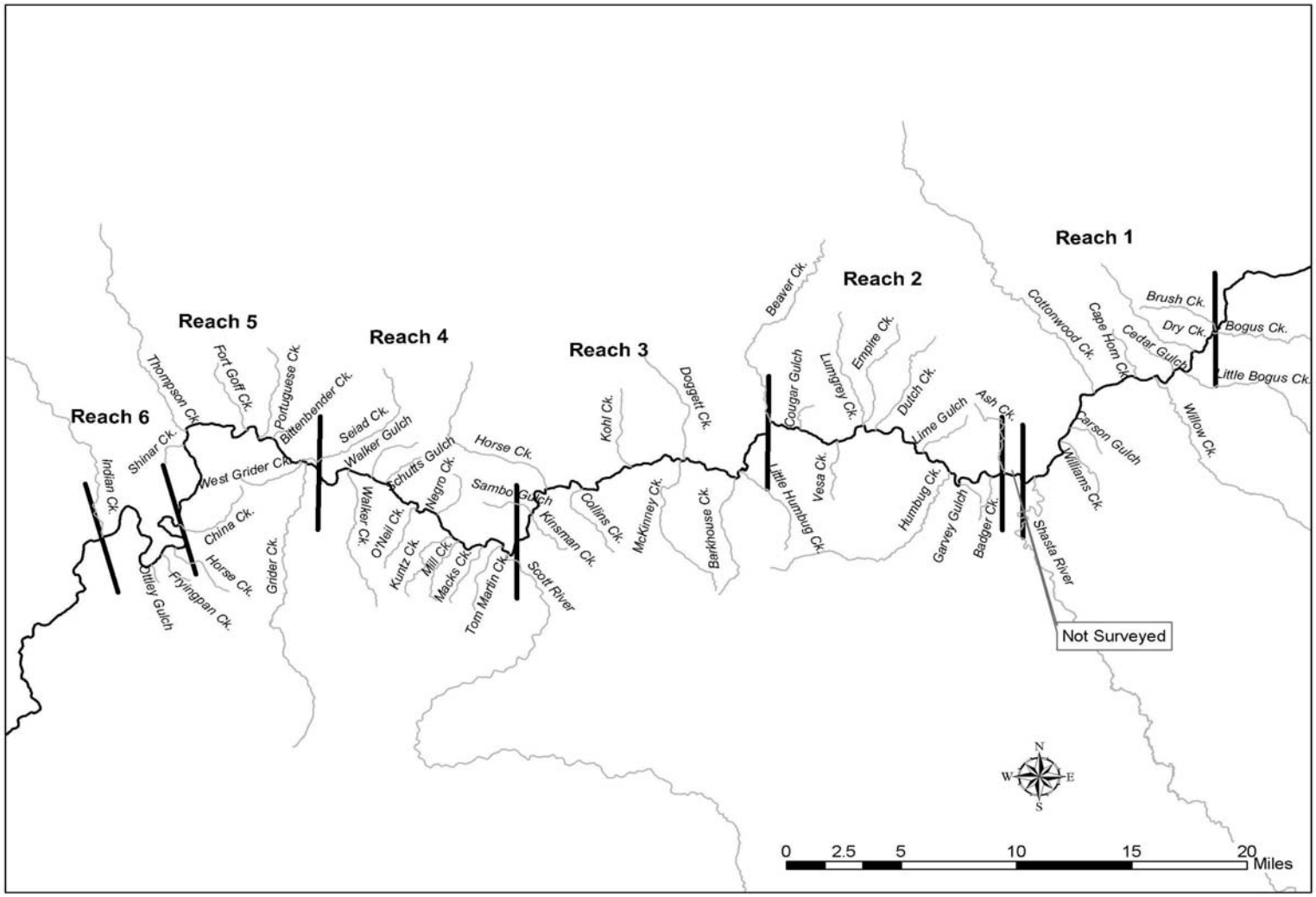

Figure 2. Mainstem Klamath River Chinook salmon spawning survey project location including individual study Reaches 1 to 6.

Rafting Equipment

Two 4.3 m (14 foot) inflatable Wing Catarafts were used for direct observation of fall Chinook salmon redds. These rafts are commonly used in white water 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) and was surveyed over a period of two days (Monday and Tuesday). Due to the high percentage of redds in Reach 1, two cataraft crews surveyed the entire reach from IGD to Deliverance Camp river access. One crew surveyed the south bank to mid-channel while the second crew surveyed from the north bank to mid-channel. A section of Reach 1 from the Interstate 5 (I-5) bridge (rkm 292.7) to the Deliverance Camp river access was completed in approximately two hours on the first day (Monday) of the survey week, depending on flows. On the second survey day of each week (Tuesday), the survey resumed from the IGD river access to the I-5 Bridge. This reach was completed in 8 to 10 hrs. The section from Deliverance Camp river access to Ash Creek river access was not surveyed because past surveys have revealed lack of available spawning habitat.

Reach 2: Ash Creek river access (rkm 285.7) to Beaver Creek riffle river access (rkm 261.9). Reach 2 is approximately 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 just downstream of Ash Creek and accessed from Klamath River road. 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 third survey day (Wednesday) of each week in about 7 hrs.

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 on the south bank approximately 2 rkm upstream from the Scott River confluence, just off Highway 96. This reach was surveyed by one crew on the third survey day (Wednesday) of each week, taking about 8 hours 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 Walley Johnson's property. Access to the river is reached by taking Diamond J road off Highway 96 and turning right onto an unmarked road located near the California Department of Transportation compound. Reach boundaries remain the same as in previous years. This reach was surveyed on the fourth day (Thursday) of each survey week by one crew, taking 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 the US Forest Service (USFS) river access

just off Highway 96. One crew surveyed this reach, on the fourth day (Thursday) of each survey week, taking about 7 hrs to complete.

Reach 6: China Point river access to the Indian Creek confluence (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 approximately 7.4 rkm (4.6 miles). Gordons Ferry river access to Indian Creek confluence is approximately 11.3 rkm (7 miles). The Gordons Ferry river access is located on the north bank of the river just off Highway 96. This reach was split into two sections and covered by two crews on the fifth day (Friday) of each survey week, with each section taking about 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.

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 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 downstream end of R-Ranch (5 rkm downstream of IGD). Hourly data was used to calculate the 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 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 Grilse Expansion

The total number of redds counted by AFWO during these surveys is used by California Department of Fish and Game (CDFG) to estimate adult and grilse (two year old) spawning abundance (Stacey 2003). Adult numbers were calculated by multiplying the total redd count by two. This estimate assumes there is only one male and female salmon per redd. The adult and grilse age apportionment for Reaches 1 to 6 was derived from length frequency and scale analysis data from the USFWS carcass surveys in Reach 1 (KRTAT 2003).

Results and Discussion

A total of 4,652 Chinook salmon redds were counted between IGD and the confluence of Indian Creek in 2002, representing a 114 % increase from the 2001 count of 2,172 (Table 1). The highest number of Chinook salmon redds/rkm is still in Reach 1 (Figure 3). The 2002 Chinook salmon redd numbers were the highest recorded since the initiation of these surveys (Figure 4). Based on field maps and notes from the survey, locations of redds for all reaches surveyed were mapped as shown in Figures 5 to 10.

Individual Reaches

Reach 1: IGD to Deliverance Camp river access. A total of 2,113 redds were observed in this reach during the 2002 survey (Table 1; Figure 5). The 2,113 redds represent 45 % of the total redd count for 2002. The redd density in this reach was 94.8 redds/rkm (Figure 3). Peak spawning (n = 885) was observed during the third week (October 21 to 25) of the survey (Table 1). The 2,113 redds counted in this reach represents the highest count since the project started in 1993 (Table 1).

Reach 2: Ash Creek river access to Beaver Creek riffle river access. A total of 566 redds were observed in this reach during the 2002 survey (Table 1; Figure 6). The 566 redds represent 12 % of the total redd count for 2002. Redd density was 23.8 redds/rkm (Figure 3). Peak spawning (n = 198) occurred during the third week (October 21 to 25) of the survey (Table 1). The 566 redds counted in this reach represent the highest count since the project started in 1993 (Table 1).

Reach 3: Beaver Creek riffle river access to Blue Heron river access. A total of 726 redds were counted in this reach during the 2002 survey (Table 1; Figure 7), comprising 16 % of the total redd count for the season. Redd density was 26.3 redds/rkm

Table 1. Weekly summary and percent frequency of mainstem Klamath River fall Chinook salmon redd counts for Reaches 1 to 6, 1993 to 2002 (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).

		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 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	
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	

Table 1. (Continued). Weekly summary and percent frequency of mainstem Klamath River fall Chinook salmon redd counts for Reaches 1 to 6, 1993 to 2002 (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).

		Reach						
Year	**Week**	**R1**	**R2**	**R3**	**R4**	**R5**	**R6**	**Total**
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
	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
	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	

(Figure 3). Peak spawning (n = 340) in Reach 3 occurred during the third week (October 21 to 25) of the survey (Table 1). The 726 redds counted in this reach represents the highest count since the project started in 1993 (Table 1).

Reach 4: Blue Heron river access to Seiad Bar river access. A total of 441 redds were counted in this reach during the 2002 survey (Table 1; Figure 8). The 441 redds represent 9 % of the total redd count for 2002. Redd density was 21.2 redds/rkm (Figure 3). Peak spawning (n = 186) in Reach 4 was observed during the third week (October 21 to 25) of the survey (Table 1). The 441 redds observed during the survey is the highest count for this reach since the project started in 1993 (Table 1).

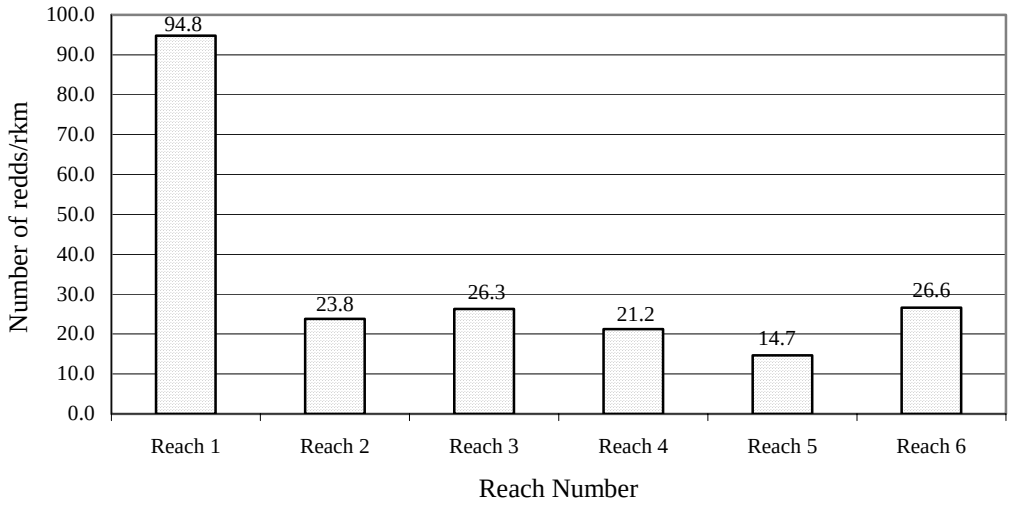

Figure 3. Mainstem Klamath River fall Chinook salmon redd density (redds/rkm) by reach, 2002.

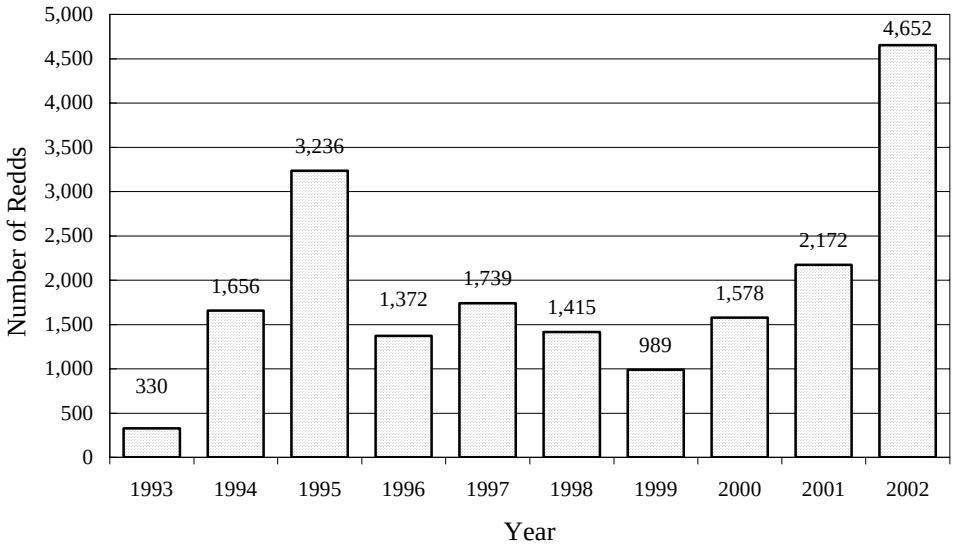

Figure 4. Yearly USFWS Chinook salmon redd counts, 1993 to 2002.

Reach 5: Seiad Bar river access to China Point river access. A total of 311 redds were counted in this reach during the 2002 survey (Table 1; Figure 9), accounting for 7% of the season total. Redd density was 14.7 redds/rkm (Figure 3). Peak spawning (n = 141)

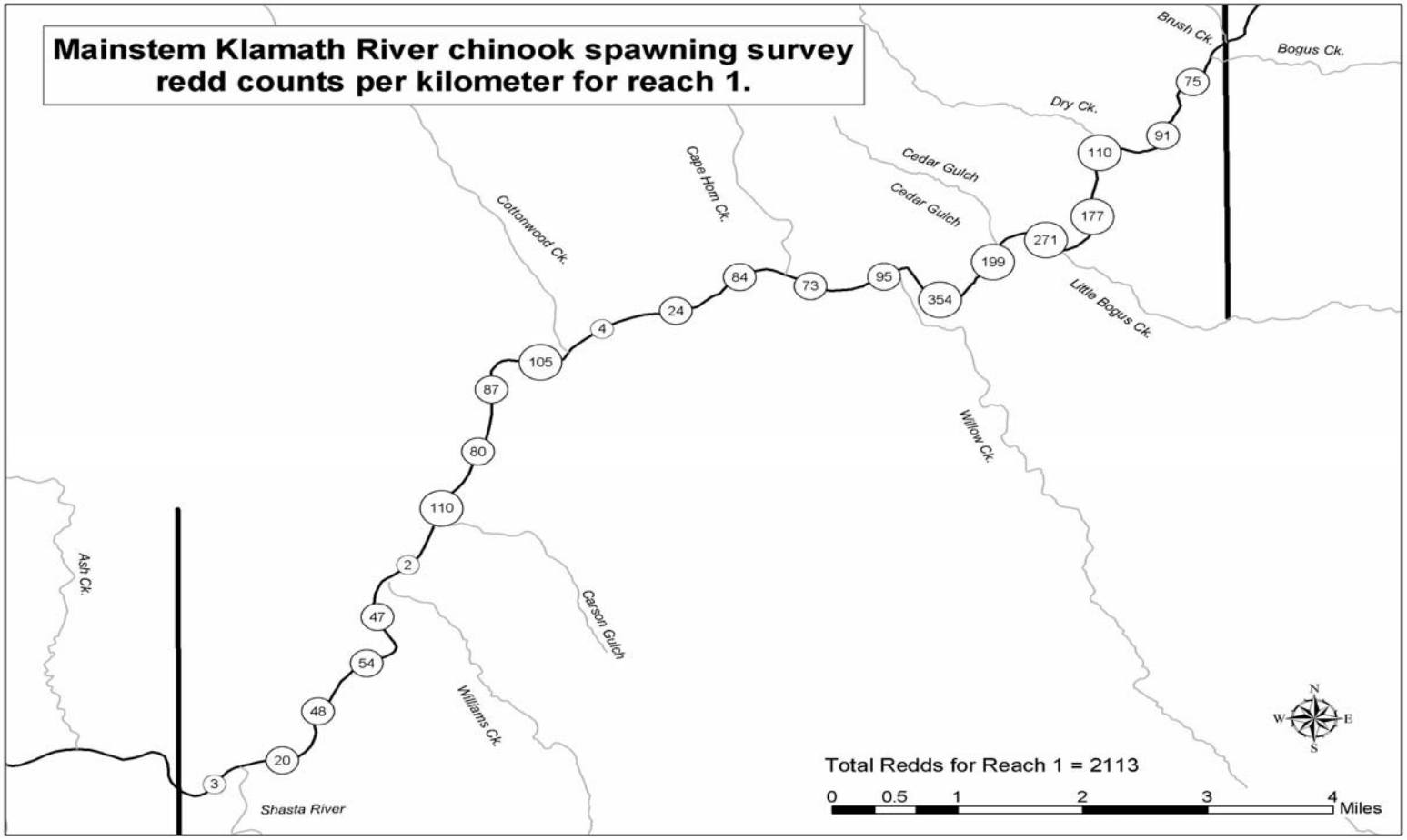

Figure 5. Redd distribution map for 2002, mainstem Klamath River, Iron Gate Dam to Deliverance Camp.

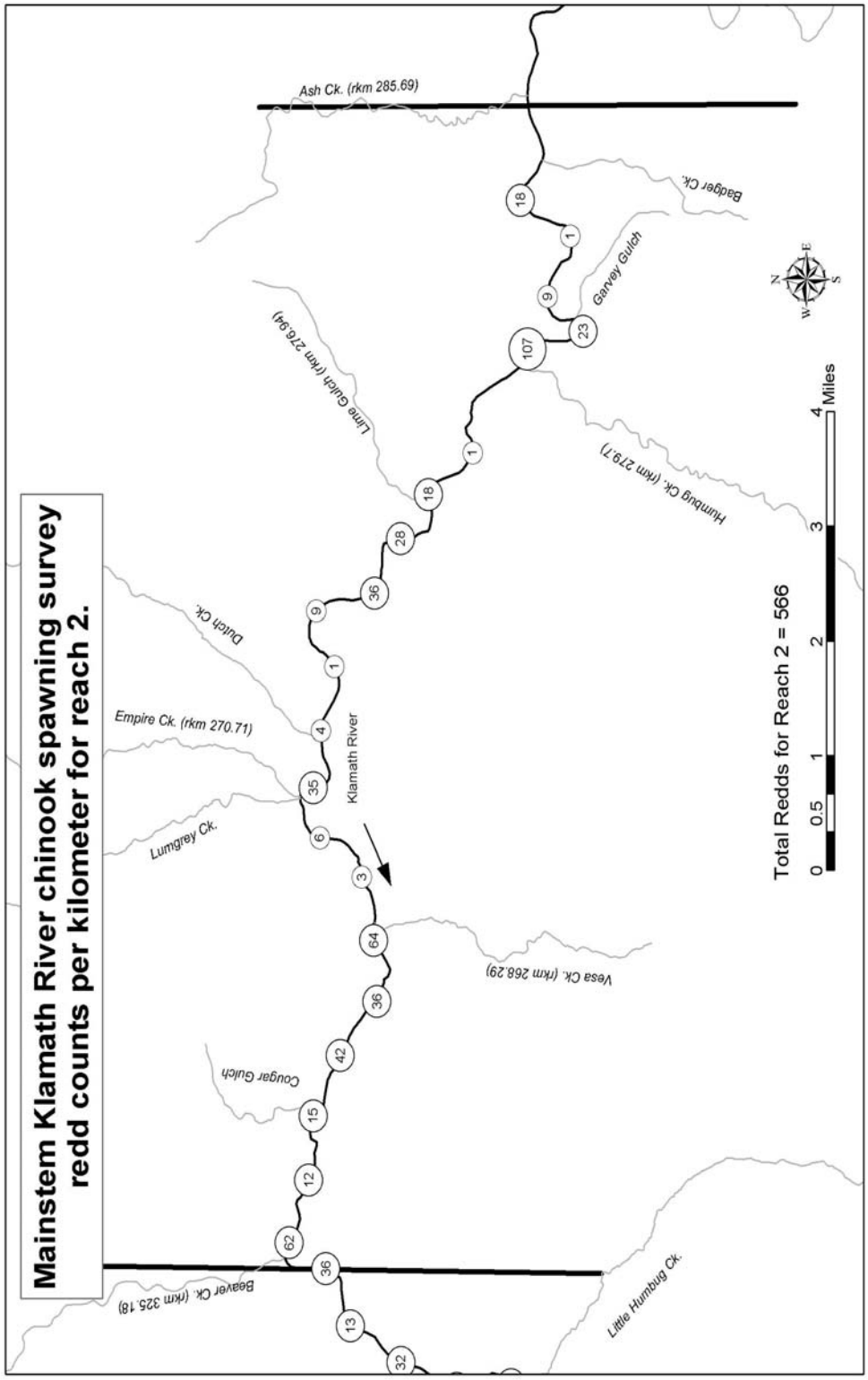

Figure 6. Redd distribution map for 2002, mainstem Klamath River, Ash Creek to Beaver Creek.

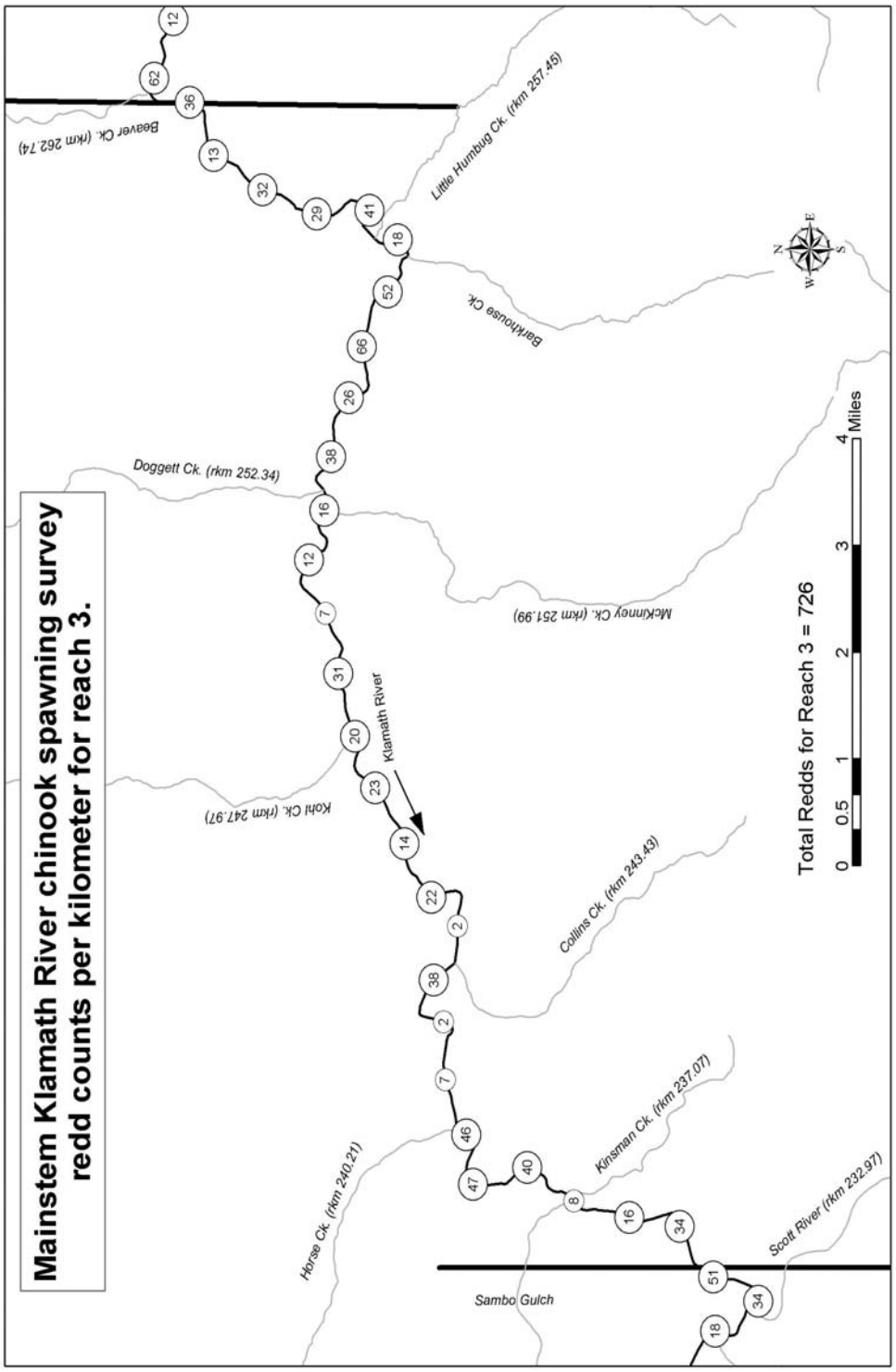

Figure 7. Redd distribution map for 2002, mainstem Klamath River, Beaver Creek to Blue Heron.

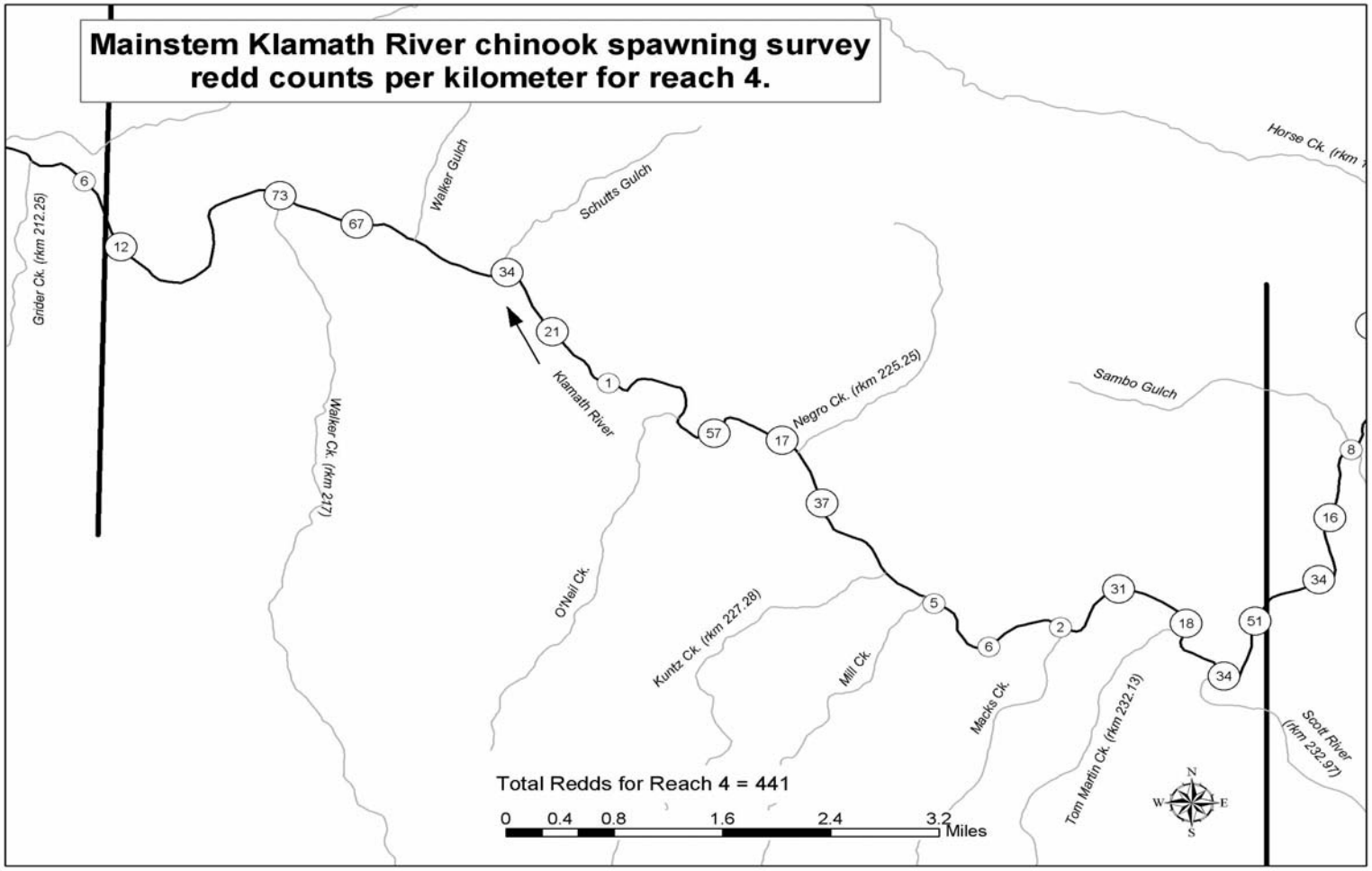

Figure 8. Redd distribution map for 2002, mainstem Klamath River, Blue Heron to Seiad Bar.

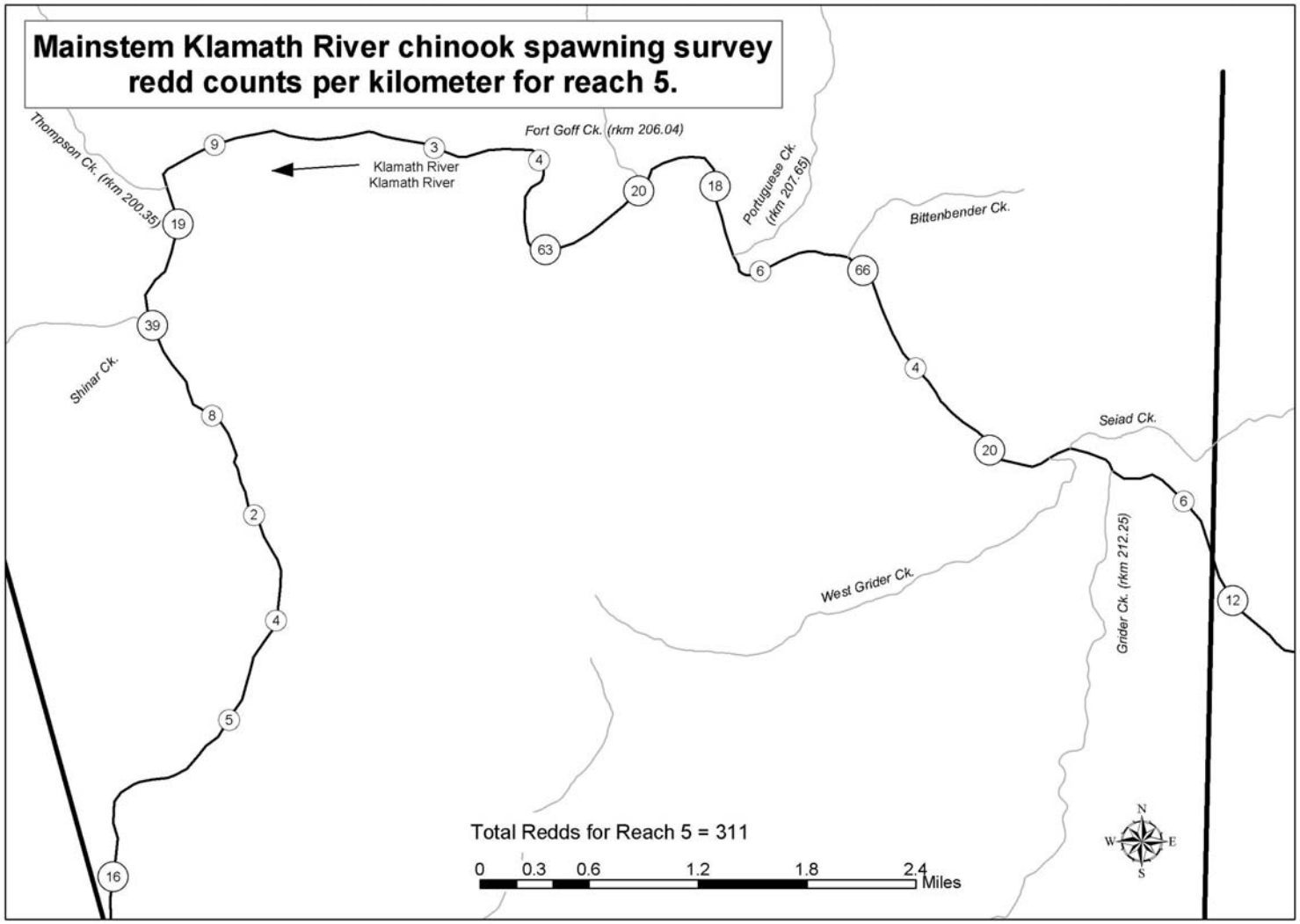

Figure 9. Redd distribution map for 2002, mainstem Klamath River, Seiad Bar to China Point.

occurred during the third week (October 21 to 25) of the survey. Reach 5 had the lowest redd count (n = 311) of any reach sampled during 2002, but the highest count since the initiation of these surveys in 1993.

Reach 6: China Point river access to Indian Creek. A total of 495 redds were counted in Reach 6 (Table 1; Figure 10), accounting for 11 % of the total redd count for 2005. The estimated redd density was 26.6 redds/rkm (Figure 3), the highest redd count for this reach since 1993. Peak spawning (n = 181) in Reach 6 occurred during the third week (October 21 to 25) of this survey (Table 1).

All Reaches

Spawning was observed throughout the mainstem river from IGD to Indian Creek and was consistent with previous survey data in that spatial distribution of redds was lowest in Reach 5 (14.7 redds/rkm), highest in Reach 1 (94.8 redds/rkm), and intermediate in reaches 2, 3, and 4 (Table 1; Figure 3). The highest weekly redd count occurred during late October, similar to past survey years. Overall, the 2002 redd survey yielded the highest count for the six reaches since the initiation of these surveys (1993 to 2002; Figure 4).

Redd Densities

The 2002 redd counts were highest (161.4 redds/rkm) between IGD and Cape Horn Creek (Table 2). Redd densities in 2002 were higher than in 2001 for all of the 10 km sections. Redd densities in 2002 were higher than those counted during past survey years (12 of the 14) 10 km sections. The lowest redd densities (9.4 redds/rkm) of any 10 rkm section occurred between Shinar Creek and China Creek (Table 2; Figure 9 and 10).

Water Temperature

Mean daily water temperatures decreased from 15.7 to 7.5 ºC during this survey (October 10 and December 6, 2002). Water temperatures continued to decrease during these surveys even though IGD flows remained fairly stable at about 886 cfs after October 14 (Figure 11).

Discharge

Discharges for the 2002 survey ranged from 886 to 1,310 cfs (Figure 11). Mean daily discharges (1,310 to 886) during the 2002 survey were some of the lowest estimated since the initiation of the surveys in 1993. The 1999 survey had some of the highest (1,360 to 1,820 cfs) discharges.

Water Clarity

Vertical Secchi disc readings for the 2002 survey ranged from 1.0 to 4.0 m compared to 1.2 to 3.0 m in 2001. The 1.0 m reading was observed on November 8 in Reach 7. The 4.0 m reading was observed on November 19 in Reach 1. Water clarity for this 2002 survey increased overall from the previous year survey. Visibility generally decreased with higher river discharge, cloud cover, and/or precipitation.

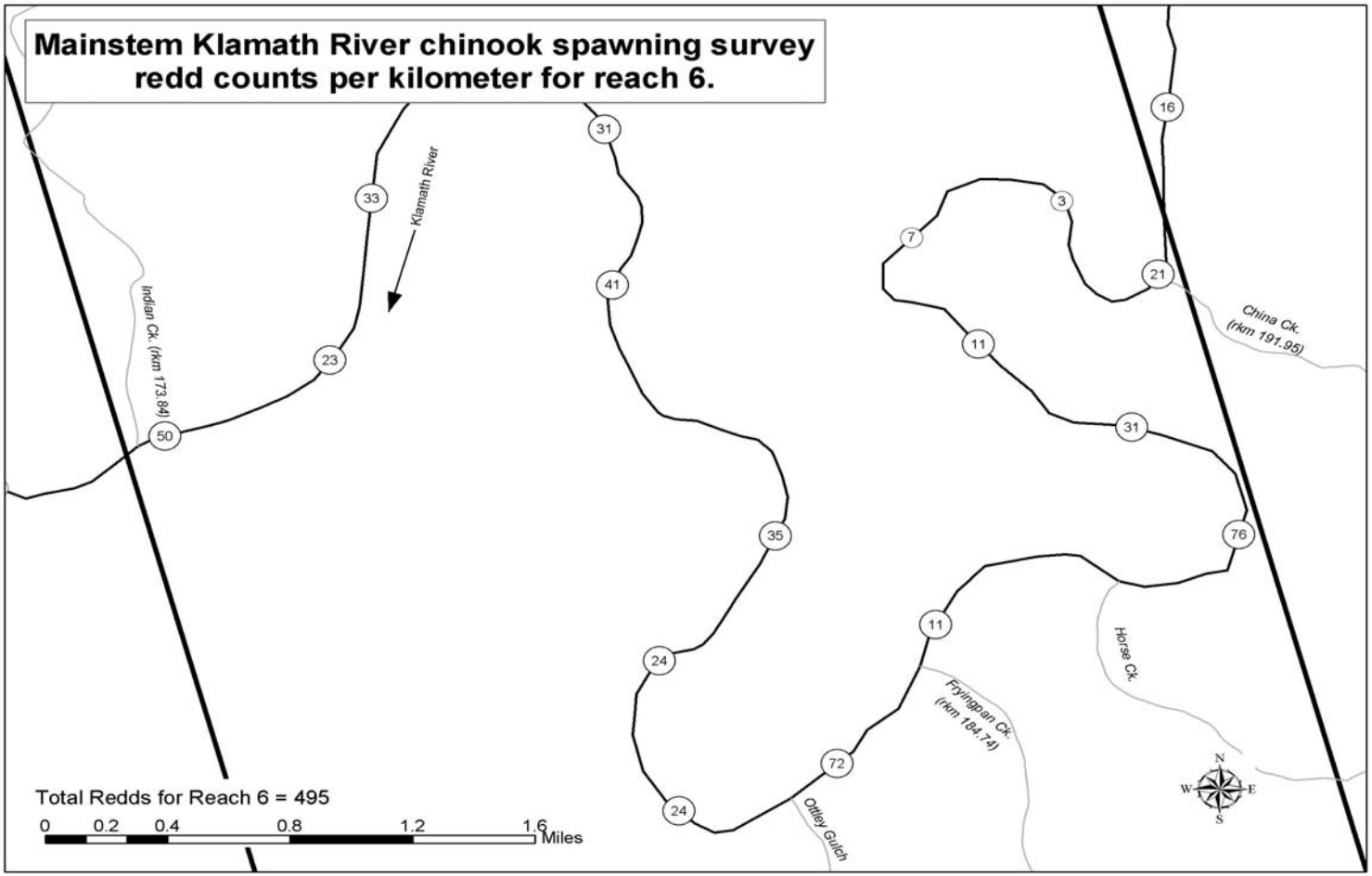

Figure 10. Redd distribution map for 2002, mainstem Klamath River, China Point to Indian Creek.

Table 2. Fall Chinook salmon redds per river kilometer (rkm) for 10 rkm (approximate) sections on the mainstem Klamath River, 1993 to 2002 ("Ns" = No survey).

Tributary Reach	Reach Length (rkm)	Year									
		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
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
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
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
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
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
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
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
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
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
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
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
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
China Creek to Ottley Gulch	8.3	4.9	14.0	23.4	17.7	13.6	8.1	4.3	14.3	25.9	27.8
Ottley 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

Suction Dredge Mining

Recreational suction dredge mining was present throughout the survey from the Highway I-5 Bridge to Happy Camp. Only one redd was observed in 2002 on suction dredge tailings. Studies have indicated that redds constructed on dredge tailings are more unstable in high flows than those on naturally deposited substrate (Harvey and Lisle 1999).

Adult Grilse Expansion

The CDFG estimated the natural fall Chinook salmon spawner escapement for the mainstem Klamath River for 2002 at 21,650 adults and 658 grilse (Table 3). The adult/grilse estimates are based on male to female ratio and jack percentages observed at

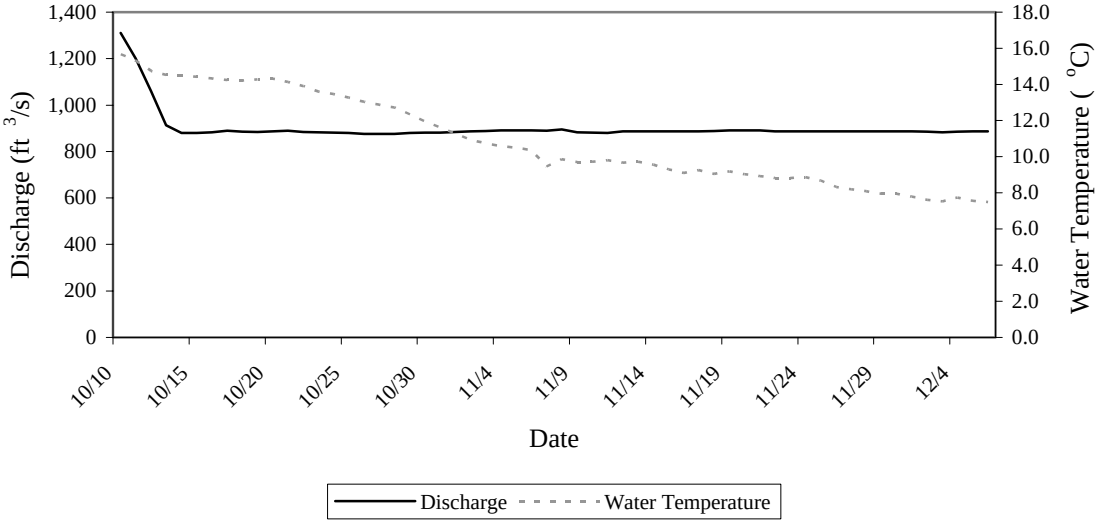

Figure 11. Water temperature (ºC) at rkm 304.8 and discharge (ft^3/s) from Iron Gate Dam (October 10 to December 6, 2002).

Table 3. Natural fall Chinook salmon spawning escapement adult and grilse expansion, Klamath River, 2002 (CDFG 2003).

	Natural Spawners		
Natural Spawning Area	**Grilse**	**Adults**	**Totals**
Mainstem Klamath River Iron Gate Dam to Indian Creek	658	21,650	22,308
Bogus Creek Basin	304	17,530	17,834
Shasta River Basin	386	6,432	6,818
Scott River Basin	47	4,261	4,308
Salmon River Basin	78	2,669	2,747
Misc. Klamath Tributaries upstream of Yurok Reservation	44	1,344	1,388
Yurok Reservation tributaries	12	339	351
Total Natural Spawners	**1,529**	**54,225**	**55,754**

upper Klamath River tributary weirs (CDFG 2005). Based on spawning data from mainstem and tributary spawning surveys conducted by AFWO, USFS, CDFG, and Hoopa and Yurok tribes, the CDFG estimated that 92,818 adults spawned in-river or at hatcheries within the Klamath River Basin.

Summary

The 2002 fall Chinook salmon redd count of 4,652 was the highest combined total for the six reaches surveyed since the initiation of these surveys in1993. The second highest redd count of 3,236 occurred in 1995. Peak mainstem Chinook salmon spawning (42 %) occurred during the third survey week (October 21 to October 25, 2002) in all 6 reaches.

Water clarity during this years survey was some of the highest (1.0 to 4.0 m) observed when compared to past survey years.

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