

Mainstem Klamath River Fall Chinook Spawning Survey

Fiscal Year 2002

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ABSTRACT

This report describes observations and results of the tenth annual U.S. Fish and Wildlife Service fall chinook salmon (*Oncorhynchus tshawytscha*) spawning survey on the mainstem Klamath River. The survey was conducted for seven weeks from October 15 to December 6, 2002, covering 135.9 river kilometers (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 represents a 114% increase from the 2001 redd count of 2,172. This years survey represents the highest number of redds ever recorded since the initiation of these surveys in 1993.

In 2002, spawning was observed throughout the mainstem Klamath River from Iron Gate Dam to Indian Creek with 45% (n=2113) of the redds located between Iron Gate Dam and the Shasta River. From 1993 to 1999, the tendency for chinook to spawn within the upper 10 river km (Iron Gate Dam to Cape Horn Creek), increased from 24.2 to 60.9%, but in 2000 decreased to 37.5%. In 2001, this number decreased once more to 25.8%. In 2002, the redd frequency increased to 31.9%. Redd density for 2002 in this upper mainstem section was 157.9 redds/rkm, compared to 59.7 redds/rkm for 2001. The lowest redd densities in 2002 were between Shinar and China Creek (13.3 redds/rkm). Water clarity between Iron Gate Dam and Indian Creek ranged from 1.0 to 4.0m, and represented some of the highest visibility recorded for these surveys.

During 2002, only one redd was observed on a suction dredge tailing between Iron Gate Dam 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 approximately 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 approximately 2,070 km². Iron Gate Dam (IGD; rkm 310.25, rm 192.8) on the Klamath River and Lewiston Dam (rkm 249, rm 154.7) on the Trinity River represent the upper limits of anadromous salmonid migration in the basin. Iron Gate Hatchery (IGH) and Trinity River Hatchery, located near the base of each dam, were constructed as mitigation for natural fish production losses resulting from each project (USFWS 1991).

The Klamath River Basin has historically supported large runs of chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), and steelhead trout (*O. mykiss*), which have contributed considerably to subsistence, sport and commercial fisheries in California. Generations of Indians have utilized fishing grounds in the drainage, and their fisheries for salmon, steelhead and sturgeon have historically provided 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 and averaged 450,000 chinook 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, dam building activity, road construction and other development. As in other river systems of the Pacific Northwest, chinook salmon of the Klamath River Basin have experienced the continued effects of habitat degradation and over-exploitation as reflected by declining runs in recent decades (USFWS 1991).

On October 27, 1986 the Congress enacted P.L. 99-552, the Klamath River Fish and Wildlife Restoration Act. This action authorized the Secretary of the Interior to restore the anadromous fish populations to optimum levels in both the Klamath and Trinity Rivers through a habitat restoration program and formation of the Klamath River Fishery Management Council (USFWS 1991).

The U.S. Fish and Wildlife Service (USFWS) was funded through the Klamath River Fish and Wildlife Restoration Program to identify fall chinook spawning areas and collect information necessary to estimate the natural fall chinook spawning escapement on the mainstem Klamath River between IGD and the confluence of Indian Creek. This information is critical for the evaluation of instream flow and harvest management alternatives.

MATERIALS AND 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 between October 10 and December 6. Two individual crews were organized for conducting the survey. Each crew covered the same survey reaches each week to remain familiar with each survey reach and prior redd locations.

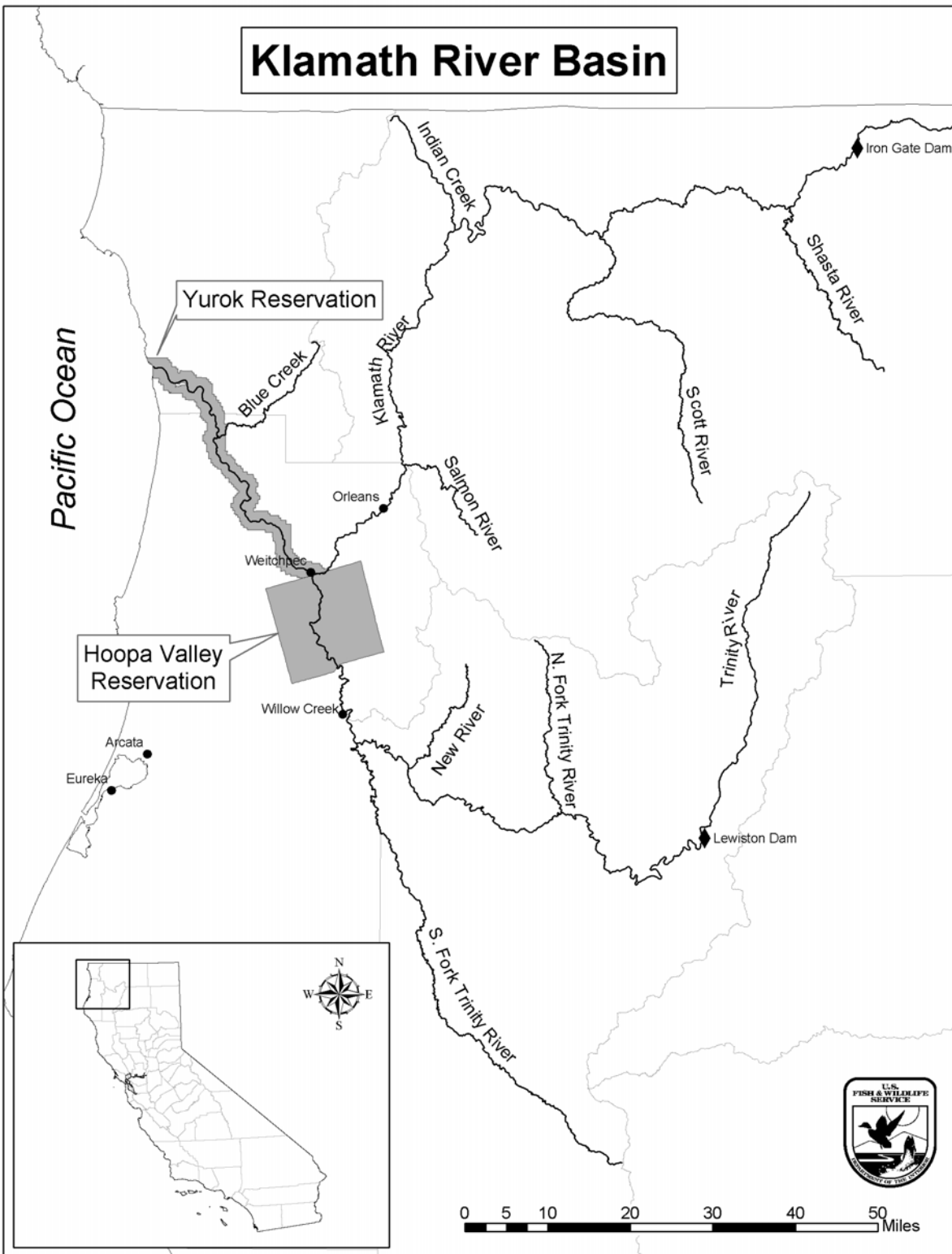


Figure 1. Overview map of the Klamath River Basin accessible to anadromous fish.

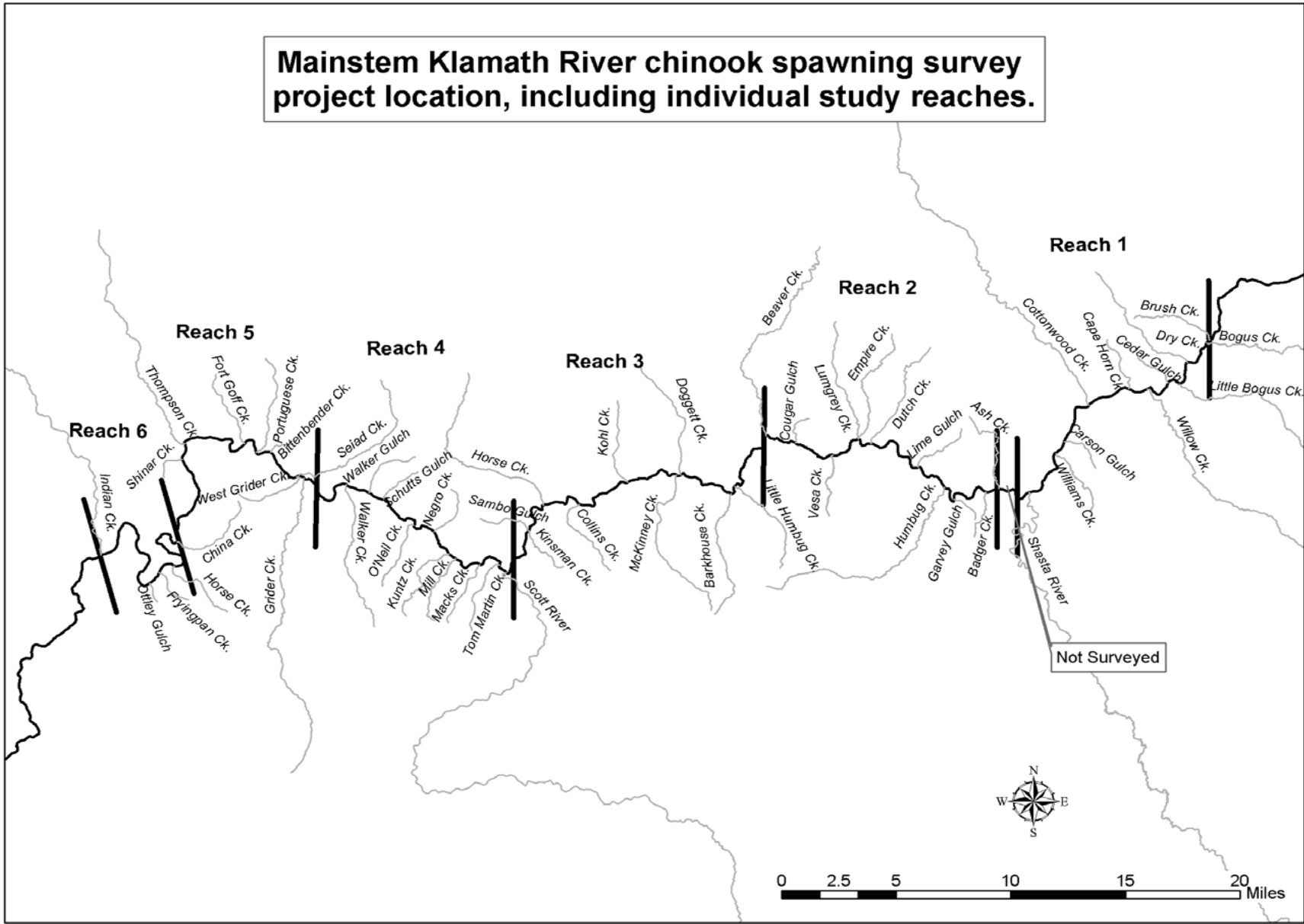


Figure 2. Mainstem Klamath River Chinook spawning survey project location including individual study reaches (1 to 6).

Rafting Equipment

Two 4.27 m (14 foot) inflatable Wing Catarafts were used for direct observation of fall chinook salmon redds. These rafts are commonly used for use in white water rescue due to their stability and maneuverability in fast water. The 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).

Survey Equipment

Plastic survey flagging tape was used to mark individual redds and redd clusters along the river bank in each reach. Polarized sunglasses and baseball style caps were used to reduce glare and improve visibility into the water. GIS aerial maps with river kilometers and handheld Garmin Global Positioning System (GPS) units were used by the crews to navigate and mark redds.

Reaches 1 to 6

Reach 1: IGD river access (rkm 309.75) to Deliverance Camp river access (rkm 287.5; Figure 2).

Reach 1 is approximately 22.25 rkm (13.8 miles) in length 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 (rkm 287.5). One crew surveyed the left bank to mid-channel while the second crew surveyed from the right 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 (rkm 287.5) was completed in approximately two hours on the first day (Monday) during weeks 0 to 7. The section from Deliverance Camp river access to Ash Creek river access (rkm 285.65) was not surveyed because past surveys have revealed lack of available spawning habitat. On the second day (Tuesday), the survey resumed from the IGD river access to the I-5 bridge. This section was completed in eight to ten hours and was surveyed each week for 8 consecutive weeks.

Reach 2: Ash Creek river access to Beaver Creek riffle river access (rkm 261.9; Figure 2).

Reach 2 is approximately 23.6 rkm (14.7 miles) in length. The Beaver Creek riffle river access is located along the right bank on a large gravel bar downstream from Beaver Creek bridge, just off Highway 96. One crew surveyed this reach, on the third day (Wednesday) in approximately seven hours. Reach 2 was surveyed each week for seven consecutive weeks.

Reach 3: Beaver Creek river access to Blue Heron river access (rkm 234.3; Figure 2).

Reach 3 is approximately 27.6 rkm (17.1 miles) in length. The Blue Heron river access is approximately 2 rkm upstream from the Scott River confluence. This reach was surveyed by one crew on the third day (Wednesday) in approximately eight hours. Reach 3 was surveyed each week for seven consecutive weeks.

Reach 4: Blue Heron river access to Seiad Bar river access (rkm 213.55; Figure 2).

Reach 4 is approximately 20.75 rkm (12.9 miles) in length. The Seiad Bar river access is located along the right bank of the Klamath River. River access was acquired approximately 2.7 rkm downstream of the access point used in past spawner surveys. The river access is acquired by taking the road to the right of the California Department of Transportation's compound. The reach

boundaries remain the same as those from past years. This reach was surveyed on the fourth day (Thursday), by one crew, in approximately eight hours. Reach 4 was surveyed each week for seven consecutive weeks.

Reach 5: Seiad Bar river access to China Point river access (rkm 192.35; Figure 2).

Reach 5 is approximately 21.2 rkm (13.2 miles) in length. China Point river access is located along the right bank of the river, at the U.S. Forest Service (USFS) river access just off Highway 96. One crew surveyed this reach, on the fourth day (Thursday) in approximately seven hours. Reach 5 was surveyed each week for seven consecutive weeks.

Reach 6: China Point river access to the Indian Creek confluence (rkm 173.75; Figure 2).

Reach 6 is approximately 18.6 rkm (11.5 miles) in length. 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 7.35 rkm (4.5 miles). Gordons Ferry river access to Indian Creek confluence is approximately 11.25 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 fifth day (Friday) with each section taking approximately five hours to survey. Reach 6 was surveyed for seven consecutive weeks.

Distribution of Redds :10 km Sections

In order to describe the frequency of spawning redd occurrence, in percentages, by yearly redd counts, the mainstem Klamath River between IGD and the confluence of Indian Creek was broken into 14 river sections approximately 10 rkm long.

Collection of Redd Data

The date, rkm, number of redds per site, location in channel, and redd site tally number were recorded on each flag. Flags were tied to the bank nearest the redd. A different color flagging was used each week to ensure that redds were not double counted during the course of the survey. Redd sites were also recorded on GIS aerial river maps and on data forms. Data recorded included: Redd location (from aerial photo to the nearest 0.025 rkm), tally number, number of old redds, number of new redds, total number of redds, redd location (left bank, right bank, middle channel, side channel, and/or split channel), habitat type (low slope, moderate slope, steep slope, pool, pool tail, and /or mesohabitat number), mean stream width, redd distance from bank, redd location from flag (distance in meters upstream, downstream, or adjacent to), flag color, survey week, water temperature, air temperature, secchi disc in meters, start and end time, weather conditions, river reach, and age of redd code. 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, which were identifiable only by pit and/or mound presence and typically could not be distinguished from surrounding substrate by brightness differences, were classified as Redd Age Code 3. Only completed redds (which included both a pit and mound) were included in the daily counts. Test redds and small (<1.0 m²) redds were omitted.

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 provided by the U.S. Geological Survey gaging station (Number 11516530), located in the Klamath River just downstream of IGD. Daily river flow was recorded in cubic feet per second (cfs)

Water Clarity

A 20 cm diameter Secchi disc was used daily throughout the surveys to measure water clarity. Water clarity was measured by lowering a Secchi disc vertically into the water column. The disc was lowered until the black and white pattern on the disc was not discernable. The disc was then raised until the pattern was just vaguely discernable, 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 total number of grilse was estimated from length frequency and scale analysis data.

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). Due to adverse weather conditions and spawn timing, effort on the individual reaches has not been consistent since the initiation of these surveys in 1993 (Figure 4). Based on field maps and notes from the survey, locations of redds for all reaches surveyed are shown in (Figures 6-11).

Reaches 1 to 6

Reach 1: IGD to Deliverance Camp river access.

A total of 2113 redds were observed in this reach during the 2002 survey (Table 1; Figure 6). The 2113 redds represent 45.4% of the total redd count for 2002. The redd density in this reach was 95 redds/rkm (Figure 3). Based on weekly redd counts, peak spawning (n=885) occurred during Week 2 (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 7). The 566 redds represent 12.2% of the total redd count for 2002. Redd density was 24 redds/rkm (Figure 3). Peak spawning (n=198) occurred during Week 2 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 8). The 726 redds represent 15.6% of the total redd count for 2002. Redd density was 26.3 redds/rkm (Figure 3). Peak spawning (n=340) in Reach 3 occurred during Week 2 (Table 1). The 726 redds observed during the survey is the highest count for this reach since the project started in 1993.

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 9). The 441 redds represent 9.5% of the total redd count for 2002. Redd density was 21.3 redds/rkm (Figure 3). Peak spawning (n=186) in Reach 4 occurred during Week 2. The 441 redds observed during the survey is the highest count for this reach since the project started in 1993.

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 10). The 311 redds represent 6.7% of the total redd count for 2002. Redd density was 14.7 redds/rkm (Figure 3). Peak spawning (n=141) occurred during Week 2 of this survey. Reach 5 had the lowest redd count (n=311) of any reach sampled in 2002 (Table 1).

Reach 6: China Point river access to Indian Creek.

A total of 495 redds were counted in Reach 6 (Table 1; Figure 11). The 495 redds represent 10.6% of the total redd count for 2002. This represents a redd density of 26.6 redds/rkm (Figure 3) and the highest redd count for this reach since 1993. Peak spawning (n=181) in Reach 6 occurred during Week 2 (Table 1).

Summary

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 is highest in the upper mainstem (IGD to Deliverance Camp river access). The highest weekly redd count occurred during Week 2 (n=1931). Overall, the 2002 redd survey yielded the highest count during the period of record (1993-2002; Figure 5).

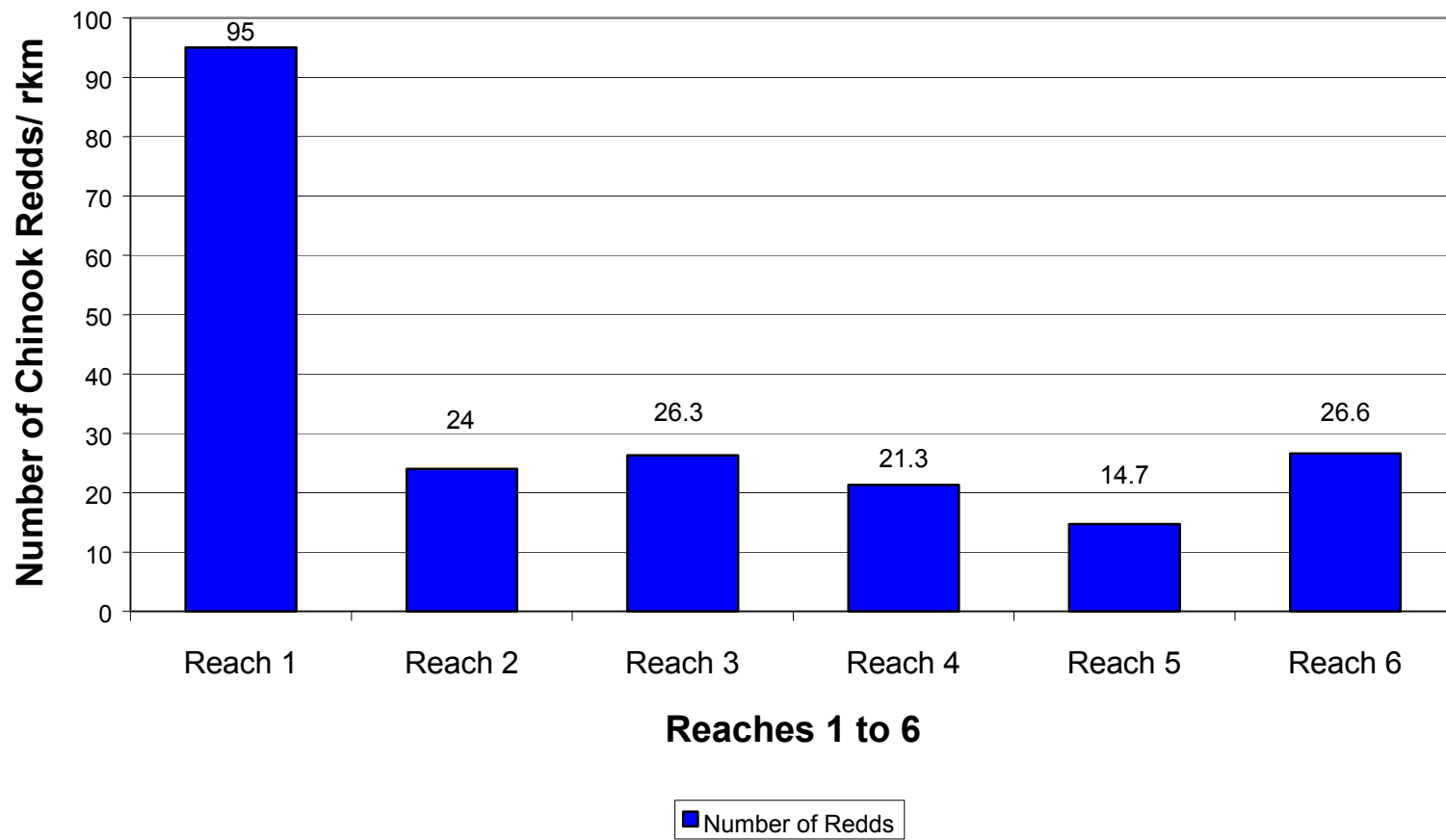


Figure 3. Chinook Redd Density by Reach, 2002.

Table 1. Weekly summary and percent frequency of mainstem Klamath River redd counts for Reaches 1 to 6, 1993 to 2002 (NS= No Survey).

	Reach 1 Iron Gate Dam to Deliverance Camp River Access	Reach 2 Ash Creek River Access to Beaver Creek Riffle River Access	Reach 3 Beaver Creek Riffle to Blue Heron	Reach 4 Blue Heron River Access to Seiad Bar River Access	Reach 5 Seiad Bar River Access to China Point	Reach 6 China Point to Indian Creek River Access	Weekly Total
Year	1993						
Week 1 Oct 25 to 29	15	13	30	18	16	81	173
Week 2 Nov 1 to 5	67	24	4	1	15	5	116
Week 3 Nov 8 to 12	5	1	18	7	0	1	32
Week 4 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	
Year	1994						
Week 1 Oct 17 to 21	89	28	48	NS	NS	98	263
Week 2 Oct 24 to 28	278	59	77	113	98	124	749
Week 3 Oct 31 to Nov 4	375	20	46	42	16	33	532
Week 4 Nov 7 to 11	86	NS	NS	NS	NS	NS	86
Week 5 Nov 14 to 18	3	2	7	4	5	5	26
Total	831	109	178	159	119	260	1656
% Frequency	50	7	11	10	7	16	
Year	1995						
Week 1 Oct 16 to 20	138	12	70	26	30	139	415
Week 2 Oct 23 to 27	598	82	199	94	91	169	1233
Week 3 Oct 30 to Nov 3	727	58	78	35	57	112	1067
Week 4 Nov 6 to 10	277	26	49	13	25	50	440
Week 7 Nov 27 to Dec 1	39	9	14	4	12	3	81
Total	1779	187	410	172	215	473	3236
% Frequency	55	6	13	5	7	15	
Year	1996						
Week 1 Oct 21 to 25	290	31	96	10	118	39	584
Week 2 Oct 28 to Nov 1	291	29	25	22	42	92	501
Week 3 Nov 4 to 8	83	4	24	8	33	59	211
Week 4 Nov 11 to 15	40	0	6	0	7	23	76
Total	704	64	151	40	200	213	1372
% Frequency	51	5	11	3	15	16	

Table 1 (continued). Weekly summary and percent frequency of mainstem Klamath River redd counts for Reaches 1 to 6, 1993 to 2002 (NS = No Survey).

	Reach 1 Iron Gate Dam to Deliverance Camp River Access	Reach 2 Ash Creek River Access to Beaver Creek Riffle River Access	Reach 3 Beaver Creek Riffle to Blue Heron	Reach 4 Blue Heron River Access to Seiad Bar River Access	Reach 5 Seiad Bar River Access to China Point	Reach 6 China Point to Indian Creek River Access	Weekly Total
Year	1997						
Week 1 Oct 16	272	NS	NS	NS	NS	NS	272
Week 2 Oct 20 to 24	252	37	69	89	29	136	612
Week 3 Oct 27 to 31	424	18	76	52	22	76	668
Week 4 Nov 3 to 7	70	7	13	16	8	27	141
Week 5 Nov 10 to 14	2	14	4	5	3	18	46
Total	1020	76	162	162	62	257	1739
% Frequency	59	4	9	9	4	15	
Year	1998						
Week 1 Oct 14 to 15	89	NS	NS	NS	NS	NS	89
Week 2 Oct 19 to 23	180	45	67	15	20	45	372
Week 3 Oct 26 to 30	368	11	12	14	7	39	451
Week 4 Nov 2 to 6	226	22	33	10	9	28	328
Week 5 Nov 9 to 12	135	3	11	3	2	2	156
Week 6 Nov 15 to 19	12	1	3	0	1	2	19
Total	1010	82	126	42	39	116	1415
% Frequency	71	6	9	3	3	8	
Year	1999						
Week 1 Oct 13 to 15	98	3	NS	NS	NS	NS	101
Week 2 Oct 18 to 22	200	27	31	17	23	39	337
Week 3 Oct 25 to 27	304	23	20	NS	NS	NS	347
Week 4 Nov 1 to 5	83	12	9	8	8	19	139
Week 5 Nov 8 to 12	37	2	2	1	5	11	58
Week 6 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 redd counts for Reaches 1 to 6, 1993 to 2002 (NS = No Survey).

	Reach 1 Iron Gate Dam to Deliverance Camp River Access	Reach 2 Ash Creek River Access to Beaver Creek Riffle River Access	Reach 3 Beaver Creek Riffle to Blue Heron	Reach 4 Blue Heron River Access to Seiad Bar River Access	Reach 5 Seiad Bar River Access to China Point	Reach 6 China Point to Indian Creek River Access	Weekly Total
Year	2000						
Week 1 Oct 16 to 20	327	92	69	25	10	19	542
Week 2 Oct 23 to 27	146	62	34	52	10	53	357
Week 3 Oct 30 to Nov 3	254	42	69	54	20	86	525
Week 4 Nov 6 to 10	57	12	15	21	2	16	123
Week 5 Nov 13 to 17	4	0	9	12	0	6	30
Week 6 Nov 20 to 22	1	NS	NS	NS	NS	NS	1
Total	788	208	196	164	42	180	1578
% Frequency	50	13	12	10	3	11	
Year	2001						
Week 1 Oct 15 to 19	92	24	28	21	2	23	190
Week 2 Oct 22 to 26	168	102	128	59	40	82	579
Week 3 Oct 29 to Nov 2	323	97	170	102	55	139	886
Week 4 Nov 5 to 9	155	10	40	12	31	29	277
Week 5 Nov 12 to 16	75	31	49	22	9	NS	186
Week 6 Nov 26 to 30	17	NS	NS	NS	NS	NS	17
Week 7 Dec 3 to 7	NS	NS	12	NS	NS	5	17
Week 8 Dec 10 to 14	NS	5	8	4	3	NS	20
Total	830	269	435	220	140	278	2172
% Frequency	38	12	20	10	6	13	

Table 1 (continued). Weekly summary and percent frequency of mainstem Klamath River redd counts for Reaches 1 to 6, 1993 to 2002 (NS = No Survey).

	Reach 1 Iron Gate Dam to Deliverance Camp River Access	Reach 2 Ash Creek River Access to Beaver Creek Riffle River Access	Reach 3 Beaver Creek Riffle to Blue Heron	Reach 4 Blue Heron River Access to Seiad Bar River Access	Reach 5 Seiad Bar River Access to China Point	Reach 6 China Point to Indian Creek River Access	Weekly Total
Year	2002						
Pre-Week 1 Oct 10	8	NS	NS	NS	NS	NS	8
Week 1 Oct 15 to 18	124	90	120	71	61	146	612
Week 2 Oct 21 to 25	885	198	340	186	141	181	1931
Week 3 Oct 29 to Nov 1	549	112	148	90	69	66	1034
Week 4 Nov 4 to 8	335	90	62	38	20	21	566
Week 5 Nov 12 to 15	136	56	39	46	14	65	356
Week 6 Nov 19 to 22	76	20	10	10	5	15	136
Week 7 Dec 2 to 6	0	0	7	0	1	1	9
Total	2113	566	726	441	311	495	4652
% Frequency	45	12	16	9	7	11	

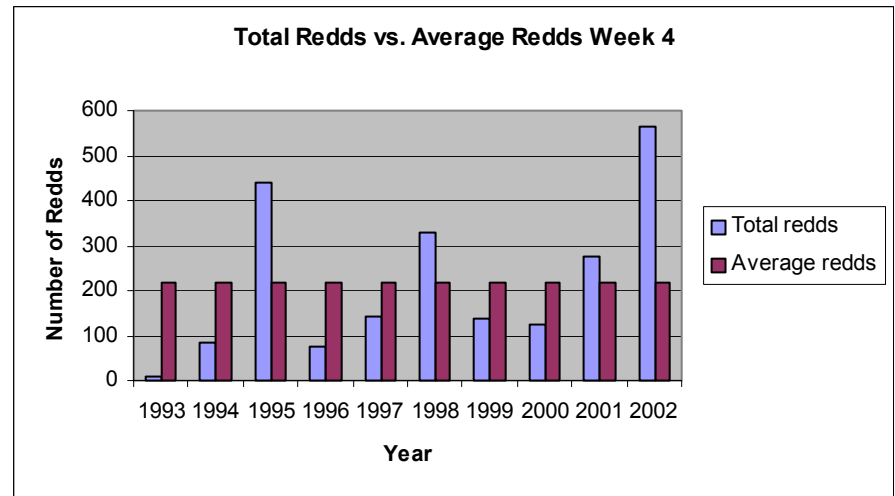
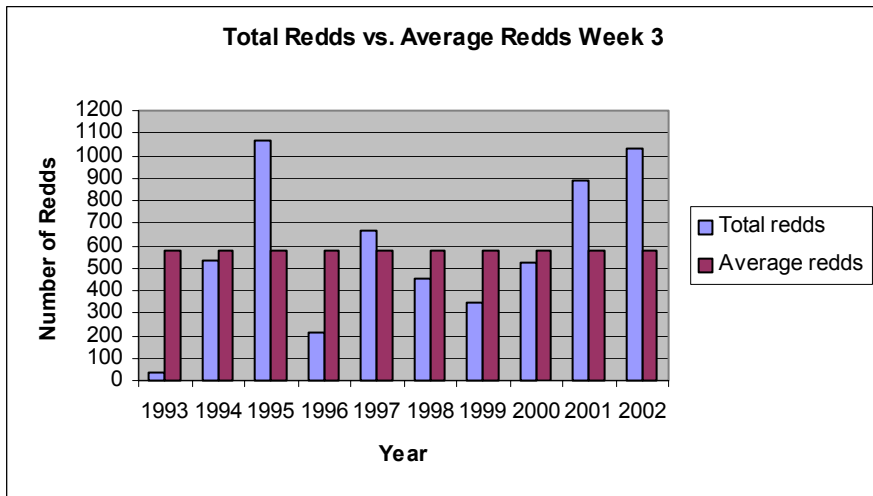
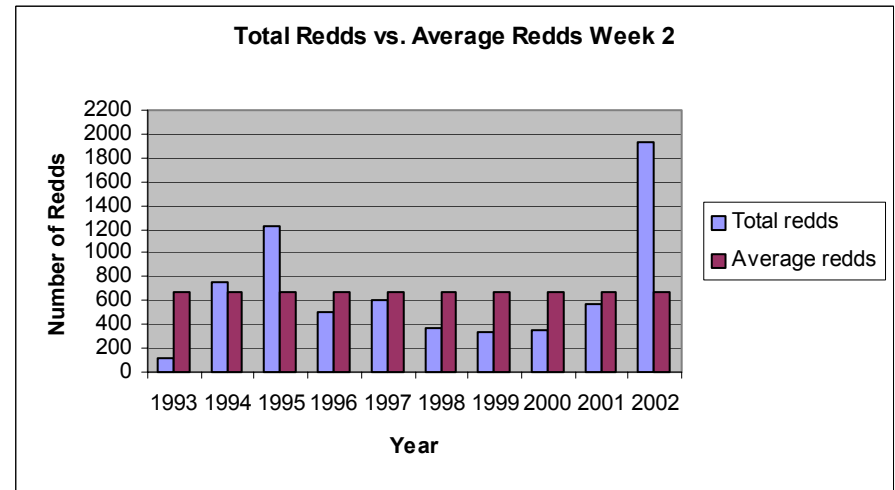
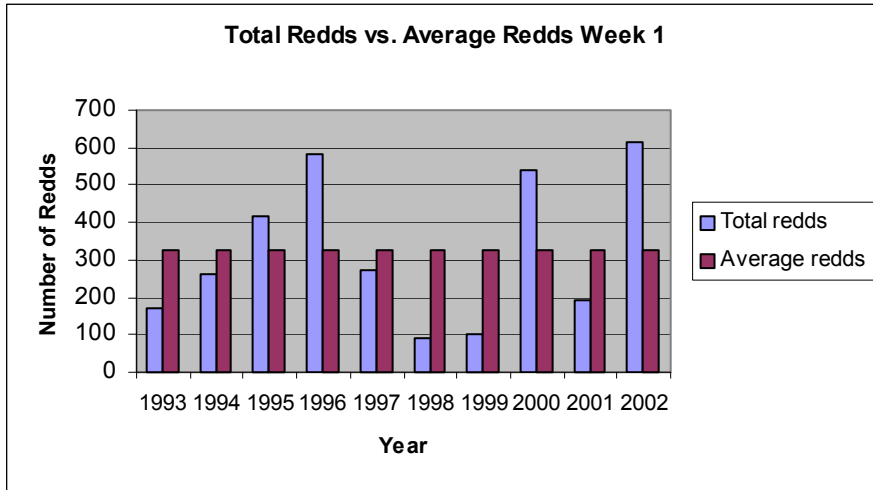


Figure 4. Total redds vs. Average redds by week, 1993 to 2002.

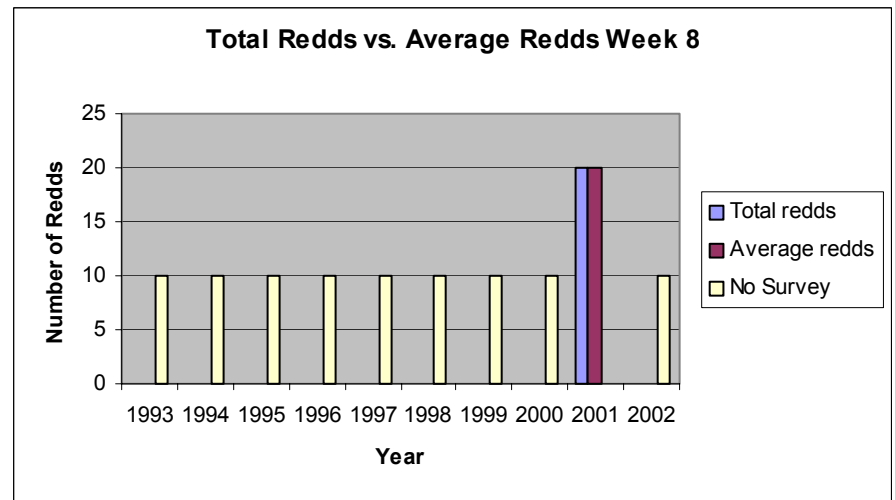
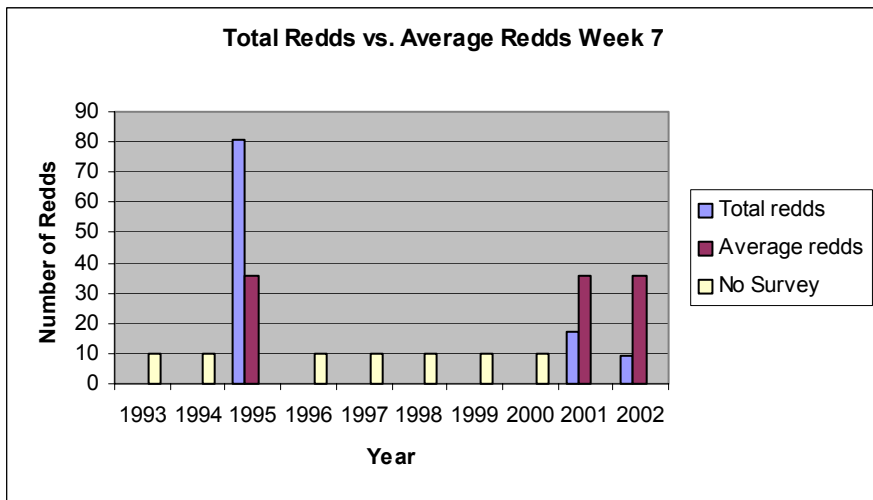
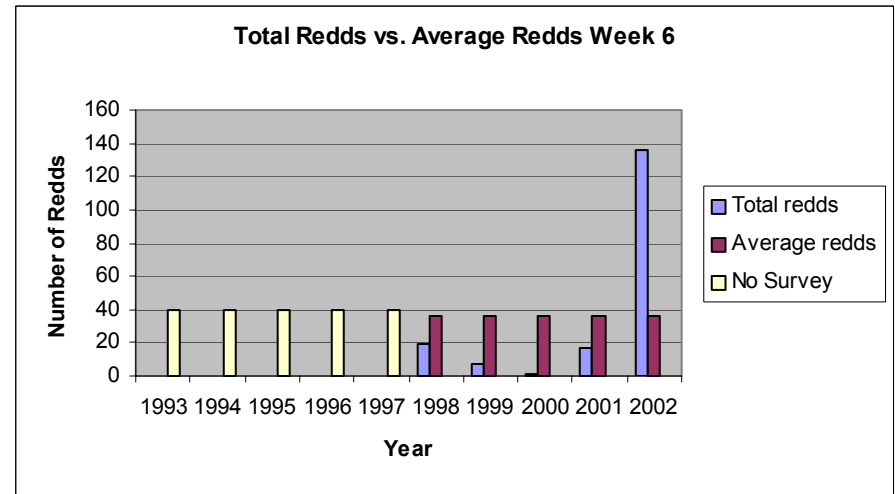
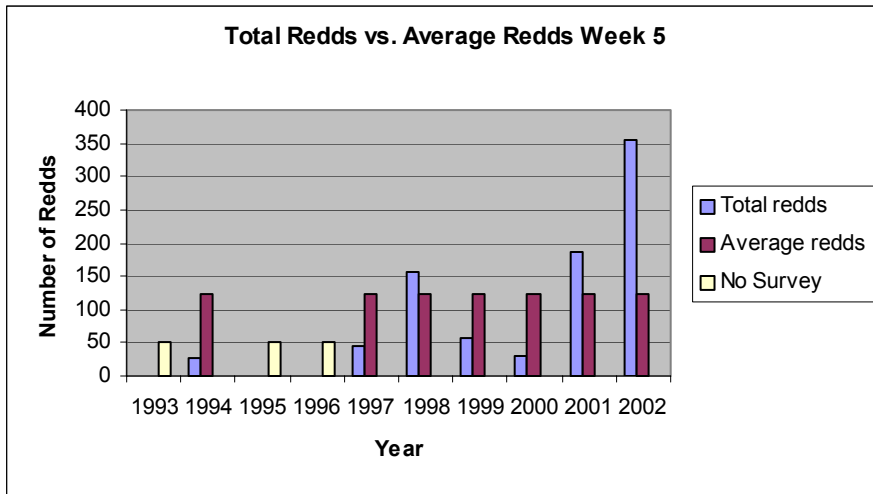


Figure 4 (continued). Total redds vs. Average redds by week, 1993 to 2002.

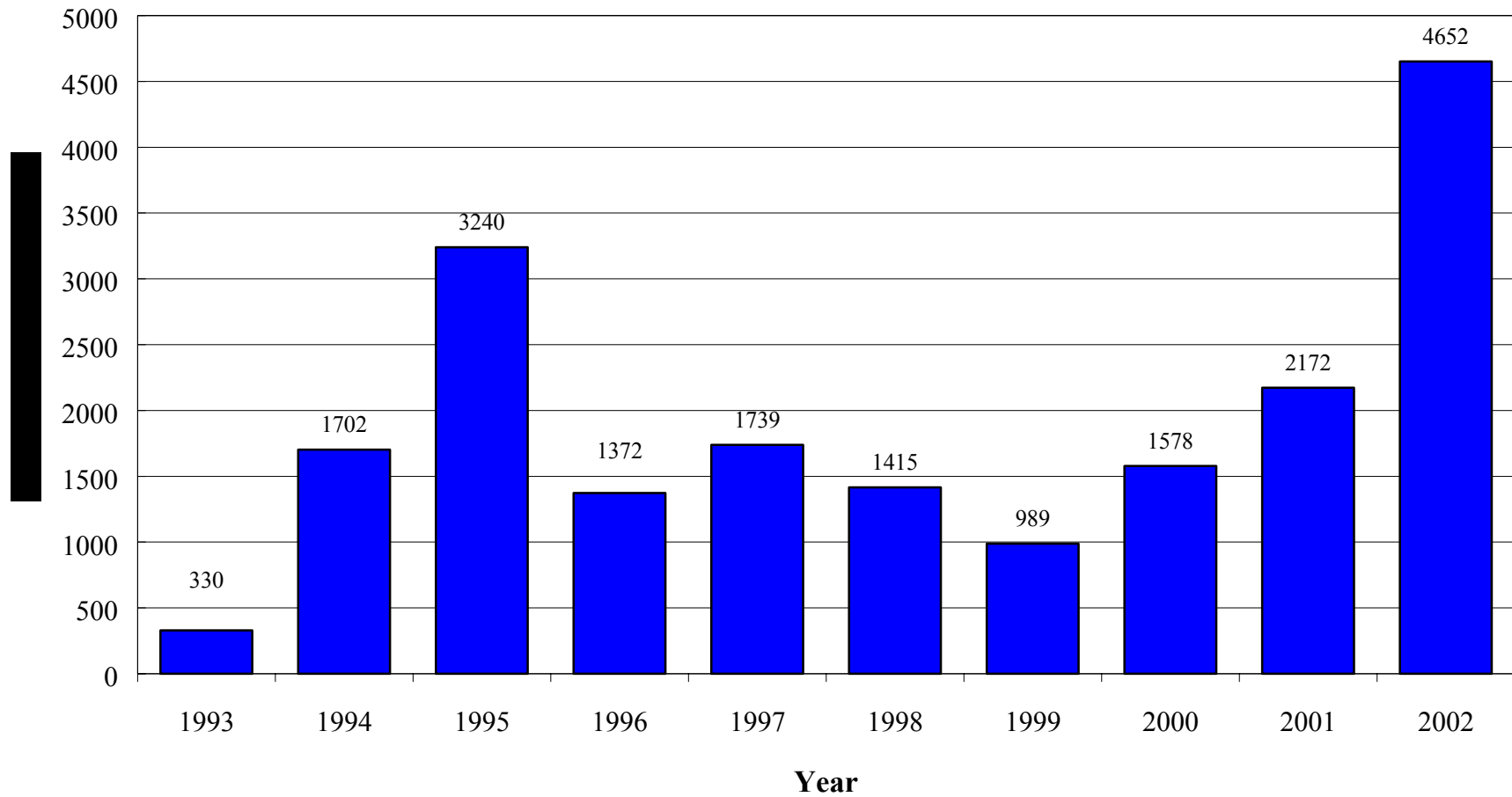


Figure 5. Yearly USFWS chinook salmon redd counts, 1993 to 2002.

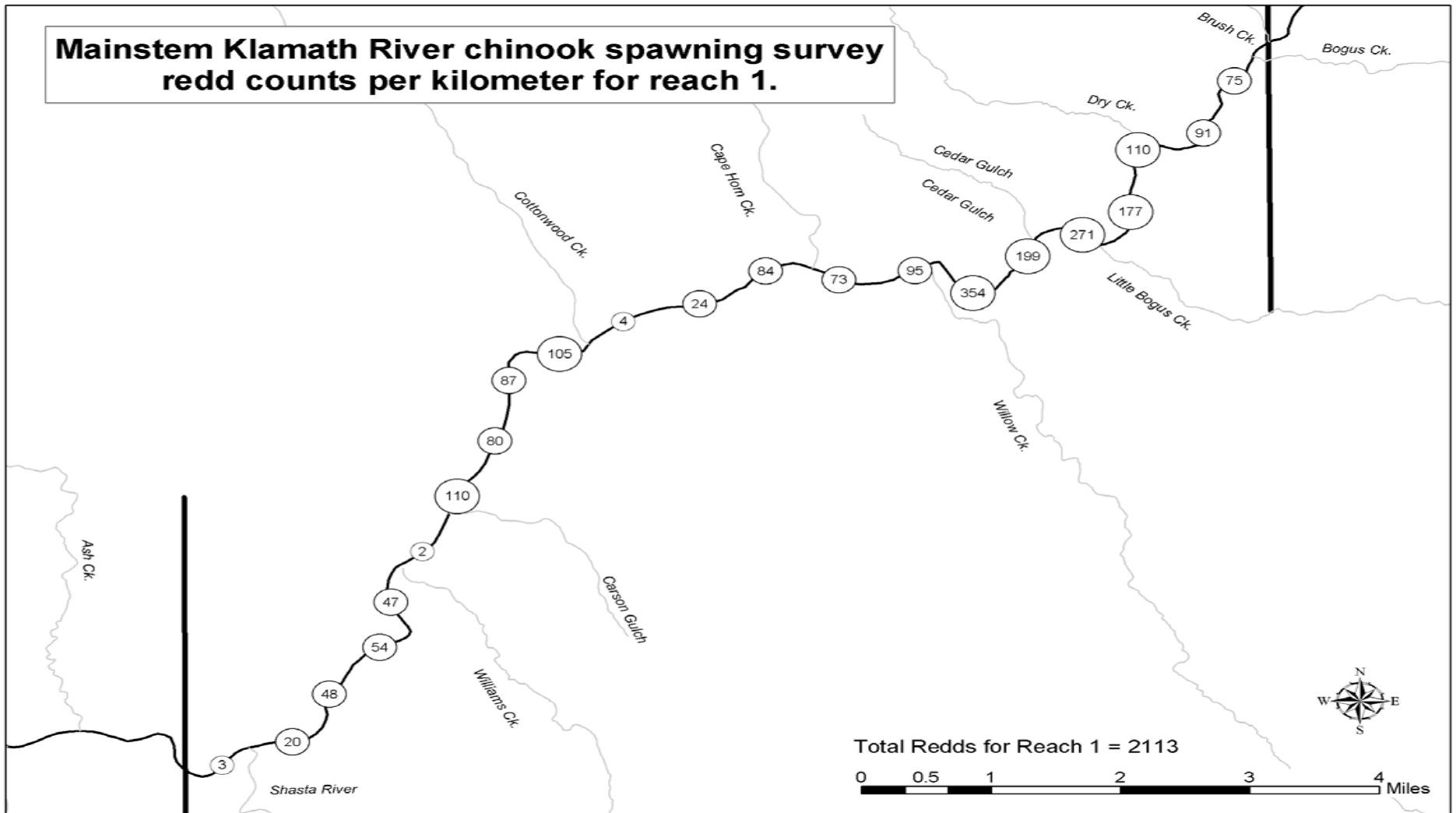


Figure 6. Redd distribution map for 2002, mainstem Klamath River, Iron Gate Dam to Deliverance Camp.

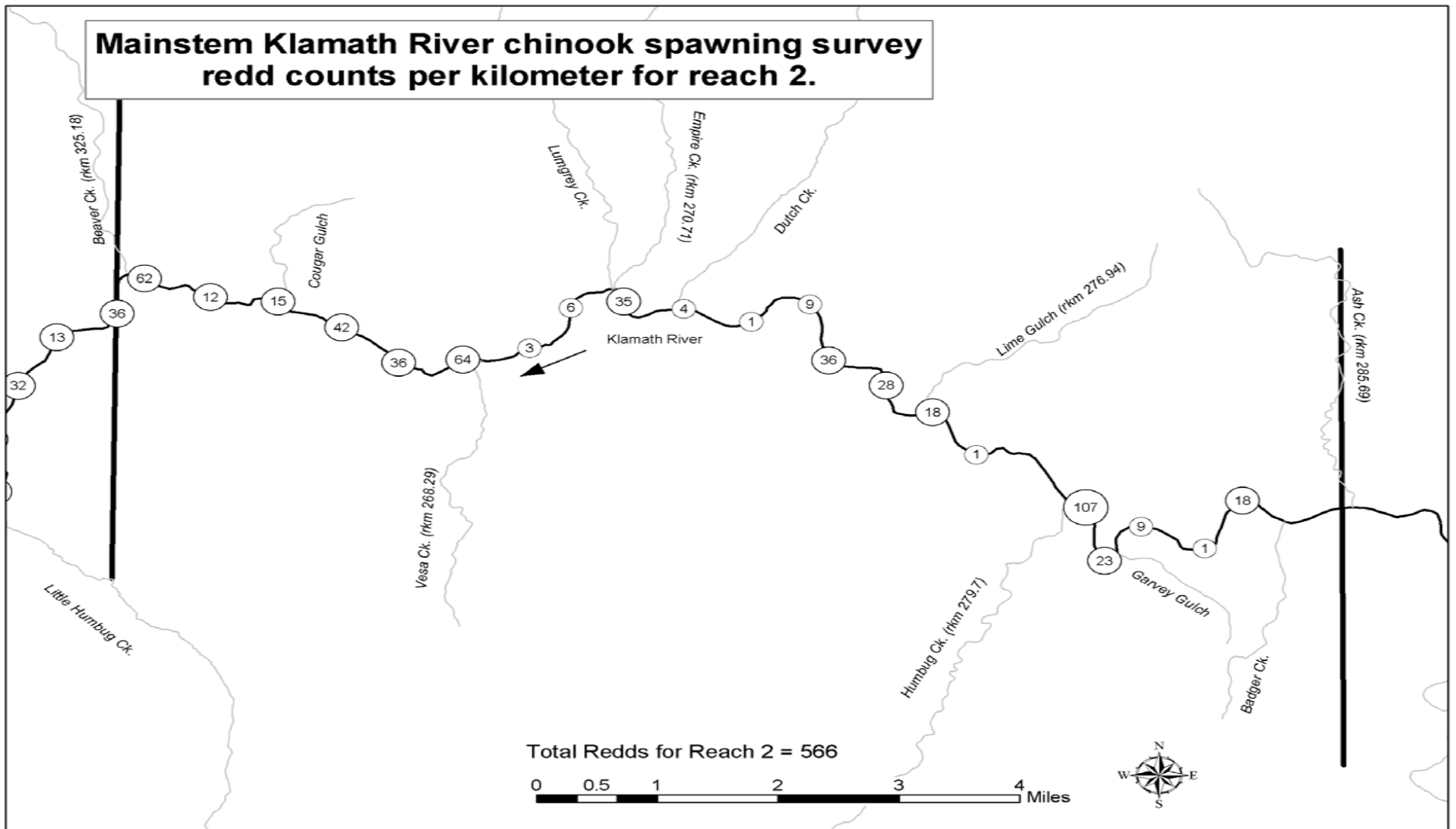


Figure 7. Redd distribution map for 2002, mainstem Klamath River, Ash Creek to Beaver Creek.

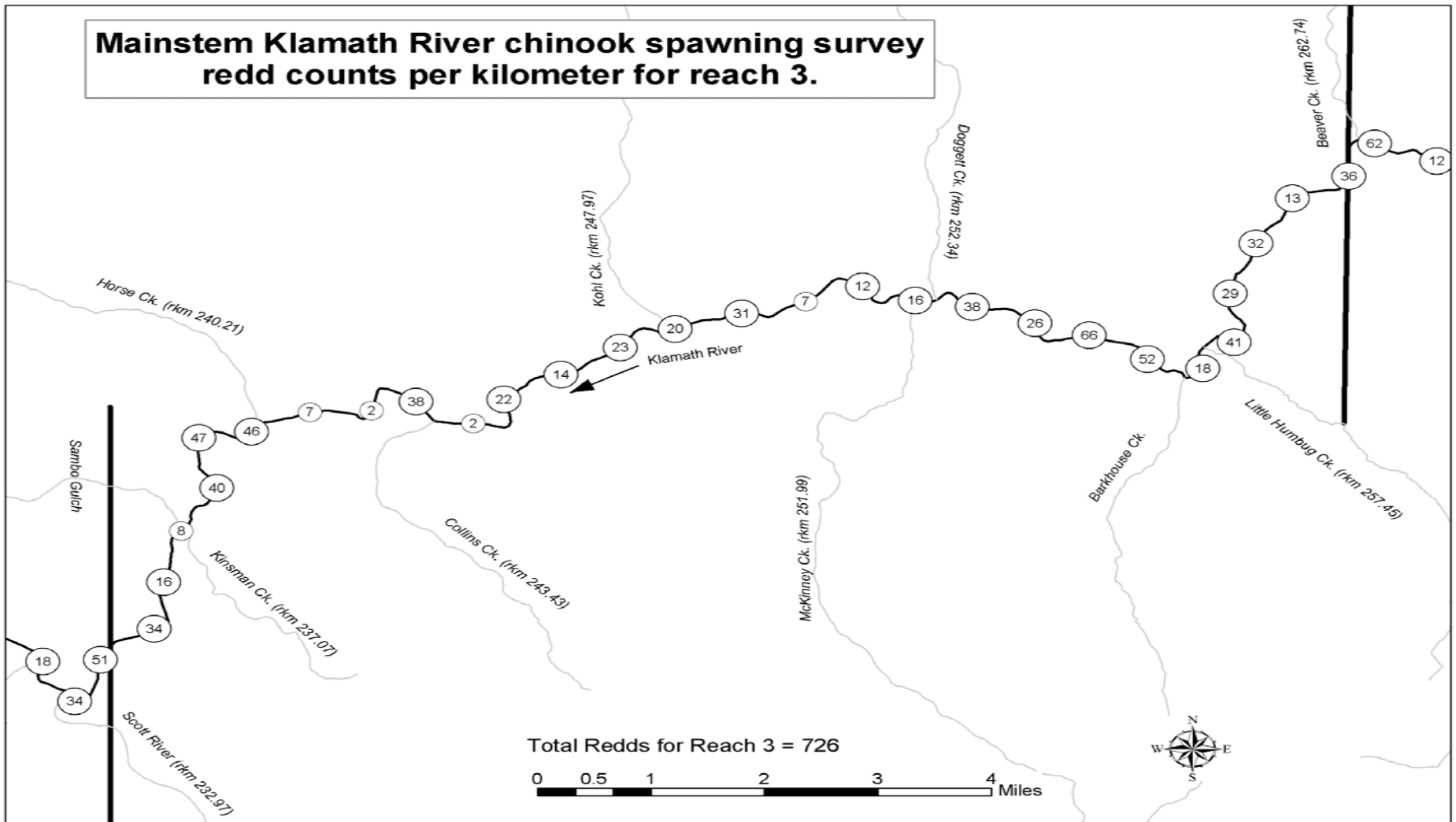


Figure 8. Redd distribution map for 2002, mainstem Klamath River, Beaver Creek to Blue Heron.

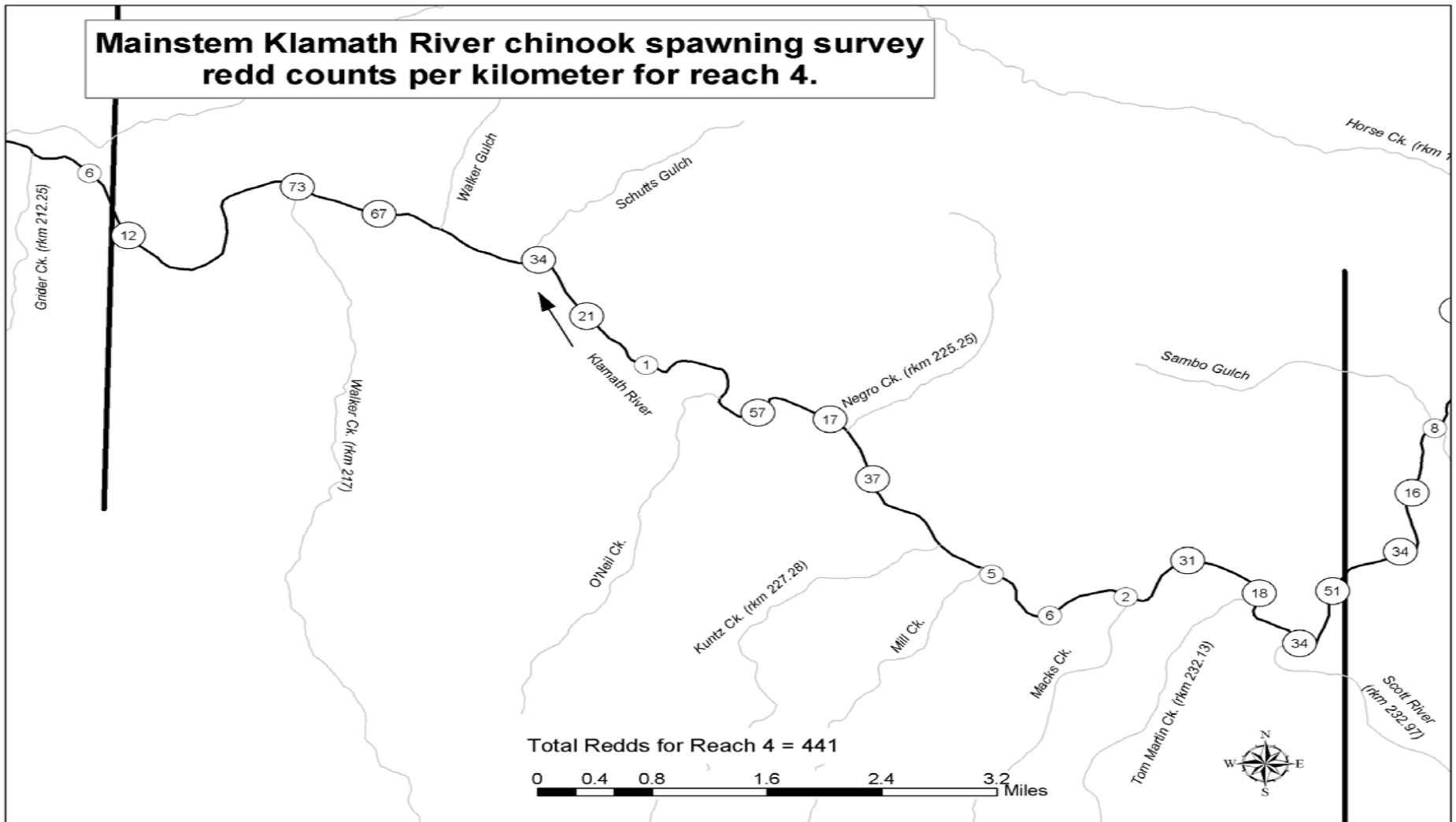


Figure 9. Redd distribution map for 2002, mainstem Klamath River, Blue Heron to Seiad Bar.

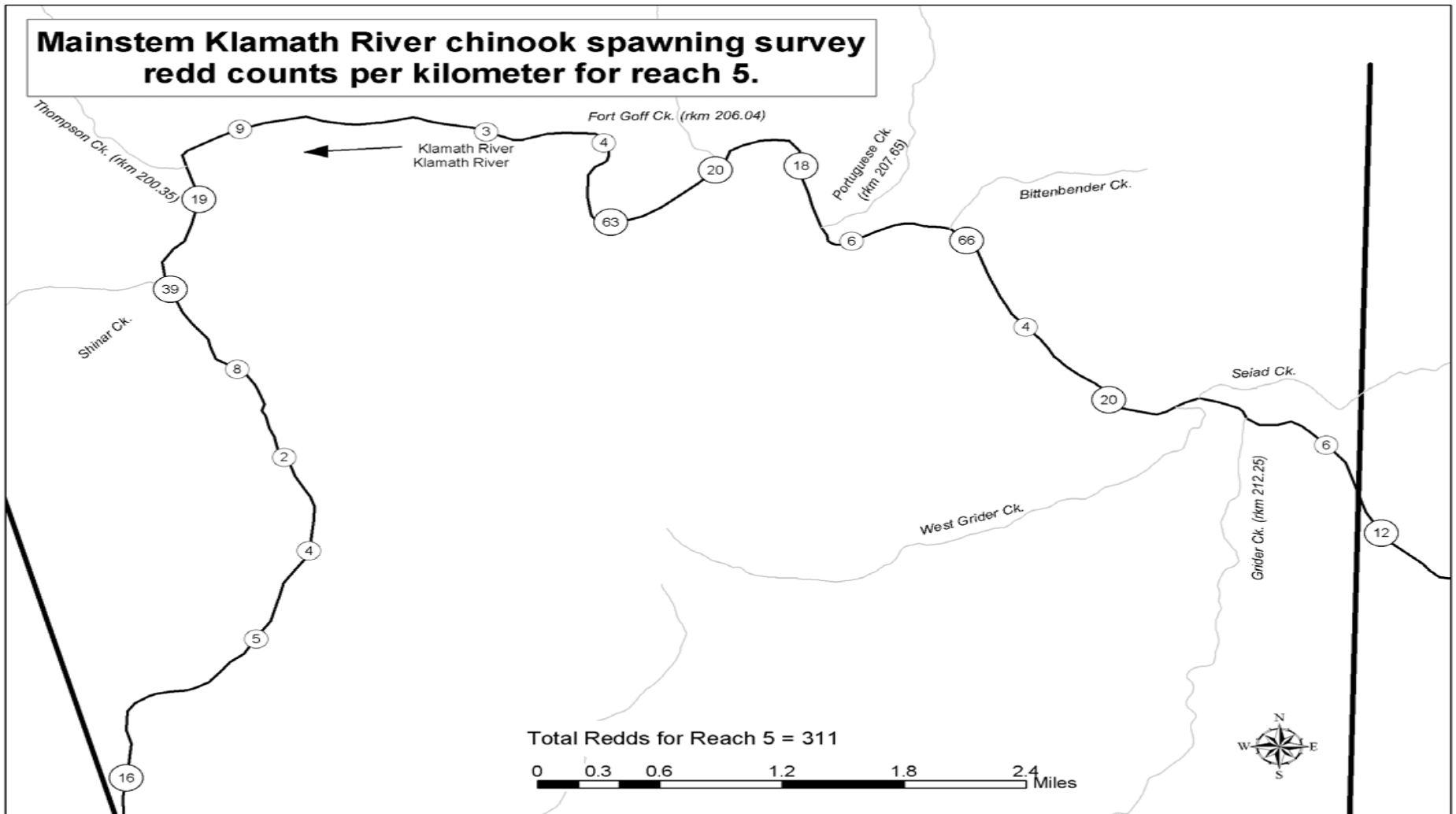


Figure 10. Redd distribution map for 2002, mainstem Klamath River, Seiad Bar to China Point.

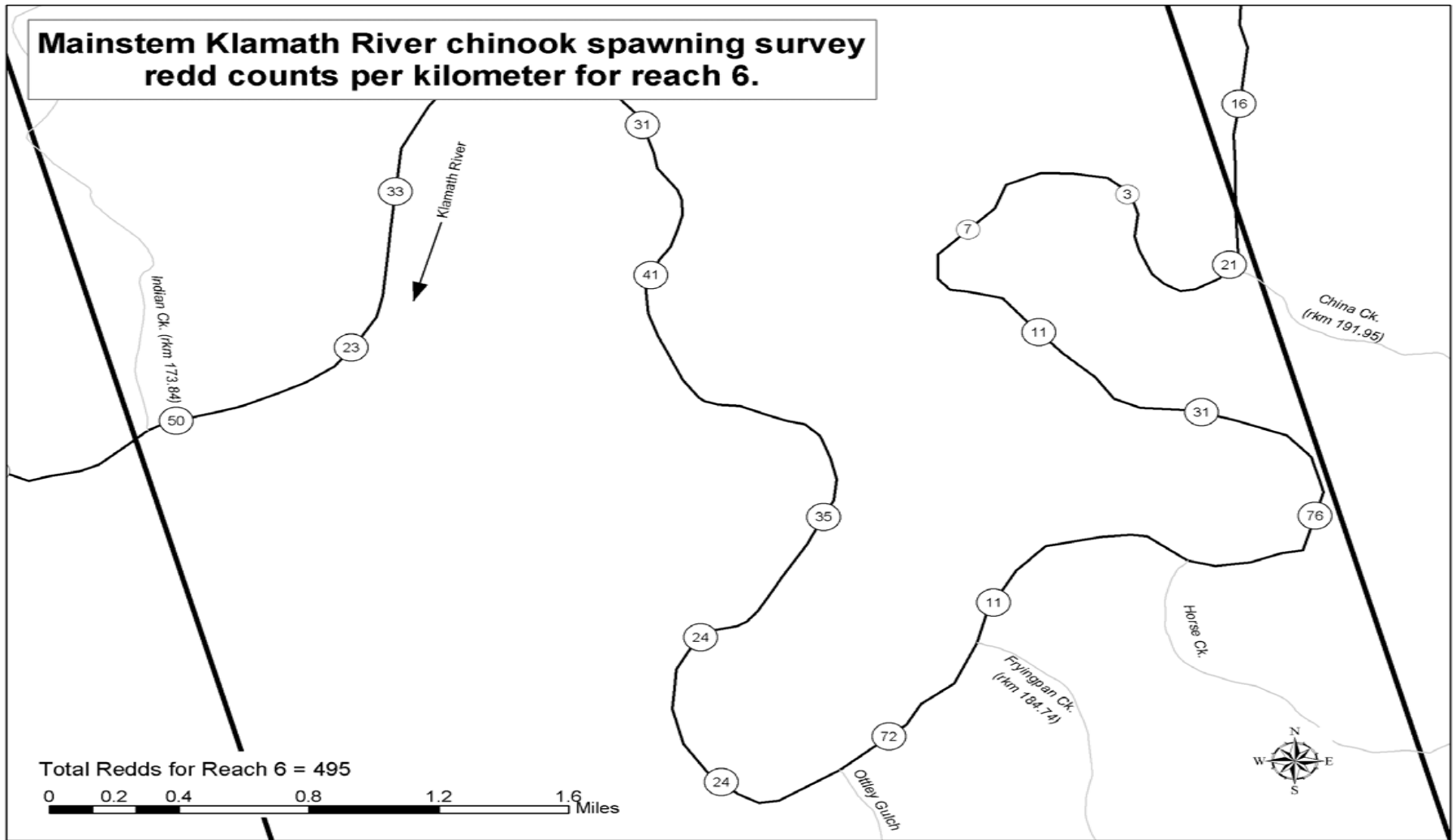


Figure 11. Redd distribution map for 2002, mainstem Klamath River, China Point to Indian Creek.

Redd counts: 10 km Sections

The 2002 redd counts were highest between IGD and Cape Horn Creek (Copco-Ager Bridge) with a redd density of 157.9 redds/rkm . The redd frequencies in this section increased from 24.2% to 60.9% during 1993 to 1999 (Table 2; Figure 12). In 2000 redd frequencies decreased to 37.5%. Redd frequencies for 2001 decreased to 25.8%. In 2002, redd frequencies increased to 31.9%. A very similar trend appears for the section between Cape Horn Creek and the Shasta River confluence (Table 2). Combined, these two upper mainstem sections account for 45.4% of the 2002 total redd count with the remaining 54.6% of the redds distributed between Shasta River and Indian Creek (Table 2). The lowest redd densities (13.3 redds/rkm) of any 10 rkm section occurred between Shinar Creek and China Creek.

Water Temperature

Mean daily water temperatures decreased from 15.66 to 7.49 °C during this survey (October 10 and December 6, respectively). Water temperatures continued to decrease during these surveys even though IGD flows remained fairly stable 1,310 to 886 cfs (Figure 13).

Discharge

Discharges for the 2002 survey ranged from 1,310 to 886 cfs (Figure 13). The 2002 discharge of 886 cfs represented the lowest discharge since the initiation of the surveys in 1993. While during the 1999 survey, mean daily discharges were some of the highest (1,360 to 1,820 cfs).

Water Clarity

Vertical Secchi disc readings ranged from 1.0 to 4.0m during this survey compared to 1.2 to 3.0m in 2001. The 1.0m reading was observed on November 8 in Reach 7. The 4.0m 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.

Table 2. Percent redd frequency by 10 rkm (approximate) section on the mainstem Klamath River, 1993 to 2002.

TRIBUTARY REACH (rkm)	REACH DISTANCE (rkm)	PERCENT FREQUENCY									
		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Iron Gate (309.75) to Cape Horn Ck (300.6)	9.15	24.2	38.9	39.1	40.9	45	55.1	60.9	37.5	25.8	31.9
Cape Horn Ck (300.59) to Shasta River (288.45)	12.15	2.1	11.1	15.6	10.6	14.2	16.1	11.7	12.5	12.4	13.5
Shasta River (288.44) to Humbug Ck (279.7)	8.75	2.7	1.1	1.9	0.8	1.1	3	3.3	5.8	3.6	3.4
Humbug Ck (279.69) to Vesa Ck (268.3)	11.4	5.5	2.2	1.1	1.1	1.8	1.6	2.9	3.5	2.8	3.8
Vesa Ck (268.29) to Little Humbug Ck (257.45)	10.85	5.8	6.9	5.2	4.8	3.3	3	2.9	7.5	10.3	7.7
Little Humbug Ck (257.44) to Kohl Ck (248.0)	9.45	7.9	3.4	4.9	3.3	4.3	3	0.9	5.1	7.2	5.9
Kohl Ck (247.99) to Kinsman Ck (237.05)	10.95	7.9	2.7	4.9	4.2	2.3	4.3	3.3	3.6	6.7	5.4
Kinsman Ck (237.04) to Kuntz Ck (227.3)	9.75	2.4	4.2	1.2	2.4	0.9	0.4	1.2	2.1	4.2	4.2
Kuntz Ck (227.29) to Walker Ck (217.0)	10.3	6.4	5.6	3.8	1.8	8.6	2.5	1.9	6.8	7.1	6.6
Walker Ck (216.99) to Portuguese Ck (207.65)	9.35	7.6	5.2	3.9	5.5	1	1	2.1	2.5	2.5	2.5
Portuguese Ck (207.64) to Shinar Ck (199.1)	8.55	1.2	3.9	2.2	3.1	1.4	1.4	1.6	1.3	3.2	3.5
Shinar Ck (199.09) to China Ck (191.95)	7.15	6.7	2.2	4.4	6	1.8	0.4	0.3	0.4	1.7	1.5
China Ck (191.94) to Ottley Gulch (183.7)	8.25	12.4	7.1	6	10.7	6.5	4.7	3.6	7.5	9.7	5
Ottley Gulch (183.69) to Indian Ck (173.85)	9.85	7.3	5.4	5.8	4.8	7.6	3.5	3	3.9	2.8	5.2

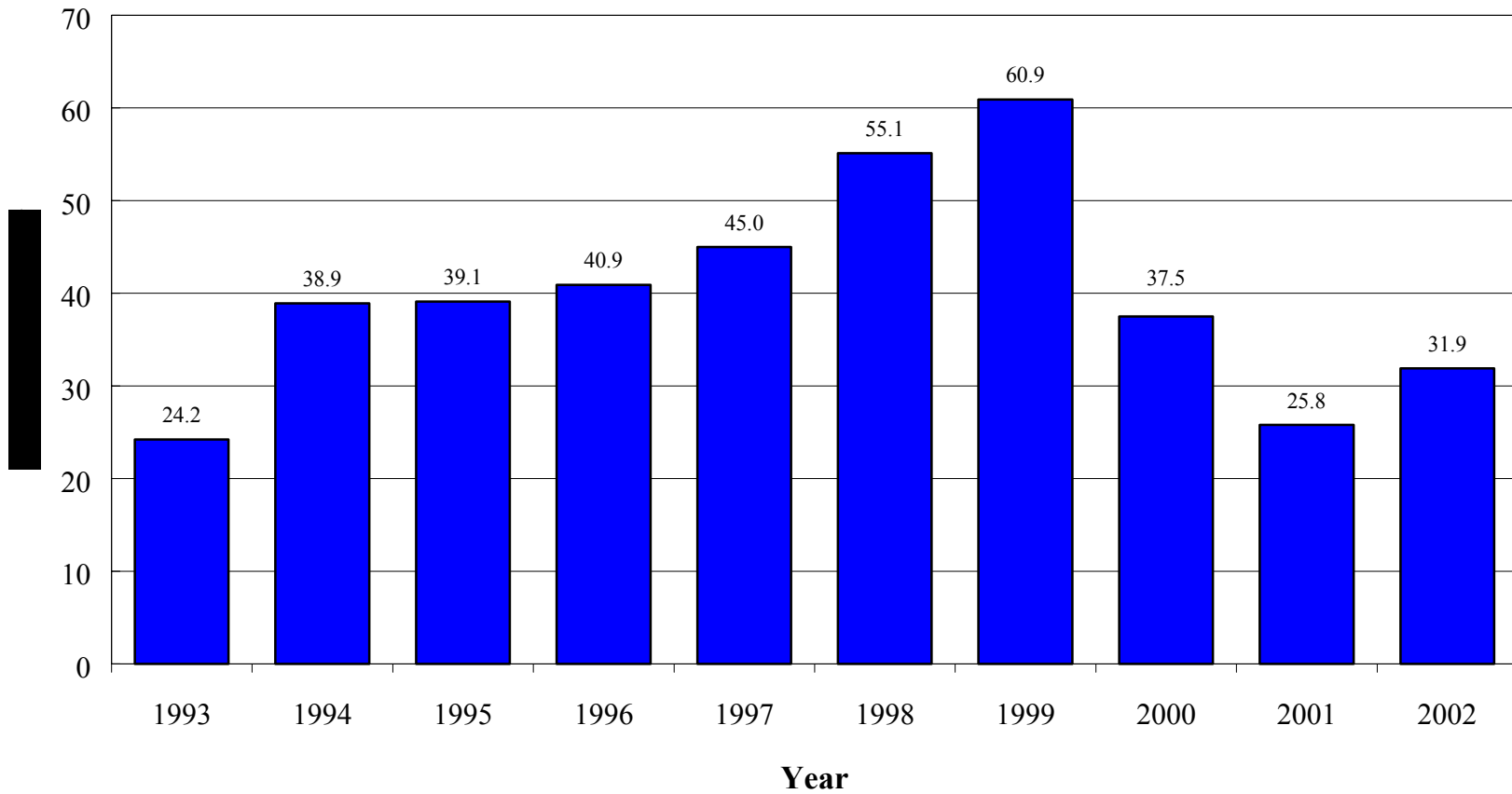


Figure 12. Percent frequency of redds by year (1993 to 2002) from Iron Gate Dam to Cape Horn Creek.

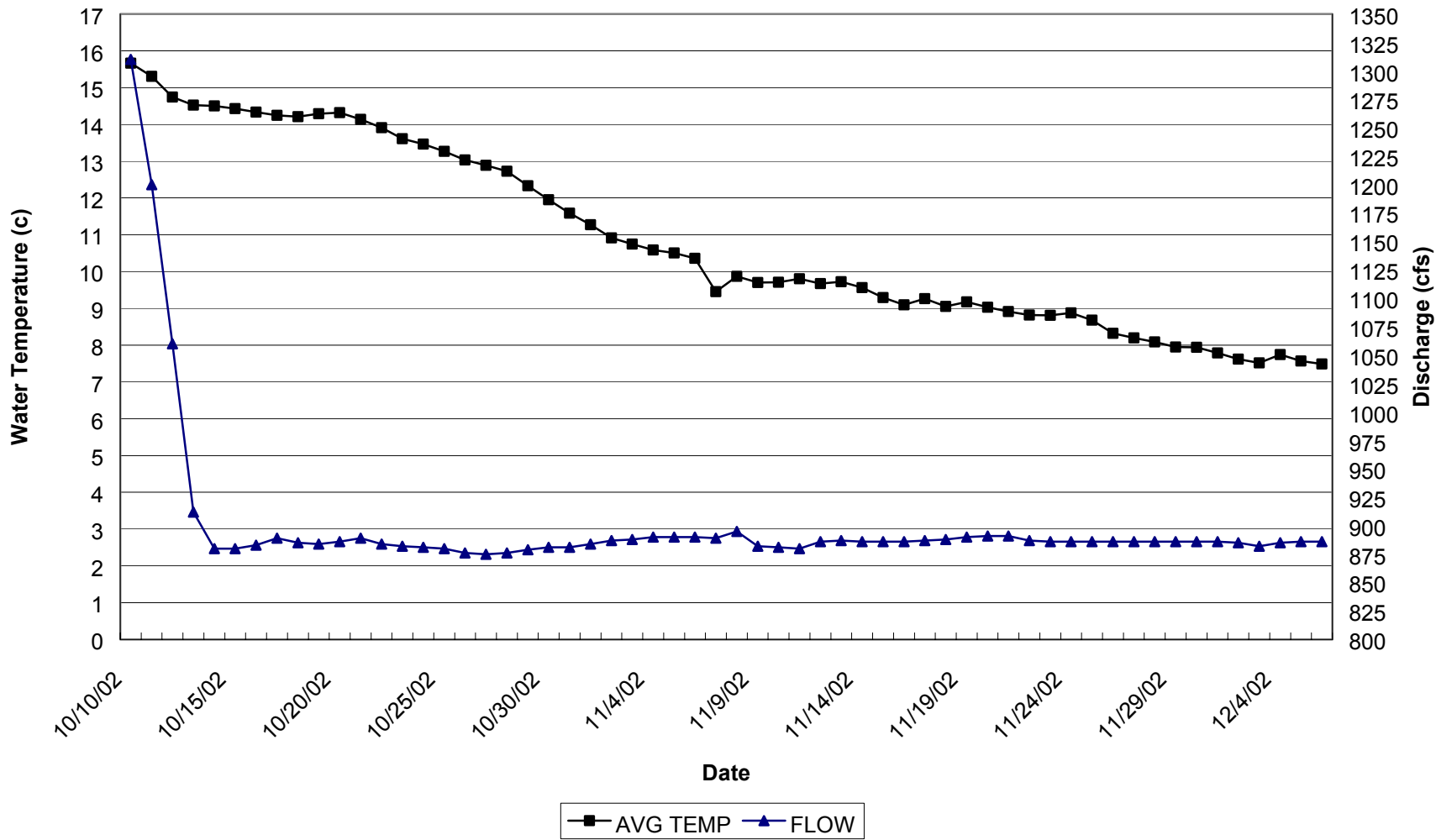


Figure 13. Water temperatures (°C) at rkm 304.75 and discharge (CFS) from Iron Gate Dam (October 10 to December 6, 2002).

Suction Dredge Mining

Recreational suction dredge mining was present throughout the survey from the HWY I-5 Bridge to Happy Camp. There was only one redd observed this year 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 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 upper Klamath River tributary weirs (Stacey 2003).

Table 3. Natural fall chinook spawning escapement adult and grilse expansion, Klamath River, 2002 (Stacey 2003).

Natural Spawning Area	Grilse	Adults	Totals
Salmon River Basin	72	2,486	2,558
Scott River Basin	47	4,261	4,308
Shasta River Basin	386	6,432	6,818
Bogus Creek Basin	305	17,529	17,834
Mainstem Klamath River IGH to Indian Creek	658	21,650	22,308
Total Natural Spawners	1,468	52,358	53,826

Based on spawning data from mainstem and tributary spawning surveys conducted by AFWO, USFS, CDFG, and Hoopa and Yurok tribes, the CDFG estimated that 92,826 adults spawned in-river or at hatcheries within the Klamath River Basin.

SUMMARY

The fall chinook redd count of 4,652 was the highest number observed since the initiation of these surveys in 1993 when 330 redds were counted. The second highest redd count of 3,240 occurred in 1995. Since 1993, the tendency for chinook to spawn in the upper 10 rkm between IGD and Cape Horn Creek had increased to 60.9%, but declined in 2000 and 2001 to 37.5% and 25.8% respectively. In 2002, the tendency for chinook to spawn in this upper section increased to 31.9%.

Peak mainstem chinook spawning (41.5%) occurred during Week 2 (October 21 to October 25) in all 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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