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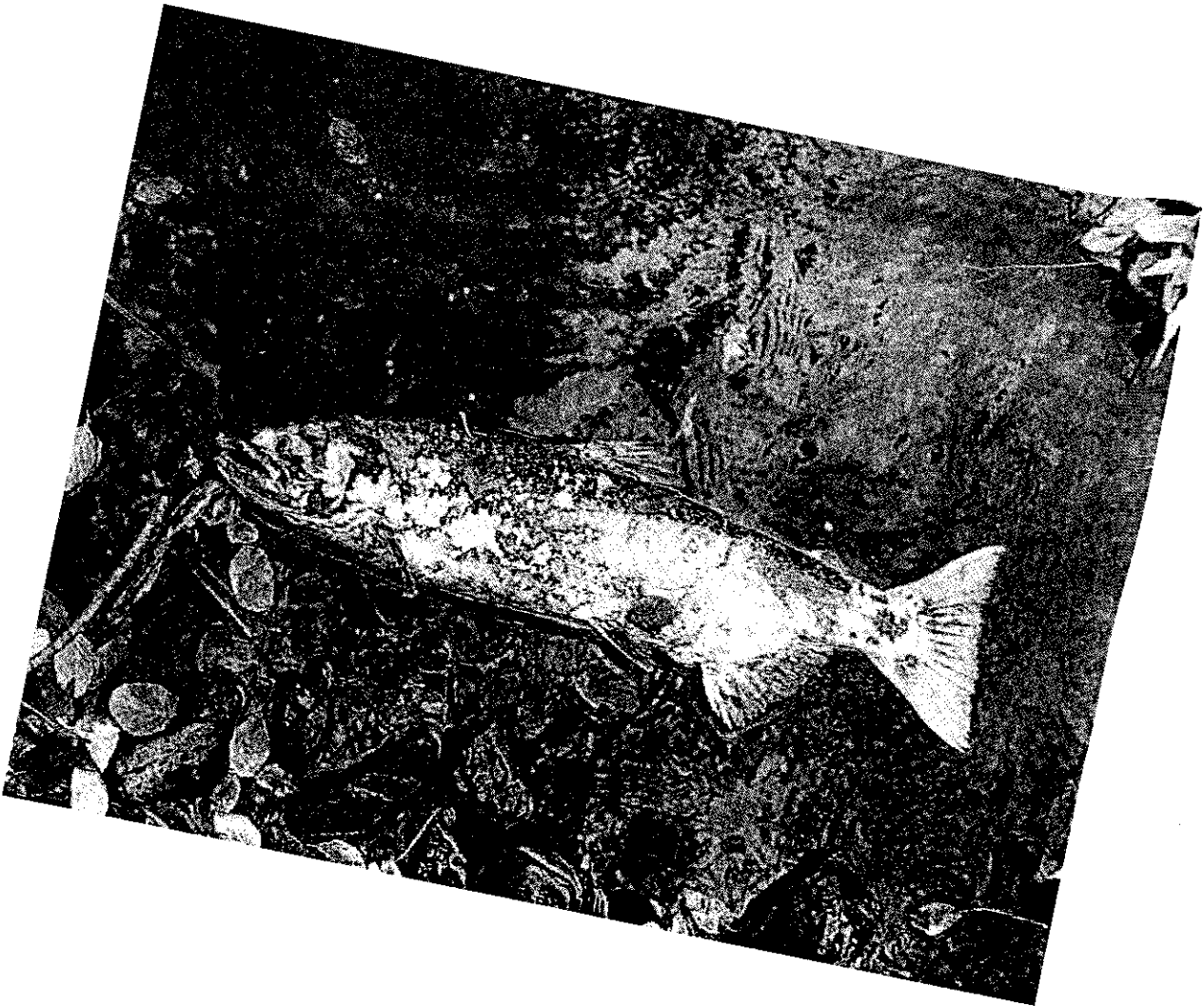
DRAFT

Mainstem Klamath River Fall Chinook Spawning Survey  
2004

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Prepared by:

Schuyler Grove



Draft Report Number AFWO- ??????

## **DISCLAIMER**

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

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## ABSTRACT

This report describes observations and results of the twelfth annual U.S. Fish and Wildlife Service fall Chinook salmon (*Oncorhynchus tshawytscha*) spawning survey on the mainstem Klamath River. The survey was conducted for six weeks from October 11 to December 3, 2004, 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 916 redds were observed during the 2004 survey which represents a 72.2% decrease from the 2003 redd count of 3,302. This years survey represents the second lowest number of redds ever recorded since the initiation of these surveys in 1993.

In 2004, spawning was observed throughout the mainstem Klamath River from Iron Gate Dam to Indian Creek with 56% (n=513) 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 Rkm (Iron Gate Dam to Cape Horn Creek), increased from 24.2 to 60.9%. In 2000, redd frequency decreased to 37.5%. In 2001, this number decreased once more to 25.8%. In 2002, redd frequencies increased to 31.9%. Redd frequency for 2003 in this upper main stem section was 29.7%. In 2004, redd frequency increased to 43.9%. The lowest redd densities in 2004 were between Shinar and China Creek (0.7 redds/Rkm). Water clarity between Iron Gate Dam and Indian Creek ranged from 2.5 to 3.0m, and represented some of the most stable visibility recorded since the initiation of these surveys.



## INTRODUCTION

The Klamath River drains approximately 14,000 km<sup>2</sup> in Oregon and 26,000 km<sup>2</sup> 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 km<sup>2</sup> 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<sup>2</sup>, and the Shasta, Scott and Salmon rivers, each draining approximately 2,070 km<sup>2</sup>. Iron Gate Dam (IGD; RKm 310.25) on the Klamath River and Lewiston Dam (RKm 249) 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 main stem 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 11 and December 3. 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.

### Rafting Equipment

Two 4.27 m (14 ft) 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 six 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 six 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 six 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 six 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 six consecutive weeks.

#### **Water Temperature**

Mean daily water temperature was provided by the USFWS Arcata Field Office. Temperature was recorded from a temperature probe located in the mainstem Klamath River above the Shasta river confluence. Average daily river temperature was calculated from the maximum and minimum temps recorded from a given day. All temperatures were recorded in degrees Celsius.

#### **Discharge**

Mean daily river flow was provided by the U.S. Geological Survey gauging station (Number 11516530), located in the Klamath River just downstream of Iron Gate Dam. 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 help estimate adult and grilse (Age 2) spawning abundance (CDFG 2005). 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 collected from carcass surveys and upper Klamath tributary fish weirs.

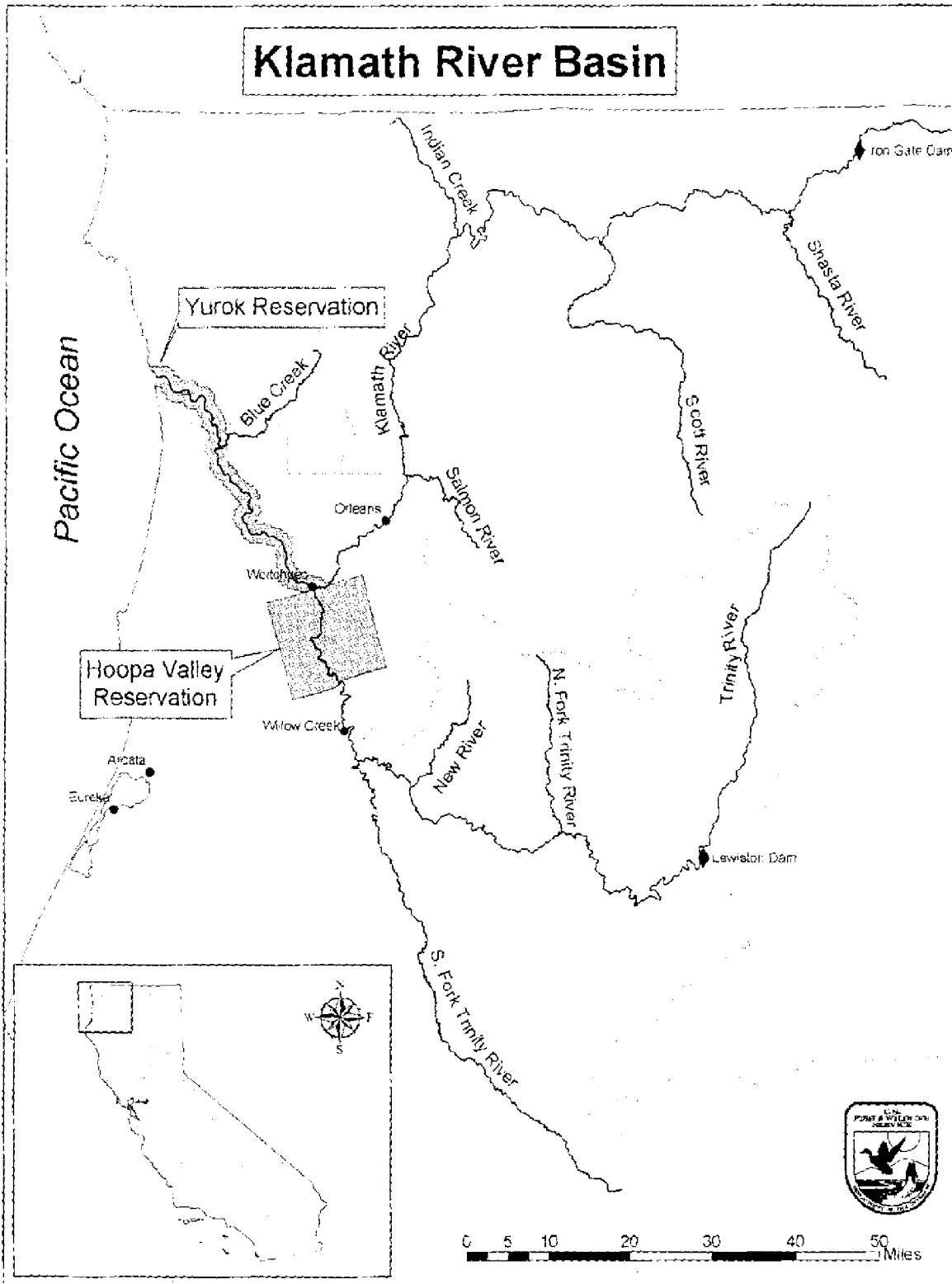


Figure 1. - Overview map of the Klamath River Basin accessible to anadromous fish.



## RESULTS AND DISCUSSION

A total of 916 Chinook salmon redds were counted between IGD and the confluence of Indian Creek in 2004, representing a 72.2% decrease from the 2003 count of 3,302 (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.

Reach one was only surveyed during week four of the survey. A total of 513 redds were observed in this reach during week four of the 2004 survey (Table 1; Figure 6). Since reach one was only sampled one time during this survey, individual weekly redd counts are unavailable. Although this reach was not sampled during weeks five and six, past years data suggests that the majority of spawning activity occurs between weeks one and four. The 513 redds represent 56% of the total redd count for 2004. The redd density in this reach was 23 redds/RKm (Figure 3). The 513 redds observed during the survey account for the second lowest count since 1993 when 87 redds were counted. (Table 1).

#### Reach 2: Ash Creek river access to Beaver Creek Riffle river access.

A total of 117 redds were observed in this reach during the 2004 survey (Table 1; Figure 7). The 117 redds represent 12.7 % of the total redd count for 2004. Redd density was 4.9 redds/RKm (Figure 3). Peak spawning (n=57) occurred during Week 2 of the survey (Table 1). The 117 redds counted in this reach represent the lowest count since 1999 when 69 redds were counted. (Table 1).

#### Reach 3: Beaver Creek Riffle river access to Blue Heron river access.

A total of 134 redds were counted in this reach during the 2004 survey (Table 1; Figure 8). The 134 redds represent 14.6 % of the total redd count for 2004. Redd density was 4.8 redds/RKm (Figure 3). Peak spawning (n=45) in Reach 3 occurred during Week 2 (Table 1). The 134 redds counted in this reach represent the third lowest count since the initiation of these surveys.

#### Reach 4: Blue Heron river access to Seiad Bar river access.

A total of 55 redds were counted in this reach during the 2004 survey (Table 1; Figure 9). The 55 redds represent 6 % of the total redd count for 2004. Redd density was 2 redds/RKm (Figure 3). Peak spawning (n=27) in Reach 4 occurred during Week 2. The 55 redds observed during the survey is the fifth lowest count for this reach since the project started in 1993.

#### Reach 5: Seiad Bar river access to China Point river access.

A total of 48 redds were counted in this reach during the 2004 survey (Table 1; Figure 10). The 48 redds represent 5.2 % of the total redd count for 2004. Redd density was 2.2 redds/RKm (Figure 3). Peak spawning (n=17) occurred during Week 2 and Week 3 of this survey. Reach 5

had the lowest redd count (n=48) of any reach sampled in 2004 (Table 1). The 48 redds represents the fifth lowest redd count for this reach since the initiation of these surveys.

Reach 6: China Point river access to Indian Creek.

A total of 49 redds were counted in Reach 6 (Table 1; Figure 11). The 49 redds represent 5.3 % of the total redd count for 2004. This represents a redd density of 2.6 redds/RKm (Figure 3). Peak spawning (n=25) in Reach 6 occurred during Week 3 (Table 1). The 49 redds represents the lowest redd count for this reach since the initiation of the surveys in 1993.

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 main stem (IGD to Deliverance Camp river access). The highest weekly redd count occurred during Week 4 (n=607). However, this number is skewed heavily due to the week four effort for reach one. Based on previous years data, peak spawning likely occurred during week two of the survey. Overall, the 2004 redd survey yielded the second lowest redd count during the period of record (1993-2004; Figure 5).

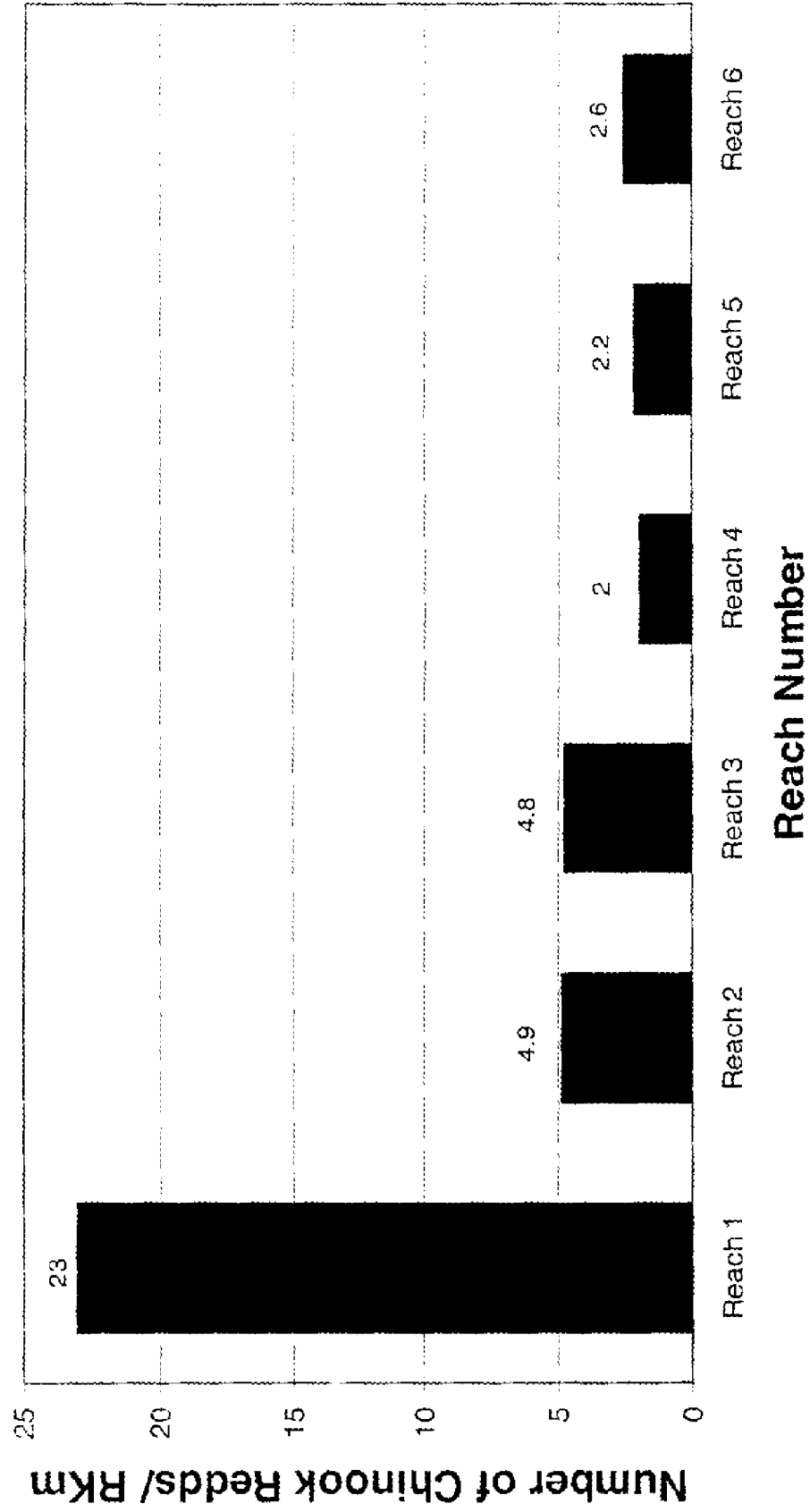


Figure 3. - Chinook Radd Density by Reach, 2004.



Table 1.- Weekly summary and percent frequency of mainstem Klamath River redd counts for Reaches 1 to 6, 1993 to 2004 (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
<b>Year</b>	<b>1993</b>						
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	<b>330</b>
% Frequency	26	12	17	9	9	26	
<b>Year</b>	<b>1994</b>						
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	<b>1656</b>
% Frequency	50	7	11	10	7	16	
<b>Year</b>	<b>1995</b>						
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	<b>3236</b>
% Frequency	55	6	13	5	7	15	
<b>Year</b>	<b>1996</b>						
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	<b>1372</b>
% Frequency	51	5	11	3	15	16	

	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
<b>Year</b>	<b>1997</b>						
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	<b>1739</b>
% Frequency	59	4	9	9	4	15	
<b>Year</b>	<b>1998</b>						
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	<b>1415</b>
% Frequency	71	6	9	3	3	8	
<b>Year</b>	<b>1999</b>						
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	<b>989</b>
% Frequency	73	7	6	3	4	7	

	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
<b>Year</b>	<b>2000</b>						
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	
<b>Year</b>	<b>2001</b>						
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	

	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
<b>Year</b>	<b>2002</b>						
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	
<b>Year</b>	<b>2003</b>						
Week 1 Oct 14 to 17	0	NS	38	22	19	48	127
Week 2 Oct 20 to 24	563	194	228	178	77	150	1390
Week 3 Oct 27 to 31	553	73	103	18	119	99	965
Week 4 Nov 4 to 7	310	33	97	61	50	74	625
Week 5 Nov 12 to 15	44	43	14	11	15	48	175
Week 6 Nov 19 to 22	2	0	4	2	5	7	20
Total	1472	343	484	292	285	426	3302
% Frequency	45	10	15	9	8	13	
<b>Year</b>	<b>2004</b>						
Week 1 Oct 11 to 15	NS	0	6	1	3	0	10
Week 2 Oct 18 to 22	NS	57	45	27	17	11	157
Week 3 Oct 25 to 29	NS	22	37	9	17	25	110
Week 4 Nov 1 to 5	513	36	27	14	7	10	607
Week 5 Nov 8 to 12	NS	2	10	4	4	3	23
Week 6 Nov 29 to Dec 3	NS	0	9	0	0	0	9
Total	513	117	134	55	48	49	916
Frequency	56	13	14	7	5	5	



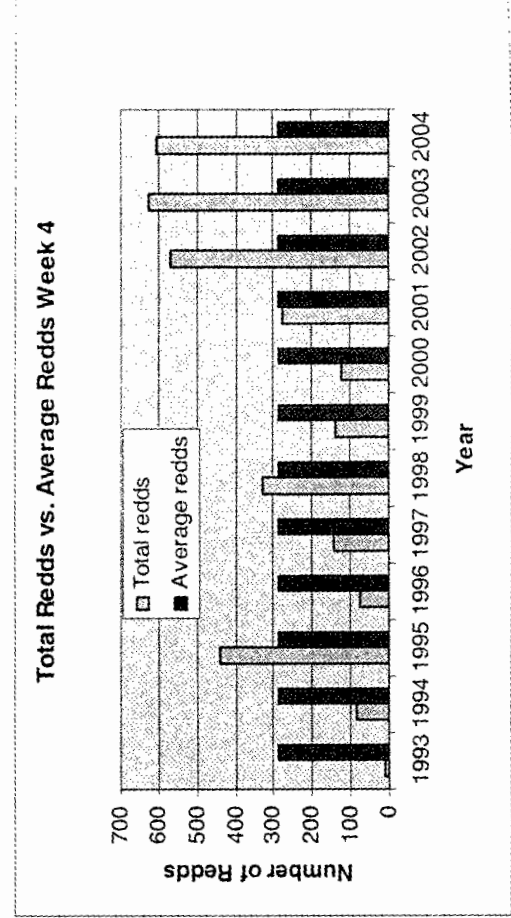
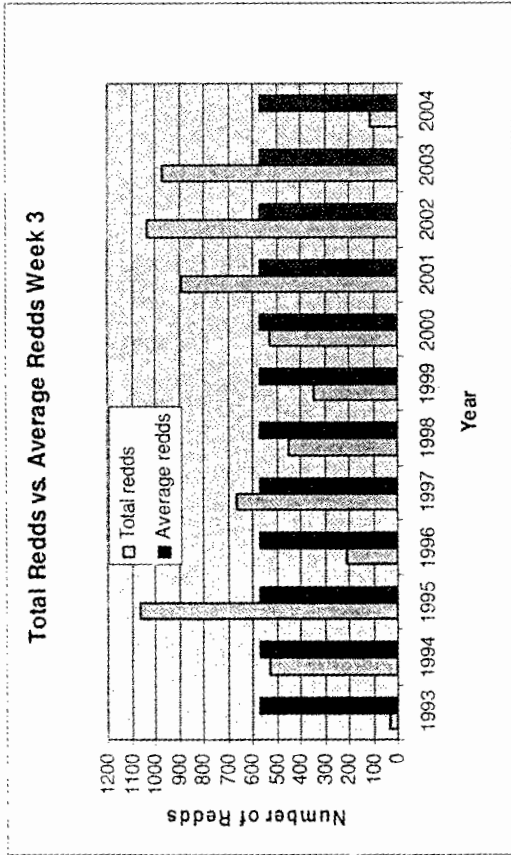
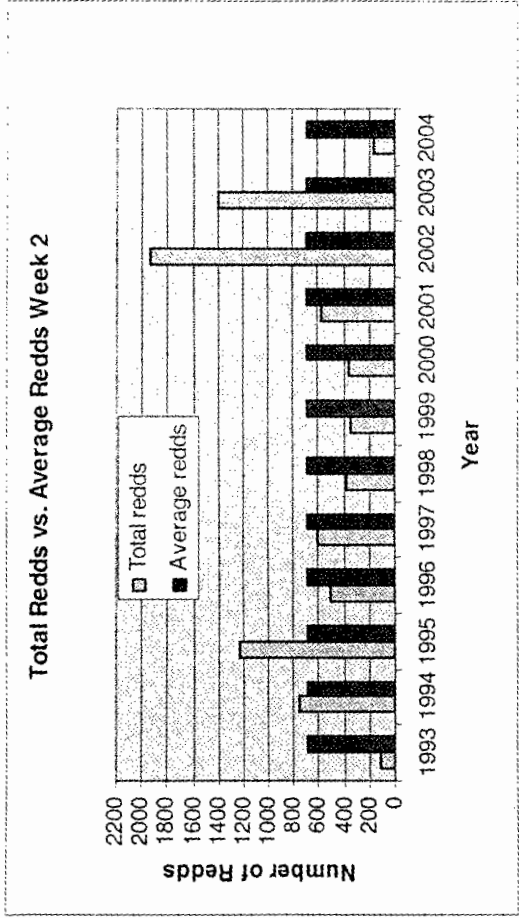
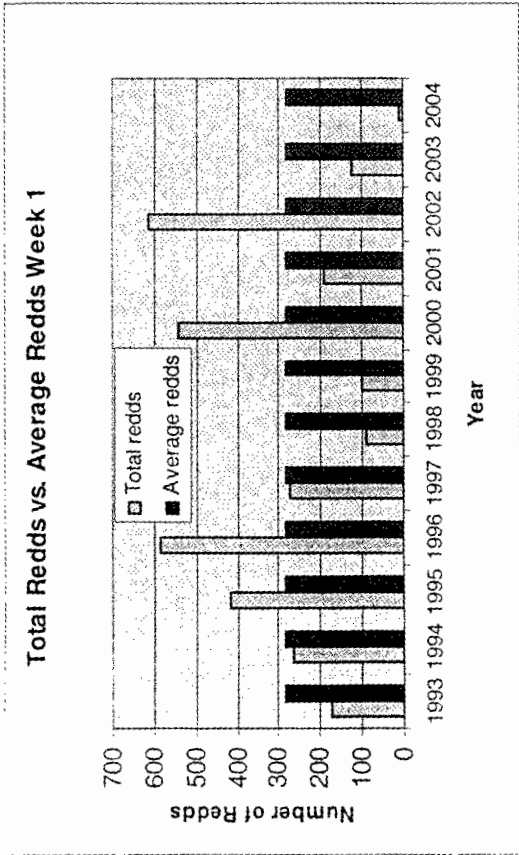
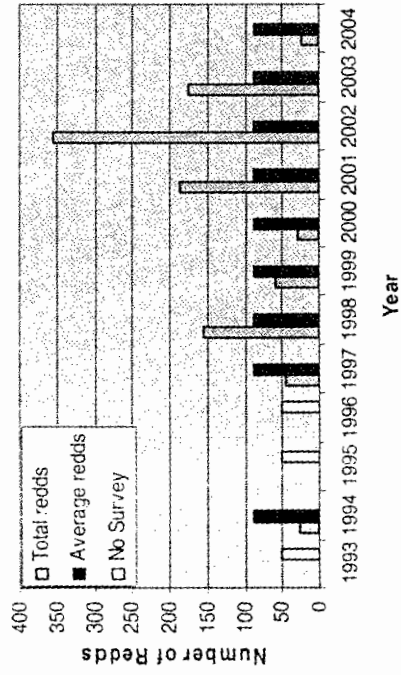
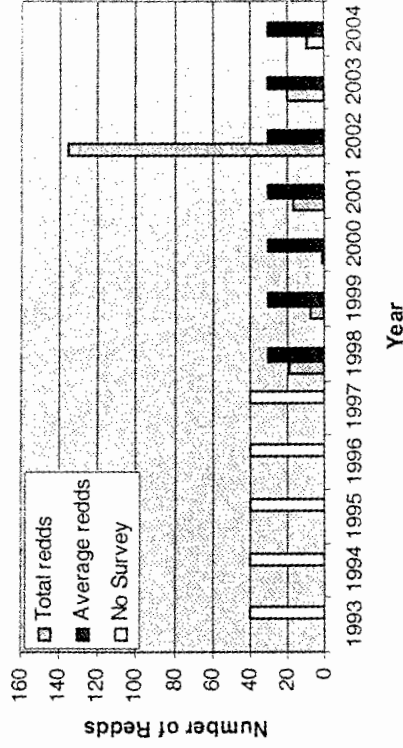


Figure 4. -Total redds vs. average redds observed during surveys for weeks 1-4 from 1993 to 2004.

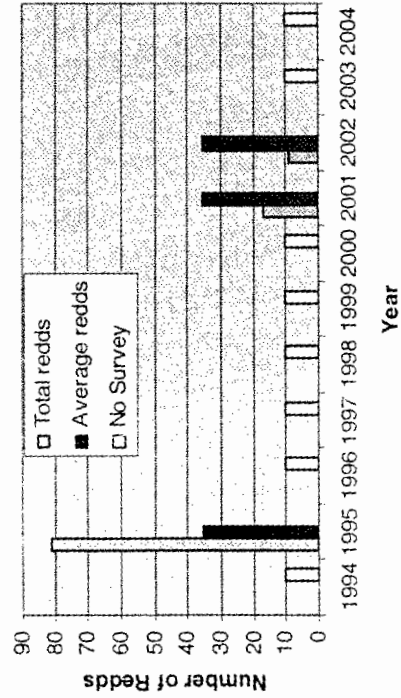
**Total Redds vs. Average Redds Week 5**



**Total Redds vs. Average Redds Week 6**



**Total Redds vs. Average Redds Week 7**



**Total Redds vs. Average Redds Week 8**

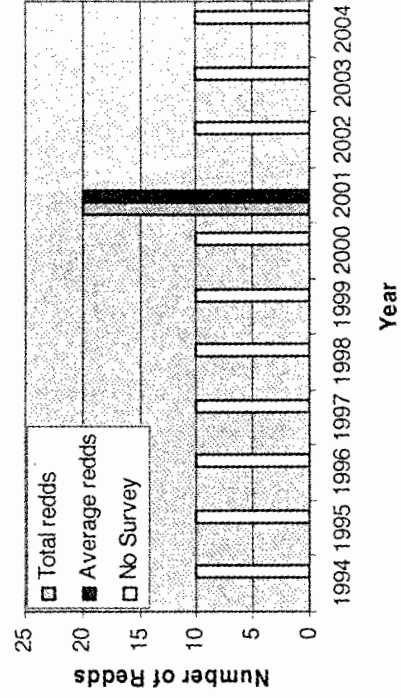


Figure 5. -Total redds vs. average redds observed during surveys for weeks 5-8 from 1993 to 2004.

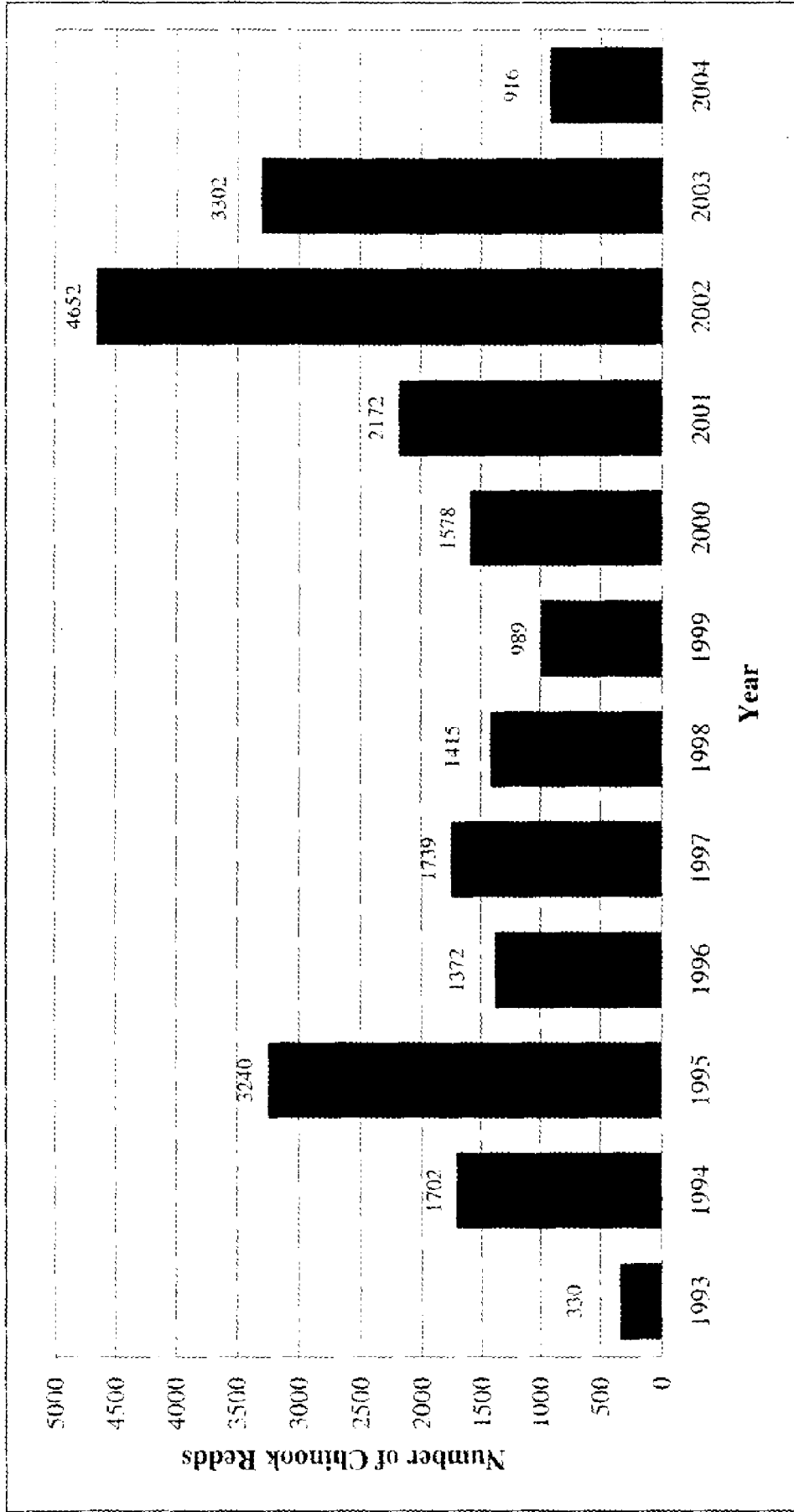


Figure 6. - Yearly USFWS Chinook salmon redd counts, 1993 to 2004.



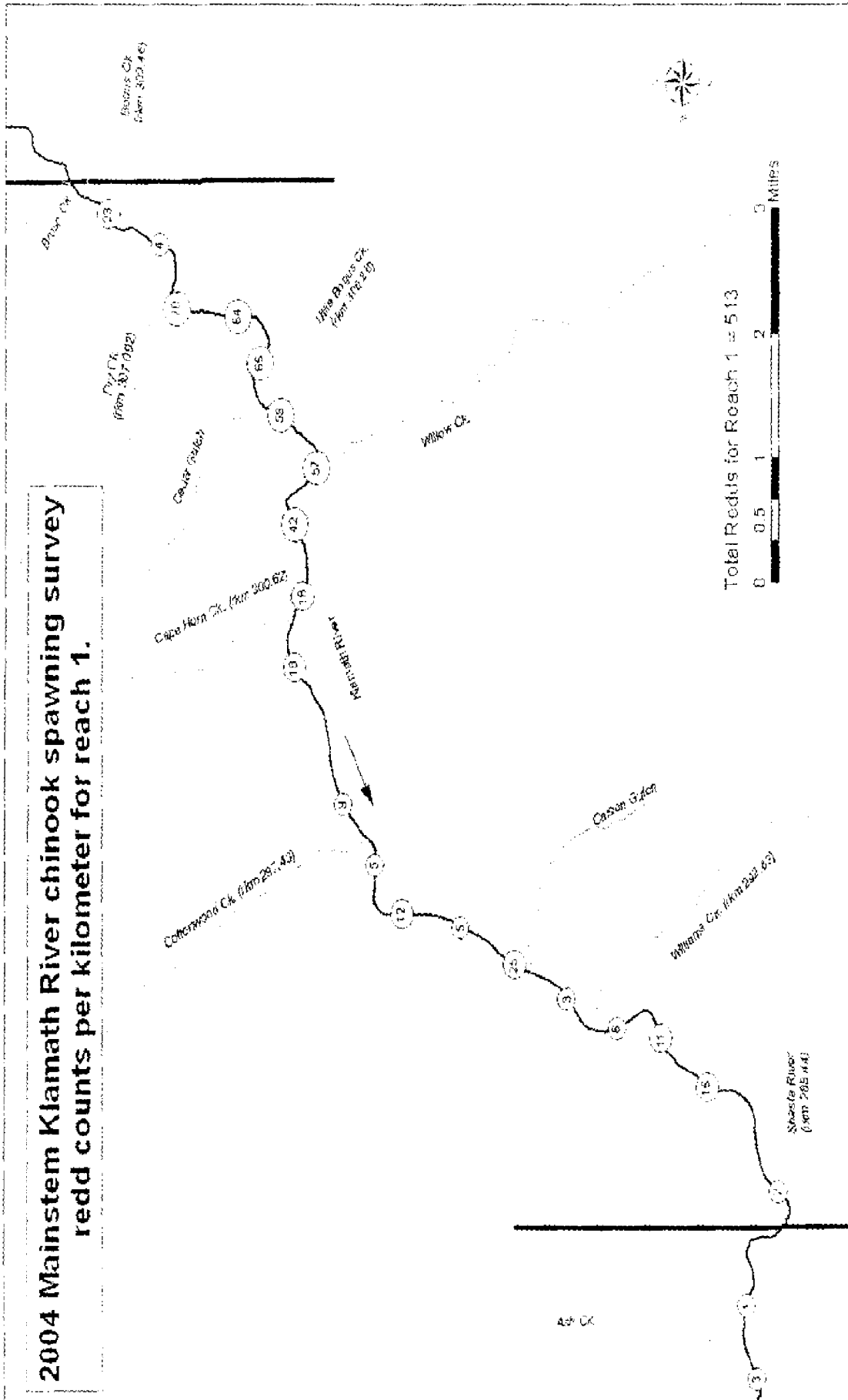


Figure 7. - Redd distribution map for 2004, mainstem Klamath River, Iron Gate Dam to Deliverance Camp.

**2004 Mainstem Klamath River chinook spawning survey  
redd counts per kilometer for reach 2.**

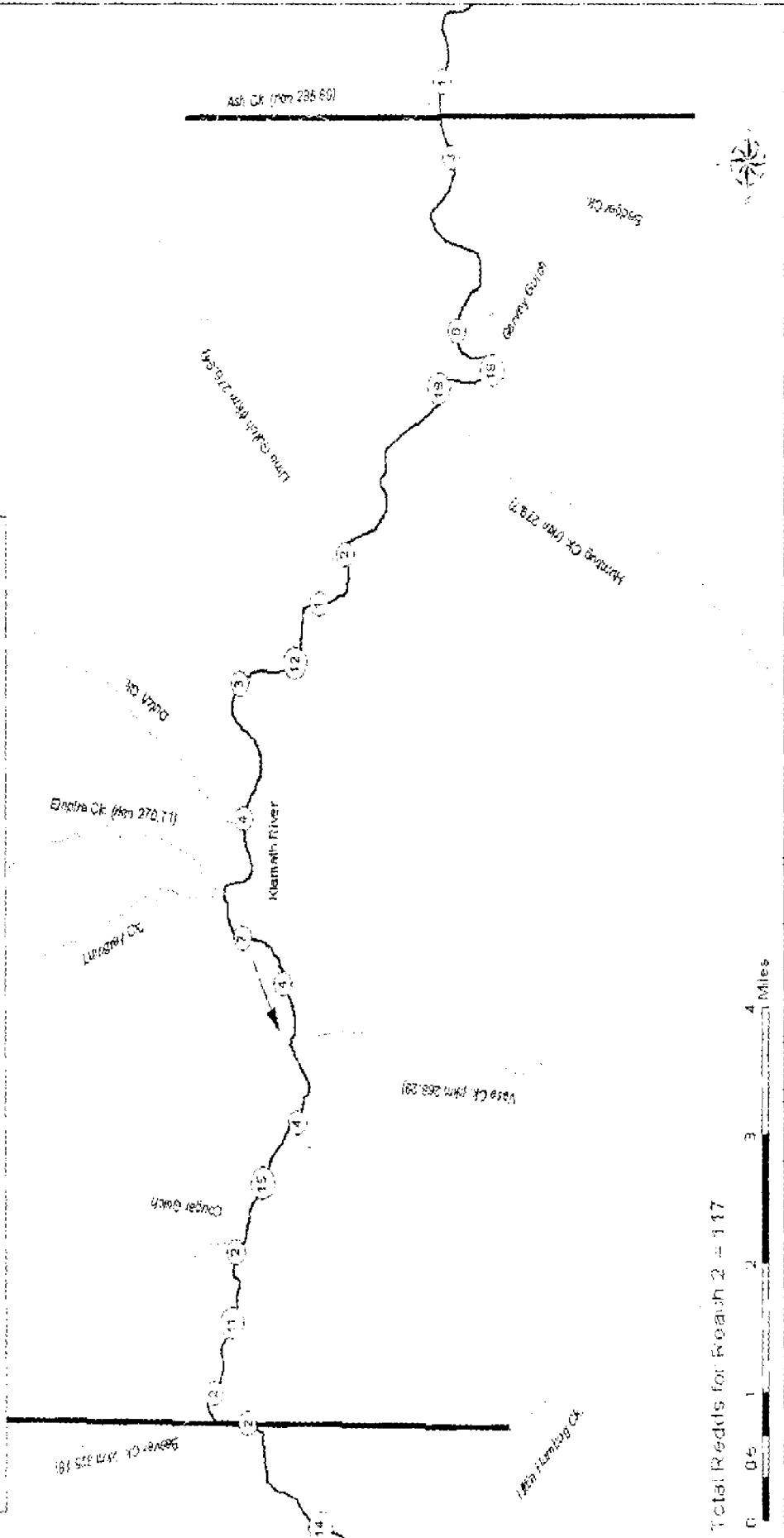


Figure 8. - Redd distribution map for 2004, mainstem Klamath River, Ash Creek to Beaver Creek.

**2004 Mainstem Klamath River chinook spawning survey  
redd counts per kilometer for reach 3.**

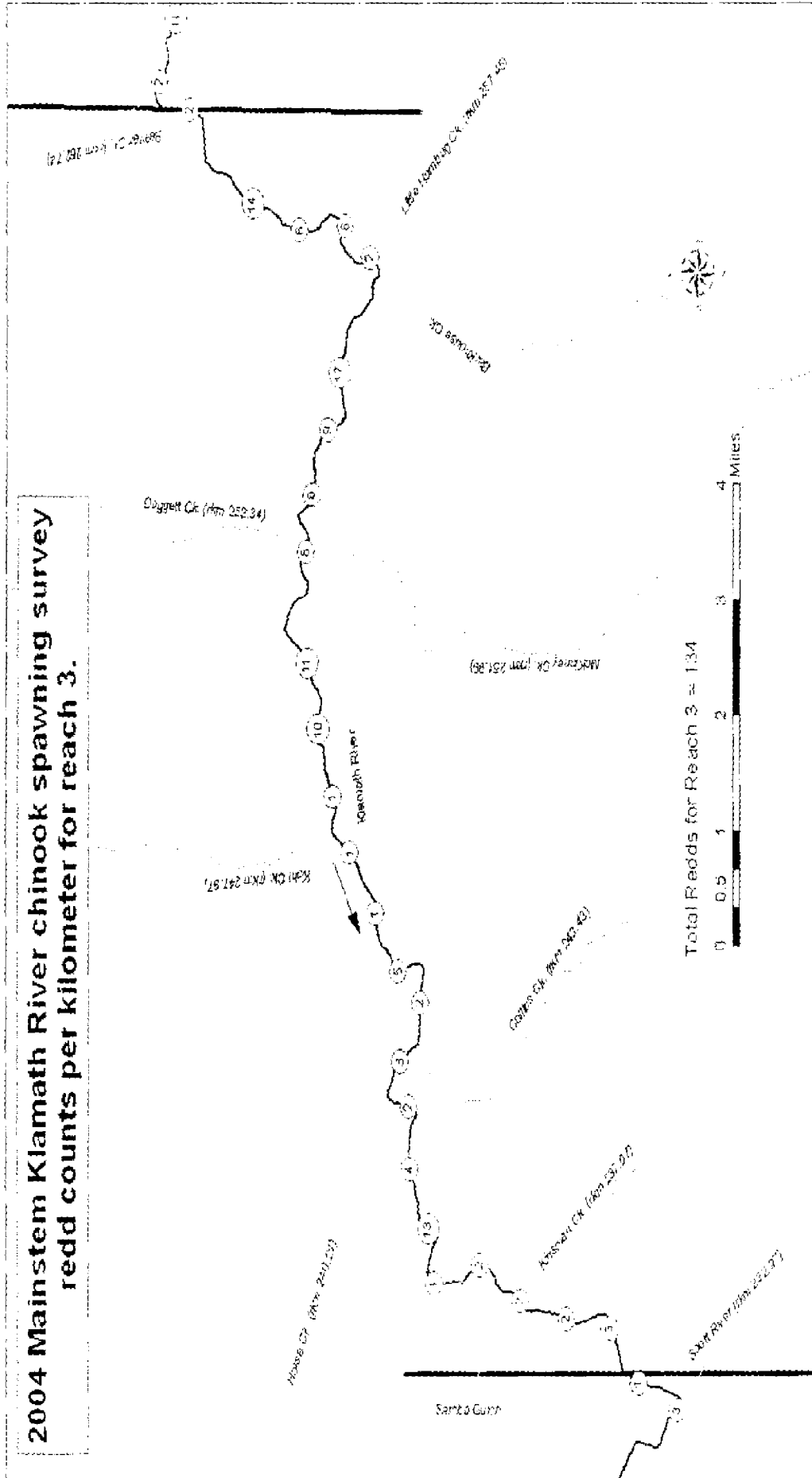


Figure 9. - Redd distribution map for 2004, mainstem Klamath River, Beaver Creek to Blue Heron.

**2004 Mainstem Klamath River chinook spawning survey  
redd counts per kilometer for reach 4.**

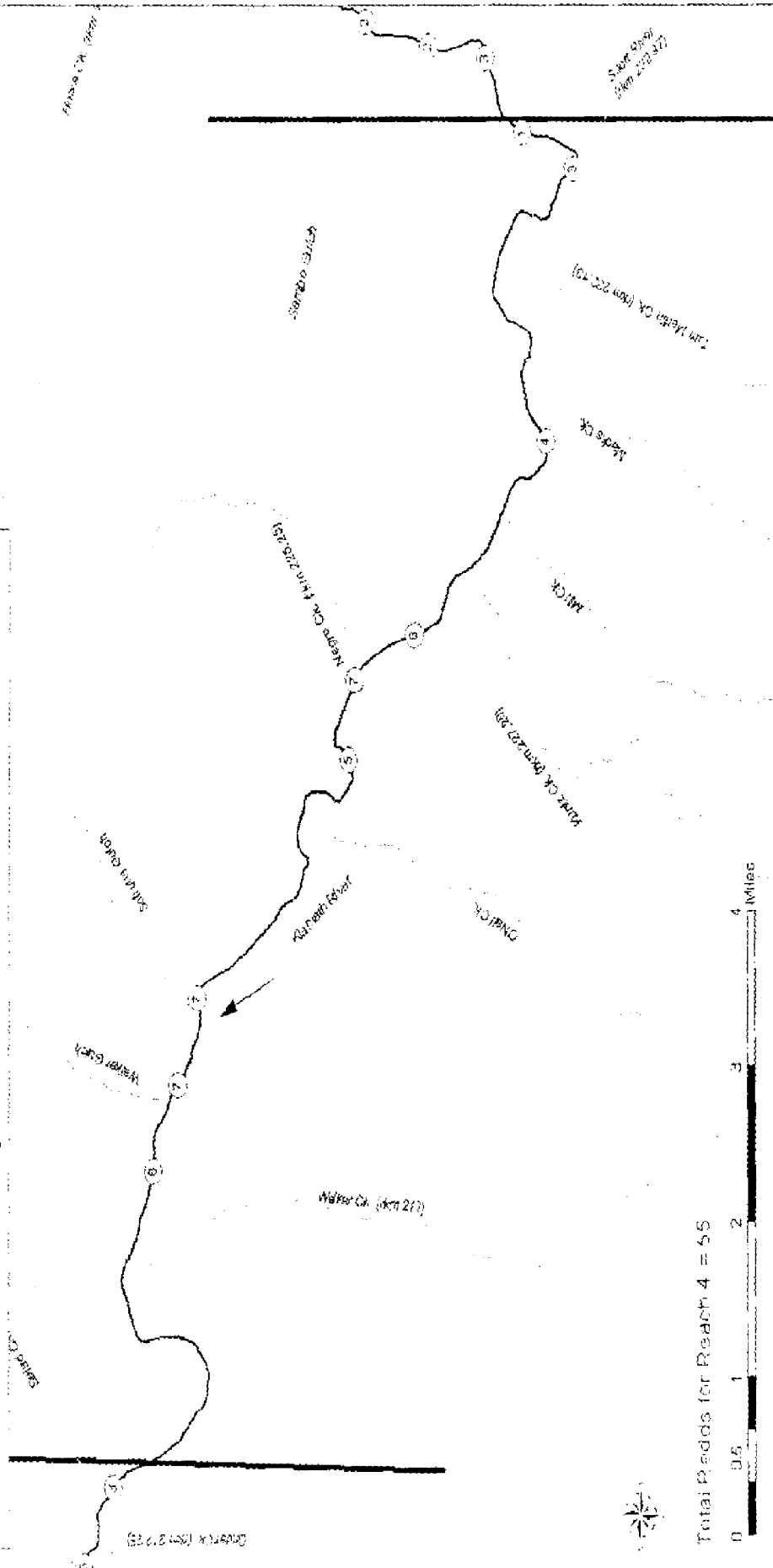


Figure 10. - Redd distribution map for 2004, mainstem Klamath River, Blue Heron to Seiad Bar.

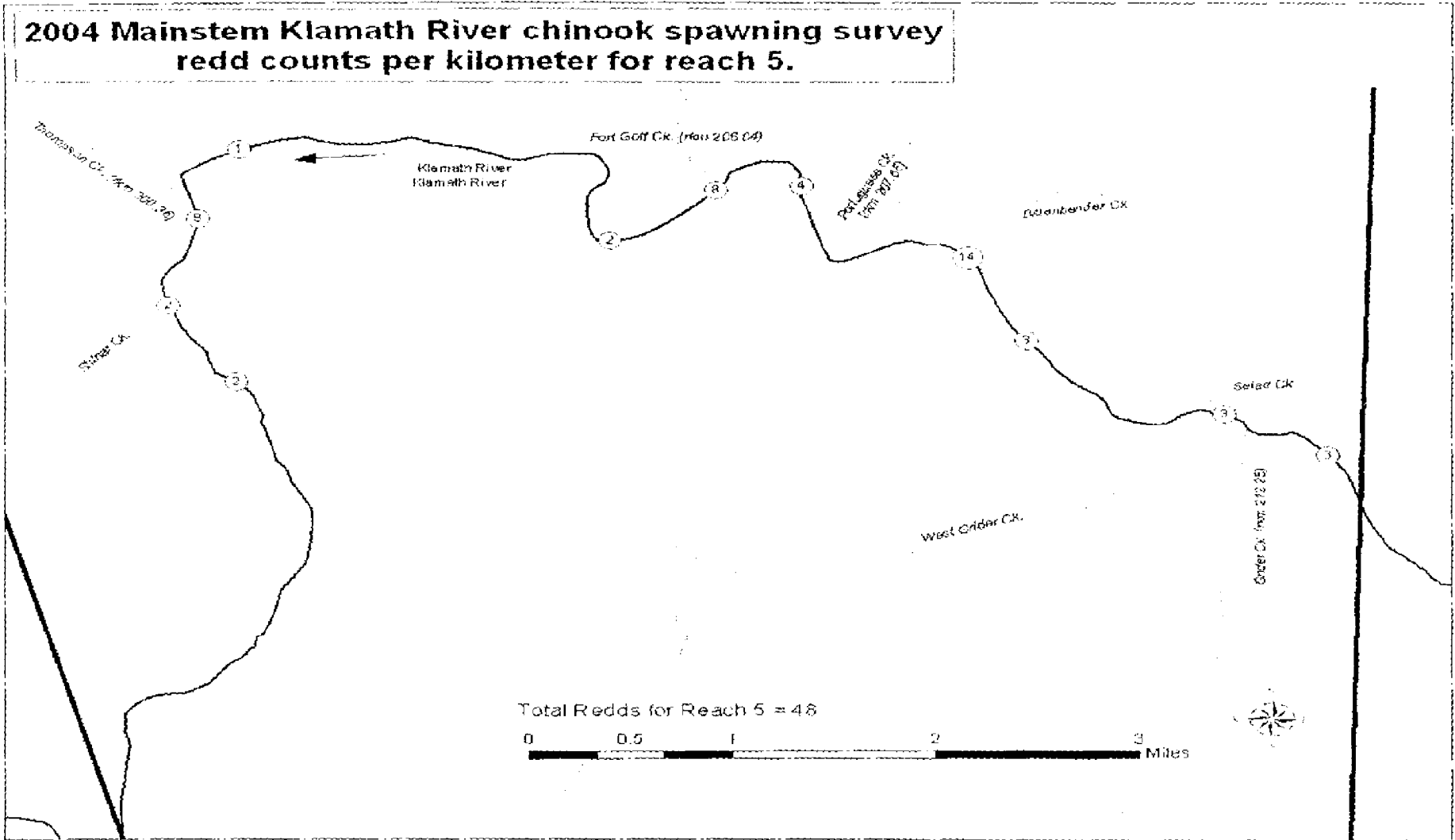


Figure 11. - Redd distribution map for 2004, mainstem Klamath River, Seiad Bar to China Point.

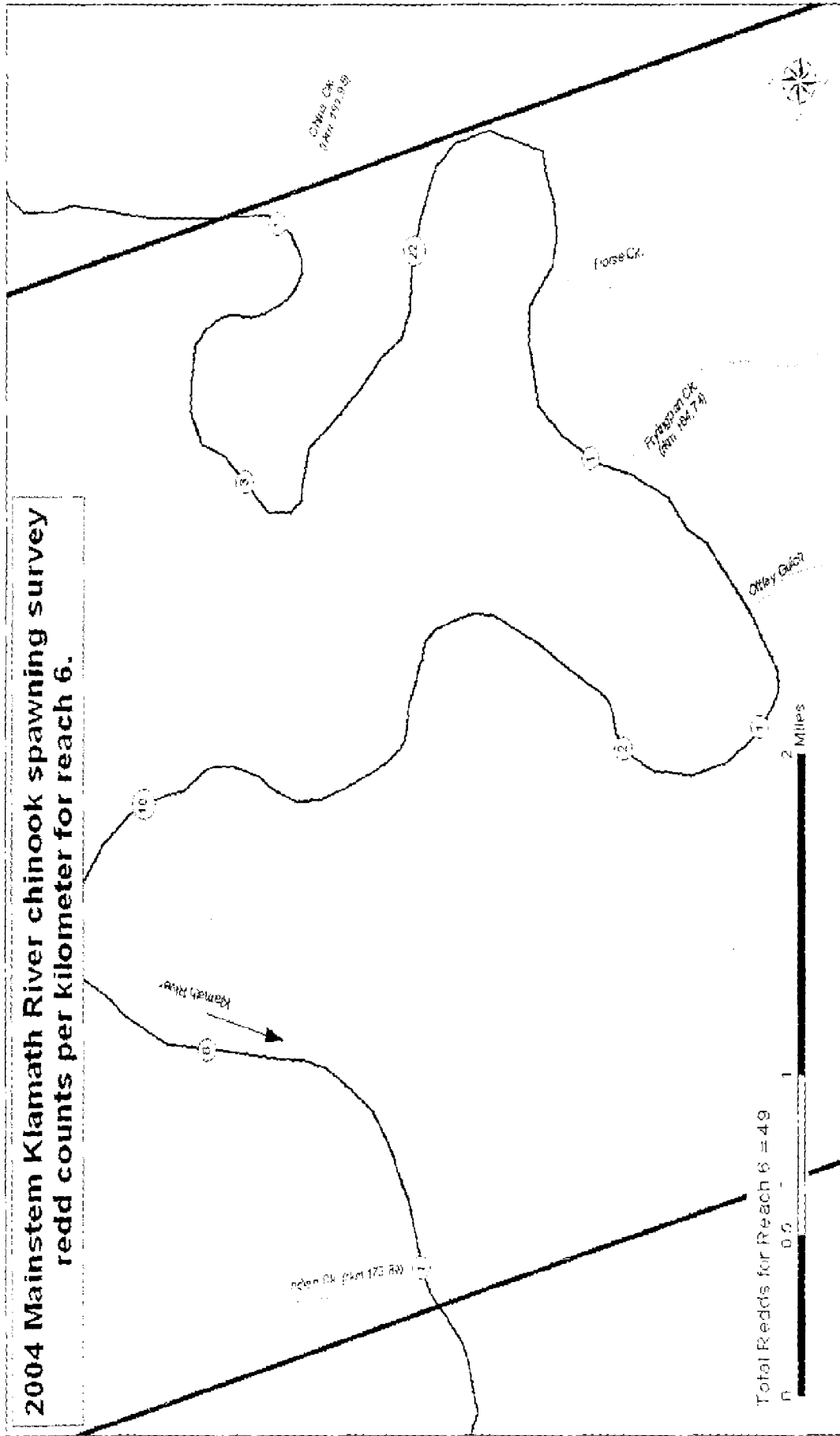


Figure 12. - Redd distribution map for 2004, mainstem Klamath River, China Point to Indian Creek.

**Redd counts: 10 km Sections**

The 2004 redd counts were highest between IGD and Cape Horn Creek (Copco-Ager Bridge) with a redd density of 43.9 redds/RKm. Since the initiation of these surveys in 1993, redd frequencies in this section have increased from 24.2% to 60.9% during 1993 to 1999 respectively (Table 2; Figure 12). In 2000, the tendency for Chinook to spawn in this section decreased to 37.5% and remained fairly stable through 2003. In 2004, redd frequency increased to 43.9%. The reach from Cape Horn Creek to the Shasta River confluence accounted for the second highest redd density at 11.9 redds/RKm. Combined, these two upper main stem sections accounted for 55.8% of the 2004 total redd count with the remaining 44.2% of the redds distributed between Shasta River and Indian Creek (Table 2). The lowest redd densities (0.7 redds/RKm) of any 10 RKm section occurred between Shinar Creek and China Creek.

**Water Temperature**

Mean daily water temperatures decreased from 15.8 to 6.5 °C during this survey (October 11 and December 3, respectively). Water temperatures continued to decrease during these surveys even though IGD flows remained stable around 900 cfs (Figure 13).

**Discharge**

Discharges for the 2004 survey ranged from 914 to 941 cfs (Figure 13). The 2004 discharges from Iron Gate Dam were the least fluctuating releases since the initiation of the surveys in 1993.

**Water Clarity**

Vertical Secchi disc readings ranged from 2.5 to 3.0m. Water clarity for this 2004 survey remained good throughout the survey, and can most likely be attributed to consistent river flows and limited rain fall. Visibility generally decreased with higher river discharge, cloud cover, and/or precipitation.

**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).

Table 2. - Percent redd frequency by 10 RKm (approximate) sections on the main stem Klamath River, 1993 to 2004.

TRIBUTARY REACH (RKm)	REACH DISTANCE (RKm)	PERCENT FREQUENCY											
		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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	29.7	43.9
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	14.7	11.9
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	3.1	5.7
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	3.7	3.6
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	6.4	6.8
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	6.1	7.2
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	4.7	3.8
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	3.1	1.5
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	6.7	4.6
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	3.1	2.6
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	4.7	2.5
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	1.7	0.7
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	6.9	2.8
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	5.3	2.4



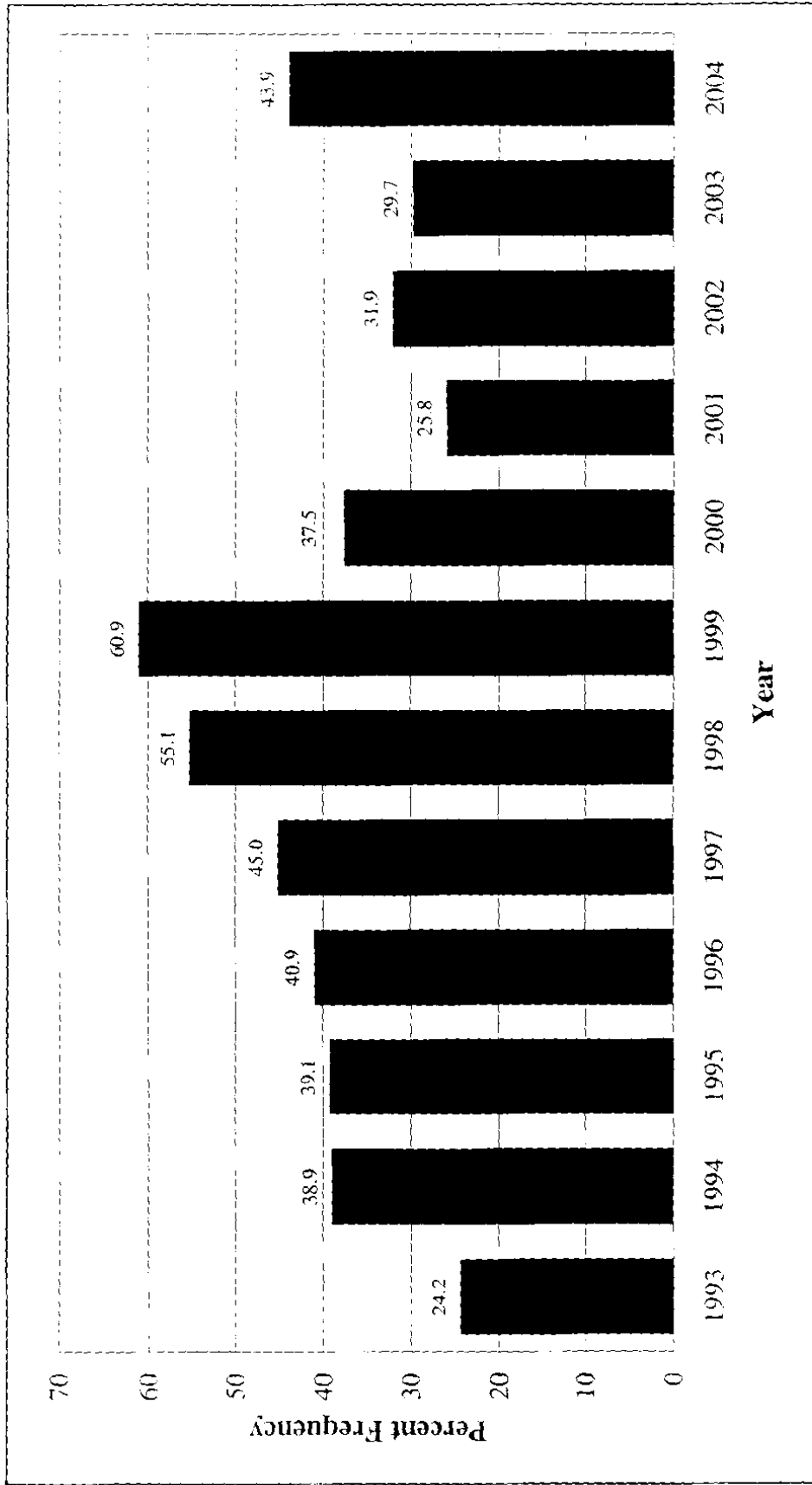


Figure 13. - Percent frequency of redds by year (1993 to 2004) from Iron Gate Dam to Cape Horn Creek.

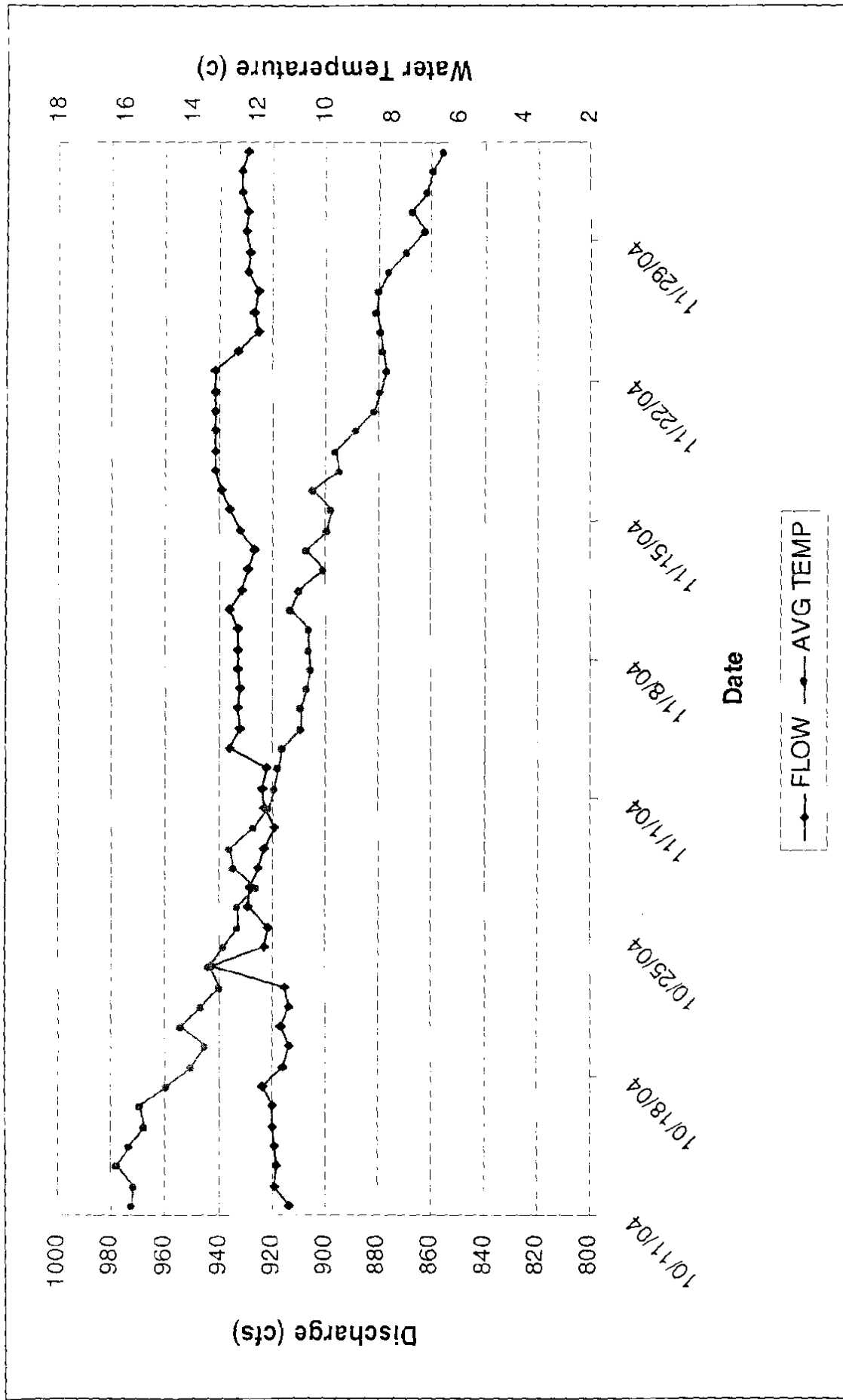


Figure 14. - Water temperature (°C) at Rkm 304.75 and discharge (cfs) from Iron Gate Dam (October 11 to December 3, 2004).

### Adult Grilse Expansion

The CDFG estimated the natural fall Chinook spawner escapement for the mainstem Klamath River for 2004 at 10,959 adults and 891 grilse (Table 3). The adult/grilse estimates are based on data obtained from mark-recapture carcass surveys redd counts, video counts at weir sites and fish scale analysis (CDFG 2005).

Table 3. - Natural fall Chinook spawning escapement adult and grilse expansion, Klamath River, 2004 (CDFG 2005).

Natural Spawning Area	Grilse	Adults	Totals
Salmon River Basin	96	530	626
Scott River Basin	22	445	467
Shasta River Basin	129	833	962
Bogus Creek Basin	295	3,493	3,788
Mainstem Klamath River IGH to Indian Creek	205	5,037	5,242
Klamath Tributaries (above Reservation)	80	477	557
Yurok Reservation Tributaries	64	144	208
<b>Total Natural Spawners</b>	<b>891</b>	<b>10,959</b>	<b>11,850</b>

Based on spawning data from mainstem and tributary spawning surveys conducted by AFWO, USFS, CDFG, and Hoopa and Yurok tribes, the CDFG estimated that 21,541 adults spawned in-river or at hatcheries within the Klamath River Basin.

### SUMMARY

The fall Chinook redd count of 916 represents the second lowest number observed since the initiation of these surveys in 1993 when 330 redds were counted. Since 1993, the tendency for Chinook to spawn in the upper 10 Rkm between IGD and Cape Horn Creek had steadily 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%. In 2003, this tendency remained consistent with 29.7% of spawning occurring in the upper 10 Rkm. Although total redd numbers were down for 2004, the tendency for Chinook to spawn from IGD to Cape Horn Creek increased to 43.9%.

In previous years surveys peak mainstem spawning occurred during week two. In 2004, the data shows peak mainstem spawning occurring during week four. However, this is due to the unequalled sampling effort on reach one. Based on previous years data, if reach one were to have

been sampled every week throughout the entire survey, the data would have likely supported peak spawning during week two.

Water clarity during this years survey was some of the highest and most consistent (2.5 to 3.0 m) observed when compared to past survey years.

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