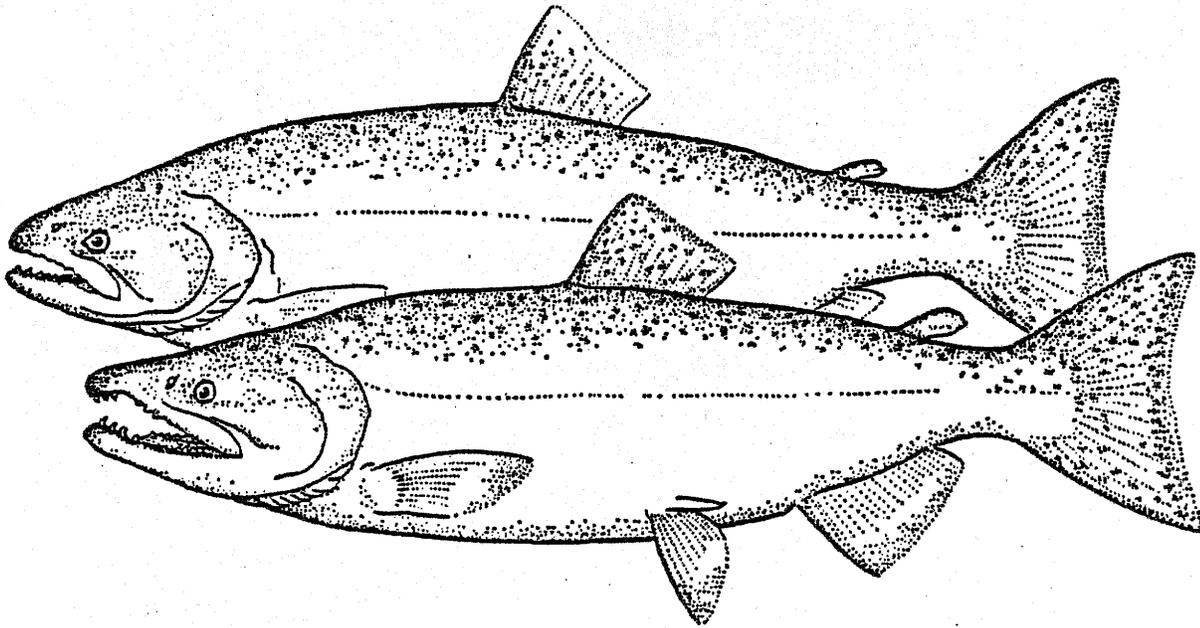


July 2001

**SPRING AND SUMMER CHINOOK SALMON
SPAWNING GROUND SURVEYS
ON THE ENTIAT RIVER, 2000**



Fish and Wildlife Service

U.S. Department of the Interior

**Spring and Summer Chinook Salmon
Spawning Ground Surveys on the Entiat River, 2000**

Prepared by:

David G. Carie

and

Charles O. Hamstreet

**U.S. Fish and Wildlife Service
Mid-Columbia River Fishery Resource Office
7501 Icicle Road
Leavenworth, Washington 98826**

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INTRODUCTION

From 1962 to 1994, spring chinook salmon (SCS), *Oncorhynchus tshawytscha* spawning, was monitored by the Washington Department of Fish and Wildlife (WDFW) in a seven-mile section of the Entiat River known as the "index area" (River Mile (RM) 21 to 28). From 1957 to 1991, the Chelan County Public Utility District (PUD) monitored summer chinook (SUS) spawning in the lower ten miles (RM 0 to 10.4) of the Entiat River. While informative, these monitoring efforts were later believed to be either deficient in scope (area surveyed) and/or methodology. In 1994, in recognition of the need to improve the spawning survey efforts, the U.S. Fish and Wildlife Service's (USFWS) Mid-Columbia River Fishery Resource Office (MCRFRO) began a more intensive spring and summer chinook spawning monitoring program on the Entiat River. Fish count data from Rocky Reach and Wells dams are also used to evaluate salmonid runs in the Entiat River area.

Efforts in 2000 mark the seventh year that MCRFRO has conducted the expanded spring and summer chinook spawning activities. Biologists also search for and note presence and/or redds of sockeye salmon *O. nerka* and bull trout *Salvelinus fontinalis* since observations of these fish have been made in previous years.

The purpose of the MCRFRO spawning surveys are to:

1. Continue to assess the distribution of spring and summer chinook salmon spawning throughout an expanded area of the Entiat River and provide accurate estimates of the respective spawning populations.
2. Supplement spawning and population trend analysis data for spring and summer chinook salmon in the Entiat River.
3. Evaluate possible straying of hatchery spring and summer chinook salmon.
4. Search for sockeye salmon and bull trout and identify their spawning distribution in the survey section of the Entiat River.

STUDY AREA

The Entiat River Basin is located in Chelan County, north-central Washington State. The river heads in a glaciated basin near the crest of the Cascade Mountains and flows southeasterly. Base flow is 385 cubic feet/second (Mullan et al. 1992) and its major tributaries are the North Fork (RM 34) and Mad River (RM 10.5). The upstream limit of anadromy is Entiat Falls (RM 29.2).

The Entiat System drains an area of about 416.5 square miles. The Watershed is nearly 42 miles in length and varies in width from 5 to 14 miles. The basin's highest elevation is the 9,249 foot summit of Mt. Fernow and its lowest is about 700 feet at the confluence with the Columbia River (USDA 1979). The Entiat River enters the Columbia River approximately 484 RM's and eight mainstem hydroelectric dams above the Pacific Ocean.

Spawning ground surveys concentrated between Fox Creek Campground and McKenzie Diversion Dam (RM 28 to 16) because this reach contains most of the suitable spawning habitat (Figure 1).

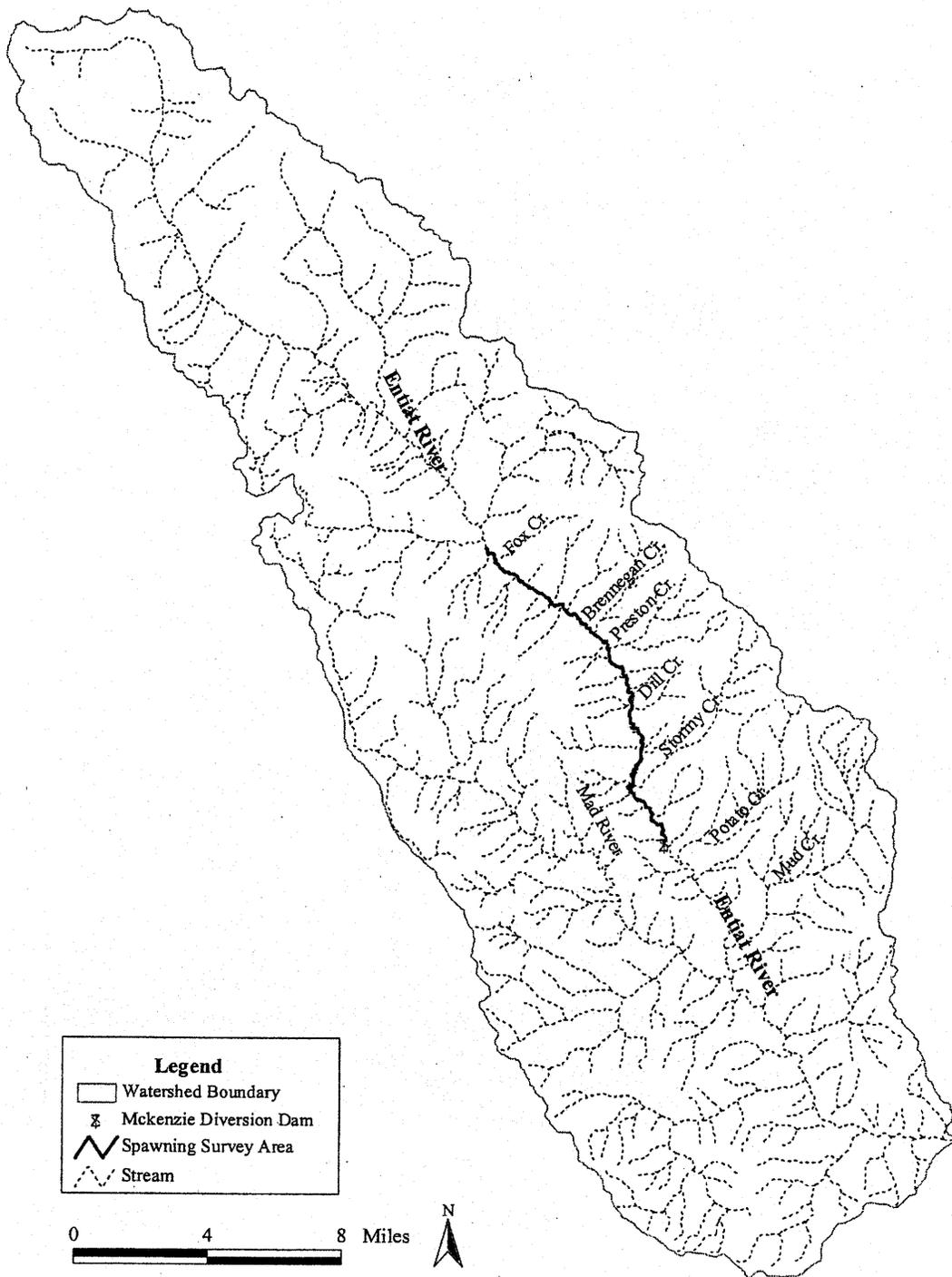


Figure 1. Overview of the Entiat River basin depicting the spawning survey area and landmark tributaries.

CHINOOK AND SOCKEYE SALMON POPULATIONS

The Entiat River historically supported excellent salmon runs that consisted of chinook (probably spring chinook) and coho salmon (Craig and Suomela 1941). Construction of dams around the turn of the century near the mouth of the Entiat River blocked salmon from their spawning grounds, and salmon runs were essentially nonexistent by 1939 when Grand Coulee Dam was built (Craig and Suomela 1941). As part of the Grand Coulee Fish Maintenance Project mitigation effort, all ascending adult salmon from upriver stocks were trapped at Rock Island Dam from 1939 to 1943 and were relocated to upstream tributary streams below Grand Coulee Dam, including the Entiat River (mainly summer and fall chinook), and to hatcheries, including Leavenworth, Entiat, and Winthrop National Fish Hatcheries (NFH) (Fish and Hanavan 1948). The goal of these efforts was to rebuild salmon runs in the tributary streams and mitigate for lost production above Grand Coulee Dam.

Spring Chinook Salmon

In the initial years after Grand Coulee Dam was built, little effort was made to re-establish wild spring chinook salmon runs in the Entiat River. Entiat NFH released approximately one million sub-yearling and less than 50,000 yearling spring chinook salmon from 1942 to 1944 that were offspring of the upriver stocks collected at Rock Island Dam (Mullan 1987). No spring chinook salmon were released from Entiat NFH from 1945 to 1975. A wild spring chinook salmon run was observed as early as 1956 and 1957 spawning in the area above Stormy Creek (RM 18.4) (French and Wahle 1960). Since 1962, spring chinook salmon redds have been counted in an index section between RM 28 and 21 where an established spring chinook salmon run has been documented (Figure 2 and Table 1). Entiat NFH resumed spring chinook salmon production in 1974. Egg sources have included Cowlitz River (1974), Carson NFH (1975 to 1982), Little White Salmon NFH (1976, 1978, 1979, 1981), Leavenworth NFH (1979-1981, 1994), and Winthrop NFH (1988). Returning adults that voluntarily entered the hatchery were the primary broodstock in 1980 and from 1983 to 2000.

Summer Chinook Salmon

Although summer chinook salmon are not believed to be endemic to the Entiat River (Craig and Suomela 1941), several efforts were made to establish summer chinook salmon in the Entiat River following completion of Grand Coulee Dam. In 1939 and 1940, a total of 3,015 adult summer chinook salmon, collected at Rock Island Dam from the commingled upriver stocks, were placed in upper Entiat River spawning areas. Only an estimated 1,308 of these survived to spawn (Fish and Hanavan 1948). Entiat NFH reared and released juvenile summer chinook salmon into the Entiat River from 1941-1964 and in 1976 (Mullan 1987). Egg sources included the commingled upriver stocks intercepted at Rock Island Dam (1939-1943), Methow River (1944), Carson NFH (1944), Entiat River (1946-1964), Spring Creek NFH (1964), and Wells Dam (1974). Summer chinook salmon spawning was monitored by aerial surveys in the lower 10.4 RM's from 1957 to 1991. Positive redd identification from the air is difficult at best, therefore aerial surveys likely underestimate actual redd numbers. Spawning numbers were never high, with a maximum of 55 redds in 1967. For years 1972-1991 aerial redd counts averaged just under five per year.

Table 1. Spring chinook salmon redd counts from annual surveys in the *index area*, Fox Creek Campground to Dill Creek (RM 28 to 21), Entiat River, 1964-1994 (WDFW) and 1995-2000 (USFWS) (see Figure 2).

YEAR	# OF REDDS	YEAR	# OF REDDS	YEAR	# OF REDDS
1962	115	1975	156	1988	67
1963	145	1976	47	1989	37
1964	384	1977	171	1990	83
1965	104	1978	326	1991	32
1966	307	1979	N/A	1992	42
1967	252	1980	107	1993	100
1968	252	1981	95	1994	24
1969	83	1982	107	1995	1
1970	70	1983	107	1996	8
1971	136	1984	84	1997	20
1972	61	1985	115	1998	15
1973	229	1986	105	1999	6
1974	88	1987	64	2000	28

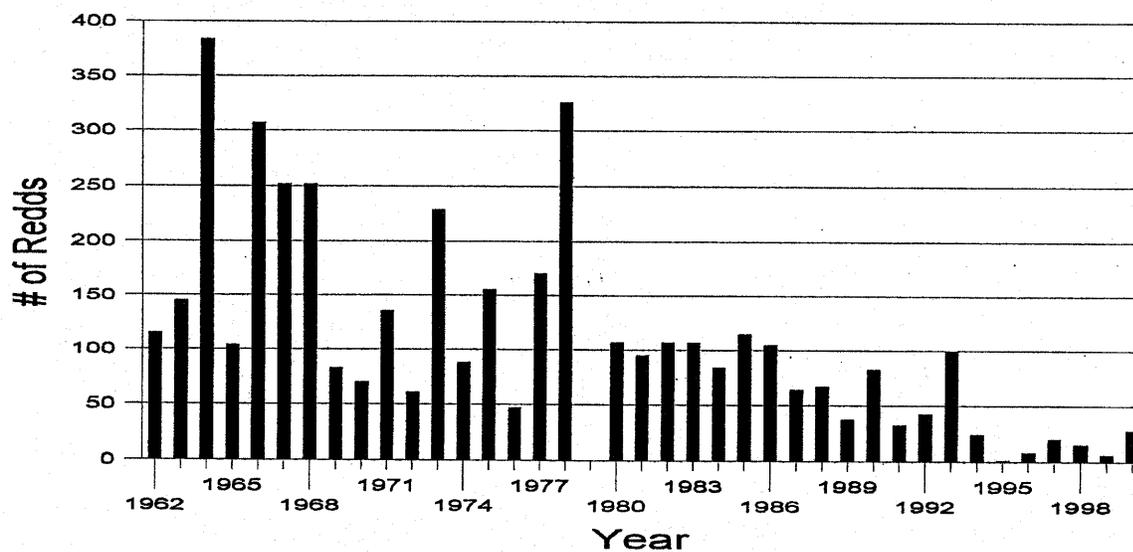


Figure 2. Spring chinook salmon redd counts from annual surveys in the *index area*, Fox Creek Campground to Dill Creek (RM 28 to 21), Entiat River, 1962-2000.

Sockeye Salmon

Sockeye salmon are not indigenous to the Entiat River (Craig and Suomela 1941) and have only been stocked on two occasions, in 1943 and 1944, from Lake Quinault and Lake Whatcom stocks (Mullan 1986). A small run of sockeye salmon became established in the Entiat River and Entiat NFH collected sockeye salmon from 1944 to 1963 for planting elsewhere (Mullan 1986).

Sockeye salmon were observed spawning in the Entiat River from 1945 to 1955, and 75-150 were counted in incidental counts between 1969 and 1981 (Mullan 1986).

METHODS

Spring Chinook Salmon

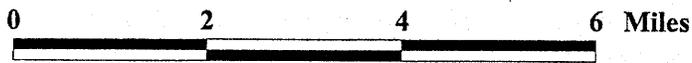
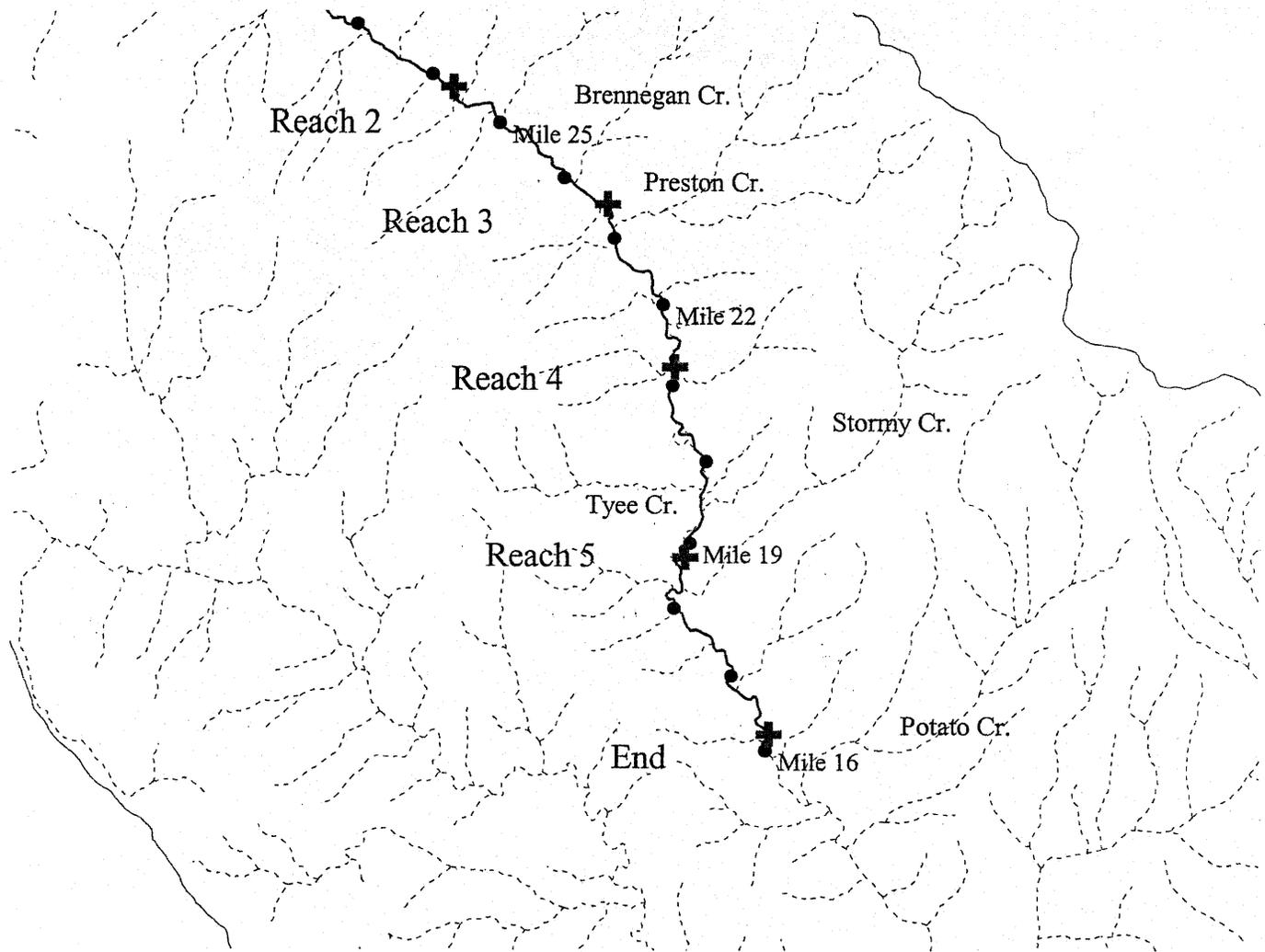
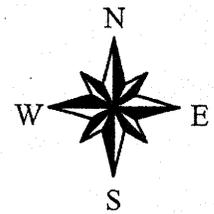
Methods for surveying spring chinook salmon consist of dividing the survey area into several reaches and single surveys of each reach were conducted after peak spawning, one in early September and the second mid-September. Each reach was surveyed walking down stream, enumerating and marking only well established redds, recording numbers of live fish and sampling any recovered carcasses. Carcasses were measured to the nearest centimeter (fork length), gender identified, females were dissected to visually determine spawning success, and scale samples taken when possible. Scales were viewed using a microfiche reader and age and origin (wild or hatchery) determined. Snouts were removed from marked hatchery fish for later retrieval and de-coding of coded-wire tags (CWT). All redd locations were marked with biodegradable flagging on nearby vegetation to distinguish them from summer chinook redds in subsequent surveys and GPS points were recorded. Landowners were contacted by mail to notify them of the spring and summer chinook salmon spawning surveys and to seek permission to access their property as surveyors walked downstream.

MCRFRO staff conducted spring chinook salmon spawning ground surveys from just above Stormy Creek to McKenzie Diversion Dam (RM 19 to 16) on September 11, 2000. The area from Fox Creek Campground to just below Tyee Creek (RM 28 to 19) was surveyed on September 12, 2000. Surveys were conducted a second time from Fox Creek to McKenzie Diversion Dam (RM 28 to 16) on September 21, 2000. Mad River was surveyed on September 22, from Pine Flats Campground to just below Mad River road bridge (RM 3.5 to 1.5).

We estimated the number of spring chinook salmon spawning in the Entiat River by expanding redd counts using the estimator of 2.4 chinook salmon adults per redd. This estimator is widely used and generally accepted in the mid-Columbia basin and under the assumption that all redds were counted.

Summer Chinook Salmon

Methods were the same as for spring chinook salmon surveys with a few differences in area surveyed, and timing. The area from Fox Creek campground to McKenzie Diversion Dam (RM 28 to 16) was divided into several reaches and each was surveyed two times. Also, the lower river from Keystone Bridge to the Columbia River influence (RM 1.5 to 0.3) was surveyed two times in November. Redd locations were marked with biodegradable flagging on nearby vegetation and carcass tails were cut off to prevent recounting. The number of summer chinook salmon that spawned was estimated by expanding redd counts using the estimator of 2.4 chinook salmon per redd. No summer chinook surveys were conducted in the Mad River.



- Watershed Boundary
- Reach Break
- River Mile
- Stream
- Survey Area

Figure 3: Survey area overview depicting reach breaks, USGS river miles, and landmark tributaries.

Sockeye Salmon and Bull Trout

Sockeye salmon and Bull Trout and/or redds were searched for on all surveys.

RESULTS

Spring Chinook Salmon

Twenty-eight spring chinook salmon redds were counted in the "index" area (RM 28 to 21). An additional 41 redds were found below the index area and four were found in Mad River (Table 1). The complete survey identified a total of 73 redds and 31 carcasses (Figure 4, Table 2 and Table 4). The index area count was 38% of the total count as compared to 22% in 99, 63% in 98, 54% in 97, and 40% in 96. The area from (RM 28 to 16) probably included all or most of the spring chinook salmon spawning in the Entiat River since spring chinook are not known to spawn in the lower river. However, some spawning gravel (very little) exists in those areas not surveyed (RM 0.3 to 16), and it is possible that some spawning occurred in that area. Assuming all redds were counted, the total redd count of 73 multiplied by 2.4 fish per redd gives an estimate of 175 adults escaping to spawn in the Entiat River. The peak of spawning appears to have occurred around the first week in September (Table 3). Eight marked and ten unmarked hatchery spring chinook were identified through scale analysis (Table 4).

Summer Chinook Salmon

Seventy-two summer chinook salmon redds were counted in the main survey section (RM 28 to 16), and these were all found below RM 23 (Table 2). Fourteen redds were located between RM 0.3 and 1.0. An additional thirteen redds were located between RM 1.0 and 2.0. There was a total of 99 redds and 54 carcasses found (Figure 4 and Table 5). The first summer chinook redd was discovered on the October 4th survey with the peak of spawning occurring the first week of October (Table 3). Multiplying the 99 redds by the estimator of 2.4 fish per redd yields an estimate of 238 summer chinook salmon adults escaping to spawn in Entiat River. This estimate should be considered a minimum since only a portion of the lower river was surveyed.

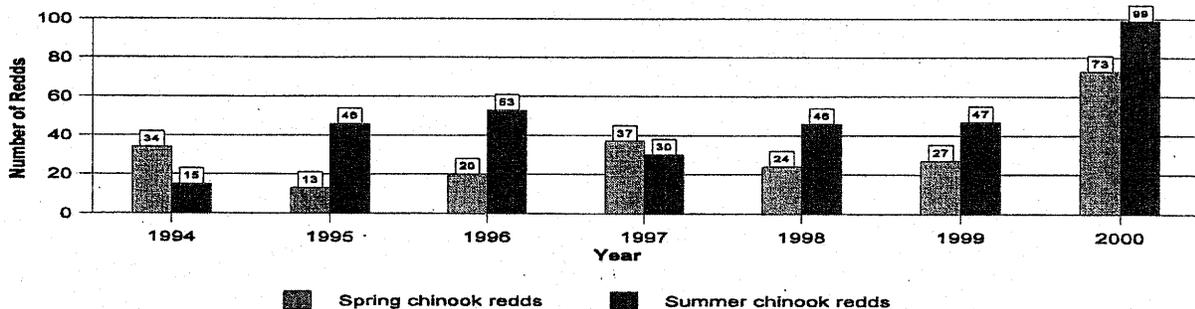


Figure 4. Total SCS and SUS redds - Entiat River, 1994 to 2000.

Sockeye Salmon and Bull Trout

Two sockeye salmon redds and two adults were observed in reach 5 on September 21, 2000. No Bull Trout redds or adults were observed during the surveys.

Table 2. Number of redds and their locations on Entiat River, 2000.

RIVER MILE	# OF SPRING CHINOOK REDDS	# OF SUMMER CHINOOK REDDS
27 - 28	5	0
26 - 27	0	0
25 - 26	4	0
24 - 25	1	0
23 - 24	4	0
22 - 23	1	1
21 - 22	13	5
20 - 21	8	1
19 - 20	3	3
18 - 19	6	13
17 - 18	10	24
16 - 17	14	25
6 - 7	0	0
1 - 2	0	13
0 - 1	0	14
Mad River	4	0
TOTAL	73	99

Table 3. Survey dates and number of new redds found, 2000

SURVEY DATES	SPRING CHINOOK REDDS	SUMMER CHINOOK REDDS
September 11,12	58	-
September 21,22	15	-
October 4	-	49
October 18	-	23
November 1, 14	-	27
TOTAL	73	99

Table 4. Sex, fork length & age of spring chinook salmon carcasses sampled in the Entiat and Mad River, 2000.

Fish #	Sex	Length (cm)	Age	Hatchery / Wild	Hatchery origin	Spawned
1.	Male	84	4	Wild		
2.	Female	69	4	Hatchery		n/s
3.	Male	57	3	Hatchery	Chiwawa Rearing Ponds	
4.	Male	72	4	Wild		
5.	Male	63	4	Hatchery	Ad clipped / no tag	
6.	Male	81	4	Hatchery	Ad clipped / no tag	
7.	Female	93	unk	unk		n/s
8.	Male	57	3	Hatchery		
9.	Female	78	4	Hatchery		n/s
10.	Male	69	4	Hatchery		
11.	Female	75	4	Hatchery	Winthrop NFH	n/s
12.	Female	75	4	Wild		n/s
13.	Female	69	unk	unk		n/s
14.	Female	72	4	Wild		n/s
15.	Female	75	4	Hatchery		n/s
16.	Female	66	4	Hatchery	Winthrop NFH	n/s
17.	Female	72	4	Hatchery		n/s
18.	Female	78	4	Hatchery		n/s
19.	Male	84	4	Hatchery	Entiat NFH	
20.	Female	78	4	Hatchery	Methow SFH	100%
21.	Male	60	3	Hatchery	Entiat NFH	
22.	Male	72	unk	unk		
23.	Female	75	unk	unk		100%
24.	Male	81	4	Wild		
25.	Female	72	4	Hatchery		100%
26.	Female	72	unk	unk		100%
27.	Female	72	4	Wild		100%
28.	Female ①	75	4	Wild		100%
29.	Male ①	90	5	Wild		
30.	Female	69	4	Hatchery		n/s
31.	Female	75	4	Hatchery		n/s

N/S = not sampled

①- Recovered in Mad River

Hatchery 18 58%
 Wild 8 26%
 unk 5 16%

Table 5. Sex, fork length & age of summer chinook salmon carcasses sampled in the Entiat River, 2000.

Fish #	Sex	Length (cm)	Age	Hatchery / Wild	Hatchery origin	Spawned
1.	Male	90	5	Wild		
2.	Male	96	5	Wild		
3.	Male	96	5	Wild		
4.	Female	90	5	Wild		n/s
5.	Male	93	5	Wild		
6.	Male	75	4	Wild		
7.	Male	105	5	Wild		
8.	Female	96	5	Wild		n/s
9.	Female	102	5	Wild		n/s
10.	Male	105	5	Wild		
11.	Female	90	5	Wild		n/s
12.	Female	-	unk	unk		n/s
13.	Female	93	5	Wild		n/s
14.	Male	81	4	Wild		
15.	Male	60	3	Wild		
16.	Male	93	5	Wild		
17.	Female	93	5	Wild		n/s
18.	Female	102	6	Wild		n/s
19.	Male	90	4	Hatchery	Turtle Rock SFH	
20.	Male	90	5	Hatchery	Turtle Rock SFH	
21.	Male	93	5	Wild		
22.	Female	90	5	Hatchery	Turtle Rock SFH	0%
23.	Female	81	4	Wild		0%
24.	Female	81	4	Hatchery	Wells Dam SFH	0%
25.	Female	93	5	Hatchery	Ad clipped / no tag	0%
26.	Male	96	5	Wild		
27.	Female	93	5	Wild		100%
28.	Male	87	4	Wild		
29.	Female	90	5	Hatchery	Wells Dam SFH	100%
30.	Female	93	5	Hatchery	Similkameen SFH	90%
31.	Female	93	5	Wild		n/s

Table 5. Continued

Fish #	Sex	Length (cm)	Age	Hatchery / Wild	Hatchery origin	Spawned
32.	Female	90	5	Hatchery	Dryden Pond	100%
33.	Female	87	4	Hatchery	Turtle Rock SFH	50%
34.	Male	81	unk	unk		
35.	Male	78	4	Hatchery	unk	
36.	Female	102	5	Wild		90%
37.	Female	93	5	Wild		10%
38.	Female	87	5	Hatchery	Similkameen SFH	95%
39.	Female	96	5	Wild		5%
40.	Female	87	5	Hatchery	Dryden Pond	100%
41.	Female	87	5	Hatchery	Turtle Rock SFH	50%
42.	Male	87	unk	unk		
43.	Female	90	5	Wild		100%
44.	Female	93	5	Wild		100%
45.	Female	87	5	Hatchery	Dryden Pond	100%
46.	Female	93	5	Wild		100%
47.	Female	90	5	Wild		n/s
48.	Male	75	4	Wild		
49.	Male	96	5	Wild		
50.	Male	75	4	Wild		
51.	Male	93	5	Wild		
52.	Male	93	5	Hatchery	Turtle Rock SFH	
53.	Female	90	unk	unk		100%
54.	Male	90	5	Wild		

N/S = not sampled

DISCUSSION

Wild spring chinook salmon adult returns to Entiat River were up in 2000. The index count of 28 redds is the seventh lowest on record and 25 percent of the 1962 to 1999 average of 112 (Table 1). Since 1987, redd counts have been depressed. Index counts have averaged only 38 redds for years 1987 to 2000, and only 15 per year since 1994. Spring chinook salmon counts at Rocky Reach and Wells dams were up in 2000 (Table 6 and Table 7). Counts at Rocky Reach Dam were up 252 percent over the previous 16 year (1984 to 1999) average of 2,844, the third highest since 1962 and up 151 percent of the same 16 year average at Wells Dam of 1,720 spring chinook salmon. Potential adult spring chinook salmon escapement (after deducting hatchery returns) between the two dams is estimated at 2,320 (Table 6) compared to the number generated by redd expansions of 175. Both methods of estimating the size of the wild salmon spawning

population have inherent assumptions that influence their results. Dam counts suffer from possible multiple counts due to fall back and failure to account for pre-spawning mortality. The date for separating the chinook run into spring and summer components is founded on historical dam counts. It does not allow for overlap of run timing between stocks nor annual variability in run timing for each stock. On the other hand, the accuracy of redd counts can be influenced by salmon spawning outside of the survey area, observer error, and/or the use of an incorrect expansion factor to estimate the number of spawners from redd counts. Given the inherent problems with each estimation method, we believe that the expanded redd counts provide a better monitoring tool, compared to dam counts, for determining trends in the Entiat River. We do not believe that the actual number of spring chinook spawning in the Entiat River differs significantly from our estimate of 175 fish.

In 1994, USFWS conducted the first summer chinook redd survey in the Entiat River when eleven redds were found. In 1995 surveyors located 40 summer chinook redds in the same area (RM 28 to 16), 45 in 1996, 30 in 1997, 46 in 1998 and 41 in 1999. Counts at Rocky Reach Dam of 19,825 summer chinook greatly exceeded the 16 year average (1984 to 1999) of 5,885 (Table 6). The difference in counts (after subtracting hatchery brood takes, spawners, and sport catch) between Rocky Reach and Wells dams was 7,646 fish (Table 6), which greatly exceeds the estimate from the Entiat River redd expansion of 238 summer chinook. During the 11/01 survey (RM 0.3 to 1.5) we located 25 SUS redds. On that same day, WDFW did an aerial survey from Ardenvoir to the mouth looking for SUS redds. While water clarity and visibility was good, they only observed six redds in the same area we walked. This re-enforces our theory that aerial counts most always underestimate actual numbers, and data obtained from these should be used with caution. Some additional redds may have been found between (RM 10-16), although suitable spawning gravel is lacking in these areas. Again, inherent problems with dam counts cause us to prefer using redd counts to better quantify the number of summer chinook actually spawning in the Entiat River.

Table 6. Estimated escapement in 2000 of wild spring and summer chinook between Rocky Reach and Wells dams using the difference between historical dam counts reduced by the number of salmon taken at state and federal fish hatcheries (includes jacks).

Count	Spring chinook	Summer chinook	
Rocky Reach Dam	7,177 ^①	19,825 ^①	
Wells Dam	2,600 ^②	10,156 ^②	
Difference	4,577	9,669	
Entiat NFH-# Fish Taken	1,919	0	
Methow SFH # Fish Transferred	338 ^③	0	
Wells SFH-# Fish Taken	0	1,263 ^④	984 / 274
Chelan River Spawners	0	470 ^④	86 / 274
Columbia River Spawners	0	200 ^④	274
Columbia River Sport Harvest Estimate	0	90 ^⑤	
Potential Entiat R. natural spawners	2,320	7,646	

① Mosey and Murphy, 2000

② Rick Klinge, pers comm. 2001.

③ Charlie Snow, pers comm. 2000

④ Andrew Murdoch, pers comm. 2000 (One hundred ninety-six redds observed multiplied by 2.4 fish/redd = 470 estimated Chelan River spawners) and (ninety-one redds multiplied by 2.2 fish/redd = 200 estimated Columbia River spawners below Wells Dam). This estimate is believed to be two or three times lower than actual numbers.

⑤ Heather Bartlett, pers comm. 2000 (estimated 90 fish caught through creel surveys)

Table 7. Historical fish counts of spring and summer chinook and sockeye salmon at Rocky Reach Dam, 1962-2000, and Wells Dam, 1967-2000.

Year	<u>Spring Chinook</u>		<u>Summer Chinook</u>		<u>Sockeye Salmon</u>	
	Rocky Reach	Wells	Rocky Reach	Wells	Rocky Reach	Wells
1962	3,697		9,295		9,870	
1963	4,644		5,776		37,046	
1964	6,536		10,752		32,159	
1965	2,755		15,975		31,735	
1966	6,962		19,445		129,557	
1967	5,560	1,157	15,558	12,504	109,434	113,232
1968	6,422	4,931	14,721	8,922	91,376	81,530
1969	4,400	3,599	12,996	6,846	20,374	17,352
1970	4,375	2,670	11,822	8,003	57,251	50,677
1971	4,132	3,168	10,031	5,988	49,838	48,172
1972	3,894	3,616	5,577	4,141	26,978	33,398
1973	4,344	2,937	9,683	5,052	48,856	37,178
1974	4,263	3,420	8,274	4,567	20,976	16,716
1975	3,353	2,225	15,367	8,522	26,925	22,286
1976	1,892	2,759	7,771	7,901	27,205	27,619
1977	5,948	4,211	10,593	7,527	25,648	21,973
1978	7,396	3,625	8,095	6,419	8,157	7,458
1979	2,203	1,103	8,577	10,080	28,747	22,655
1980	1,866	1,182	5,367	4,892	29,906	26,573
1981	3,529	1,935	4,668	4,276	30,649	28,234
1982	2,815	2,401	2,705	3,349	17,379	19,005
1983	3,406	2,869	2,777	2,821	26,069	27,925
1984	4,171	3,280	5,875	5,941	73,290	81,054
1985	8,910	5,257	5,937	4,456	54,077	53,170
1986	4,300	3,150	5,554	4,178	32,912	34,876
1987	3,586	2,344	4,078	3,142	41,115	39,948
1988	4,959	3,036	3,683	2,775	34,090	33,980
1989	3,316	1,740	5,654	3,333	16,176	15,895
1990	1,951	981	4,297	3,354	9,296	7,597
1991	1,401	779	3,158	2,028	27,439	27,492
1992	2,774	1,623	2,257	1,967	41,804	41,844
1993	4,256	2,444	4,980	3,603	28,318	23,038
1994	388	257	7,293	4,891	1,680	1,662
1995	290	103	5,638	5,043	4,985	4,892
1996	628	387	5,737	4,479	21,741	17,701
1997	2,014	971	6,750	3,902	30,485	25,304
1998	867	531	8,524	4,108	5,653	4,669
1999	1,688	649	14,752	9,033	14,118	12,388
2000	7,177	2,600	19,825	10,156	57,428	59,944

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APPENDIX

Appendix A. River mile index of the Entiat River from the mouth to Box Canyon.

River-mile	Description
0.0	Mouth of <u>Entiat River</u> at river-mile 483.7 on Columbia River
0.3	Head of Pool from Rocky Reach Dam
1.5	Keystone Bridge
3.1	Entiat River Road Bridge
4.5	Entiat River Road Bridge
6.8	Entiat National Fish Hatchery
10.5	Mad River
15.2	Potato Creek
16.0	McKenzie Ditch and Diversion Dam
18.4	Stormy Creek
21.2	Dill Creek
23.1	Preston Creek
23.4	Brief Bridge
23.9	Brennegan Creek
25.0	McCrea Creek
25.5	Burns Creek
27.7	Fox Creek
28.0	Fox Creek Campground
28.6	Tommy Creek
28.9	Lake Creek Campground
29.2	Entiat Falls

mileage may not be exact