

U.S. Fish & Wildlife Service
**SPRING AND SUMMER CHINOOK
SALMON SPAWNING GROUND
SURVEYS ON THE ENTIAT RIVER, 2004**



U. S. Fish and Wildlife Service
Mid-Columbia River Fishery Resource Office
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SPRING AND SUMMER CHINOOK SALMON SPAWNING
GROUND SURVEYS ON THE ENTIAT RIVER, 2004.

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INTRODUCTION

From 1962 to 1994, spring Chinook salmon, *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 28.9 to 21.3). From 1957 to 1991, Chelan County Public Utility District monitored summer Chinook salmon spawning in the lower ten miles (river mile 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 United States Fish and Wildlife Service (USFWS), Mid-Columbia River Fishery Resource Office (MCRFRO), began a program of monitoring spring and summer Chinook salmon spawning more intensely on the Entiat River. Efforts in 2004 mark the eleventh year that MCRFRO has conducted the expanded spawning surveys.

The objectives of the spawning surveys are to:

1. Continue to assess the distribution of spring and summer Chinook salmon spawning throughout the index and expanded areas of the Entiat & Mad rivers and provide estimates of the respective spawning populations.
2. Analyze population trend 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 and note presence and/or redds of other salmonid species, which may include sockeye salmon, *O. nerka*, coho salmon, *O. kisutch*, Pacific lamprey, *Entosphenus tridentatus* and bull trout, *Salvelinus confluentus* and identify their spawning distribution in the survey sections.

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 per second (Mullan et al. 1992) and major tributaries are the North Fork (river mile 34) and Mad River (river mile 10.5). The upstream limit of anadromy is Entiat Falls (river mile 33.8).

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 at approximately river mile 484 and eight mainstem hydroelectric dams above the Pacific Ocean.

Spring Chinook salmon spawning ground surveys were conducted between Fox Creek Campground (C.G.) and McKenzie Diversion Dam (river mile 28.1 to 16.2), and Mad River (river mile 5.2 to 1.5) (Figure 1). Summer Chinook salmon surveys focused on Reaches 1 through 5 (river mile 28.1 to 16.2) and between Dinkleman Canyon Road to the Columbia River influence (river mile 4.1 to 0.3) (Figure 1).

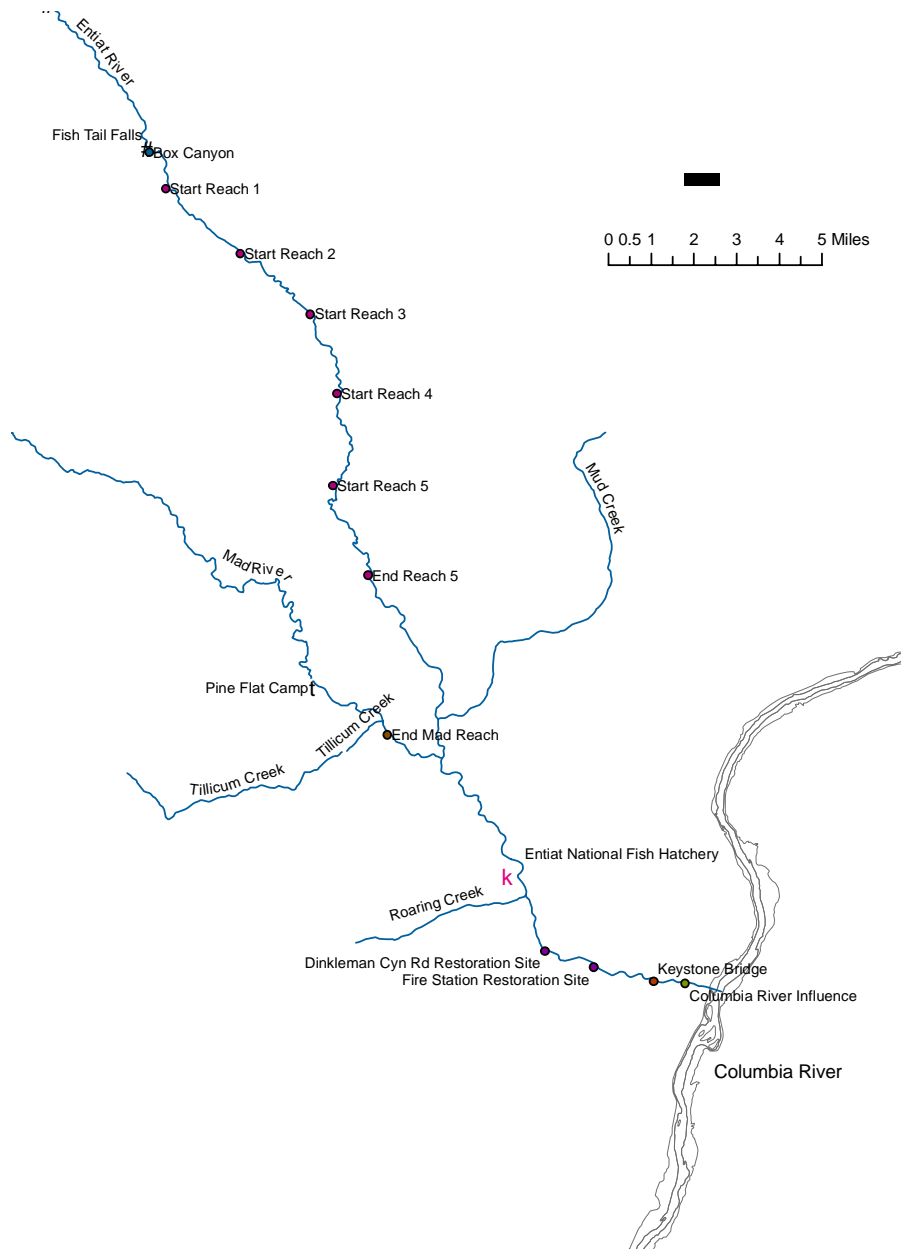


Figure 1. Overview of the Entiat River spawning ground survey areas.

SALMON AND BULL TROUT POPULATIONS

The Entiat River has historically supported excellent salmon runs consisting of Chinook (probably spring Chinook salmon) 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). From 1939 to 1943, as part of the Grand Coulee Fish Maintenance Project mitigation effort, all ascending adult salmon, mainly summer and fall Chinook salmon, were trapped at Rock Island Dam and relocated to upstream tributary streams below Grand Coulee Dam, including the Entiat River, 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. From 1942 to 1944, Entiat NFH released a total of 1.3 million sub-yearling and fewer than 50,000 yearling spring Chinook salmon 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. As early as 1956 and 1957, a wild spring Chinook salmon run was observed 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* area between river mile 28 and 21 where an established spring Chinook salmon run has been documented. 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). Adults that voluntarily returned to the hatchery were the primary brood stock in 1980 and from 1983 to 2004.

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 river miles 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 about five per year.

Bull Trout, Sockeye Salmon and Coho Salmon

Bull trout presence/absence surveys were conducted in 1984 and 1987, with limited data obtained (WDFW 1997). In 1989, Okanogan-Wenatchee National Forest contracted with

WDFW to determine bull trout distribution and abundance within the Wenatchee National Forest, including the Entiat River mainstem and Mad River (Brown 1992). In 2004, United States Forest Service (USFS) personnel counted 37 bull trout redds in the Mad River index reach, Young Creek to Jimmy Creek (Archibald 2004). Incidental sightings of bull trout (1993 to 2004) have also been recorded by USFS personnel from Entiat Falls to the gauging station pool (river mile 33.8 to 33.5). In 2004, six bull trout redds were recorded. Since 1994, MCRFRO searched for bull trout and/or redds during the spring and summer Chinook salmon spawning ground surveys. In 2004, one bull trout redd was identified. Beginning in 2004, MCRFRO initiated bull trout redd surveys from the gauging station pool (just below Entiat Falls) to Fox Creek Camp Ground (river mile 33.5 to 28.0), where a total of 40 redds were counted.

Sockeye salmon are not indigenous to the Entiat River (Craig and Suomela 1941), and have only been stocked on two occasions (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, and their progeny were planted elsewhere (Mullan 1986). In 2004, 39 sockeye salmon redds and 76 live adults were counted.

In an effort to re-introduce coho salmon to upper Columbia tributaries, the Yakama Nation has initiated a juvenile release program in the Wenatchee and Methow River basins. During the 2004 spawning ground surveys, five coho redds and seven live adults were observed.

METHODS

Spring Chinook Salmon

Methods for surveying spring Chinook salmon consisted of dividing the survey area into several reaches. Single surveys of each reach were conducted twice, one in early September and again the third week of September. Each reach was surveyed walking downstream, 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), tails were removed to prevent recounting, gender was identified, females were dissected to visually determine spawning success, and scale samples were taken when possible. Scales were pressed onto acetate plastic and viewed using a microfiche reader to determine age and origin (wild or hatchery). Snouts were removed from carcasses with missing adipose fins for later retrieval and de-coding of coded-wire tags. All redd locations were marked with colored survey 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.

Spring Chinook salmon spawning ground surveys were conducted from Fox Creek C.G. to McKenzie Diversion Dam (river mile 28.1 to 16.2) from September 7-10, and September 21-27, 2004. Mad River was surveyed on September 7 and then again on the 27th, from Pine Flats C.G. to half mile below Tillicum Creek (river mile 3.5 to 1.5). In 2004, the number of spring Chinook salmon spawning in the Entiat River was estimated by expanding redd counts using the estimator of 2.4 spring Chinook salmon adults per redd.

Summer Chinook Salmon

Methods were the same as for spring Chinook salmon surveys with a few differences in area surveyed, and timing. Surveys were conducted in Reach 1 through Reach 5 (river mile 28.1 to 16.2) from October 8-13 and October 22-27, 2004. Lower river surveys were conducted from Dinkleman Canyon Road to the Columbia River influence (river mile 4.1 to 0.3) on October 21 and a second time November 10, 2004. On October 22, 2004, a redd survey was conducted on the Mad River from the Old Mill Bridge to the mouth (0.2 to 0.0). The number of summer Chinook salmon that spawned was estimated by expanding redd counts using the estimator of 2.4 fish per redd.

Bull Trout, Sockeye and Coho Salmon

Bull trout and/or redds were searched for during spring and summer Chinook salmon spawning ground surveys. Bull trout redds are generally smaller in size and utilize smaller substrate than spring and summer Chinook salmon. Sockeye and coho salmon redds were identified during the spawning ground surveys through observation of fish on occupied redds.

Age Designation

Age designation in this report follows the Gilbert-Rich (1927) system, where total age is referenced by the first digit and age at the time of migration from freshwater is indicated by the subscript.

Estimating Coded Wire Tag expansions for Spring and Summer Chinook

Using the estimated number of spawning spring Chinook salmon (302), divided by the number of examined recovered carcasses (43) gives an expansion number of 7.0. To expand the number of coded-wire tags for each tag code recovered, you would multiply the expansion number (7.0) to the number of coded-wire tags recovered in each coded-wire tag group (100% marked).

The estimated number of spawning summer Chinook salmon (403), divided by the number of recovered carcasses (105) gives an expansion number of 3.8. To estimate the number of coded-wire tags for each tag code recovered, you would multiply the expansion number (3.8) to the number of coded-wire tags recovered in each coded-wire tag group (100% marked).

RESULTS

Spring Chinook Salmon

Sixty-five spring Chinook salmon redds were counted in the old *index* area (river mile 28.1 to 21.3). An additional 61 redds were found in the expanded survey area (river mile 29.2 to 28.1 and 21.3 to 16.2) including six redd found in the Mad River (river mile 3.5 to 1.5). A total of **126** redds were identified during surveys conducted in 2004 (Table 1). Annual redd counts from the old *index* area surveys are found in Table 2. The peak spawning occurred around the first week in September.

The total redd count of 126 included all or most of the spring Chinook salmon spawning in the Entiat River since spring Chinook salmon are not known to spawn in the lower river. Assuming all redds were counted, the total redd account of 126 multiplied by 2.4 fish per redd gives an estimate of **302** adults escaping to spawn in the Entiat River. This estimate does not account for any pre-spawn mortality or poaching that may have occurred in the Entiat River.

Table 1. Spring Chinook salmon spawning ground surveys on the Entiat and Mad Rivers, 2004.

Section	River Mile	Date	Redds	Live Fish	Carcasses
Reach 1	28.1-25.8	09/10/04	17	7	0
Old <i>Index</i> Area		09/24/04	<u>2</u>	<u>1</u>	<u>0</u>
	Cumulative Total Count		19	8	0
Reach 2	25.8-23.4	09/08/04	21	20	5
Old <i>Index</i> Area		09/22/04	5	0	3
		¹ 10/08/04	<u>NA</u>	<u>NA</u>	<u>1</u>
	Cumulative Total Count		26	20	9
Reach 3	23.4-21.3	09/07/04	15	13	3
Old <i>Index</i> Area		09/22/04	<u>5</u>	<u>4</u>	<u>6</u>
	Cumulative Total Count		20	17	9
Index Total			65	45	18

Reach 4	21.3-18.7	09/07/04	18	13	3
<i>Expanded</i> Area		09/21/04	4	0	2
		² 10/12/04	<u>NA</u>	<u>NA</u>	<u>1</u>
	Cumulative Total Count		22	13	6
Reach 5	18.7-16.2	³ 07/22/04	0	0	1
<i>Expanded</i> Area		09/07/04	24	31	6
		09/20/04	<u>7</u>	<u>2</u>	<u>12</u>
	Cumulative Total Count		31	33	19
Box Cyn. to Fox Creek C.G.		⁴ 09/30/04	2	0	0
<i>Expanded</i> Area	29.2-28.1				
Mad River	3.5-1.5	09/07/04	6	0	0
<i>Expanded</i> Area	3.5-1.5	09/27/04	<u>0</u>	<u>0</u>	<u>0</u>
	Cumulative Total Count		6	0	0
Expanded & Mad River Total			61	46	25
TOTAL			126	91	43

¹ One spring Chinook carcass recovered during 10/8 summer Chinook spawning ground survey. ² One spring Chinook carcass recovered during 10/12 summer Chinook spawning ground survey. ³ One spring Chinook carcass recovered during 7/22 snorkel survey. ⁴ Two spring Chinook redds were counted during 9/30 bull trout spawning ground survey.

Spring Chinook Redd Counts

Reach 1 RM 28.1 to 25.8 (Old *Index* Area)

Nineteen redds were counted in Reach 1. Surveys were conducted on September 10 and 24, 2004, (Table 1). Reach 1 accounted for 29% of the *index* area count and 15% of the total redds found in the Entiat River.

Reach 2 RM 25.8 to 23.4 (Old *Index* Area)

Twenty-six redds were counted in Reach 2. Surveys were conducted on September 8 and 22, 2004, (Table 1). Reach 2 accounted for 40.0% of the *index* area count and 21% of the total redds found in the Entiat River.

Reach 3 RM 23.4 to 21.3 (Old *Index* Area)

Twenty redds were counted in Reach 3. Surveys were conducted on September 7 and 22, 2004, (Table 1). Reach 3 accounted for 31% of the *index* area count and 16% of the total redds found in the Entiat River.

Reach 4 RM 21.3 to 18.7 (*Expanded* Area)

Twenty-two redds were counted in Reach 4. Surveys were conducted on September 7 and 21, 2004, (Table 1). Reach 4 accounted for 17% of the total redds found in the Entiat River.

Reach 5 RM 18.7 to 16.2 (*Expanded* Area)

Thirty-one redds were counted in Reach 5. Surveys were conducted on September 7 and 20, 2004, (Table 1). Reach 5 accounted for 25% of the total redds found in the Entiat River.

Box Canyon to Fox Creek Campground RM 29.2 to 28.1 (*Expanded* Area)

Two redds were counted between Box Canyon and Fox Creek Campground. This redds were observed on September 30, 2004 (Table 1). Box Canyon to Fox Creek Campground accounted for less than 1.0% of the total redds found in the Entiat River.

Mad River (*Expanded* Area) RM 5.2-1.5

Six redds was counted in the Mad River surveys conducted on September 7 and 27, 2004, (Table 1). Mad River accounted for 5.0% of the total redds counted in the Entiat River.

Table 2. Entiat River spring Chinook salmon redd counts from annual surveys in old *index* area, Fox Creek Campground to Dill Creek (RM 28 to 21), 1962-1993 (WDFW) and 1994-2004 (USFWS).

YEAR	#of REDDS	YEAR	#of REDDS	YEAR	#of REDDS
1962	115	1977	171	1992	42
1963	145	1978	326	1993	100
1964	384	1979	N/A	1994	24
1965	104	1980	107	1995	1
1966	307	1981	95	1996	8
1967	252	1982	107	1997	20
1968	252	1983	107	1998	15
1969	83	1984	84	1999	6
1970	70	1985	115	2000	28
1971	136	1986	105	2001	144
1972	61	1987	64	2002	72
1973	229	1988	67	2003	70
1974	88	1989	37	2004	65
1975	156	1990	83		
1976	47	1991	32		

N/A= not available

Spring Chinook Carcass Recoveries

A total of 43 spring Chinook salmon carcasses were recovered in 2004. Sex ratios of the 43 sampled carcasses were 24 (56%) females and 18 (44%) were males. All female carcasses were examined for spawning success, 21 (88%) were completely spent and 3 (12%) did not spawn.

No difference in spawning success between hatchery and wild females was detected. Thirty-two DNA samples were also collected from the 43 recovered carcasses.

Spring Chinook Age Composition

Through scale analysis it was determined that 15 (35%) of the 43 sampled carcasses were wild, 17 (39%) were of hatchery origin, and 11 (26%) were unidentifiable (Table 3).

Table 3. Spring Chinook salmon age composition from Entiat River carcass recoveries, 2004.

Origin	Age	Male	(N)	%	Female	(N)	%	Total	%
Hatchery	2/2		1	6	0	0		1	6
	3/2		2	12	0	0		2	12
	4/2		5	29	8	47		13	76
	5/2		<u>1</u>	<u>6</u>	<u>0</u>	<u>0</u>		<u>1</u>	<u>6</u>
			9	53	8	47		17	100

Wild	3/2		0	0	0	0		0	0
	4/1		1	7	0	0		1	7
	4/2		2	13	11	73		13	86
	5/2		<u>0</u>	<u>0</u>	<u>1</u>	<u>7</u>		<u>1</u>	<u>7</u>
			3	20	12	80		15	100

Unknown			7		4			11	
Total			19		24			43	

Spring Chinook Coded-Wire Tag Recoveries

All 43 recovered carcasses from the Entiat River were checked for missing adipose fins, 12 (28%) were identified as missing (Table 4).

Table 4. Coded-wire tag recoveries from spring Chinook salmon carcasses, recovered in the Entiat River, 2004.

Tag code	Brood Yr.	Release Agency	Hatchery	CWT Release %	Recovered	CWT Estimated Return
054528	99	USFWS	Entiat NFH	100	1	7
054434	00	USFWS	Entiat NFH	67	2	21
054913	00	USFWS	Entiat NFH	26	1	27
050490	01	USFWS	Entiat NFH	50	2	28
090119	00	ODFW	Willamette SFH	100	1	7
Ad clip/ no tag					5	0
TOTAL					12	90

Summer Chinook Salmon

A total of **168** redds were counted in reaches 1-5 (river mile 28.1 to 16.2), Cooper's store (10.1 to 10.0), Dinkleman Canyon Road Bridge to Columbia River influence (4.1 to 0.3), and Mad River (0.2 to 0.0) in 2004 (Table 5). The total redd count of 168 should be considered a minimum since not all portions of the Mad and lower Entiat River were surveyed, and this number doesn't account for any pre-spawn or poaching mortality. Assuming most redds were counted, the total redd number of 168 multiplied by 2.4 fish per redd yields an estimate of **403** summer Chinook salmon adults spawning in the Entiat River.

Table 5. Summer Chinook spawning ground surveys on the Entiat River, 2004.

Section	River Mile	Date	Redds	Live Fish	Carcasses
Reach 1	28.1-25.8	09/10/04	0	0	1
		10/22/04	<u>0</u>	<u>0</u>	<u>0</u>
		Cumulative Total Count	0	0	1
Reach 2	25.8-23.4	10/08/04	15	9	2
		10/26/04	<u>4</u>	<u>0</u>	<u>2</u>
		Cumulative Total Count	19	9	4
Reach 3	23.4-21.3	10/13/04	22	14	0
		10/26/04	<u>1</u>	<u>0</u>	<u>7</u>
		Cumulative Total Count	23	14	7
Reach 4	21.3-18.7	10/12/04	11	10	5
		10/27/04	<u>3</u>	<u>5</u>	<u>2</u>
		Cumulative Total Count	14	15	7
Reach 5	18.7-16.2	10/12/04	55	79	13
		10/27/04	<u>10</u>	<u>16</u>	<u>18</u>
		Cumulative Total Count	65	95	31
Mad River Mouth	0.2-0.0	10/22/04	5	14	0
Cooper's Store	10.1-10.0	10/22/04	1	3	0
Dinkleman Cyn. Rd. Br. To Fire Station	4.1-3.1	10/21/04	3	5	13
		11/10/04	<u>1</u>	<u>0</u>	<u>7</u>
		Cumulative Total Count	4	5	20
Fire Station to Keystone Br. G.S.	3.1-1.5	10/21/04	5	10	9
		11/10/04	<u>0</u>	<u>0</u>	<u>2</u>
		Cumulative Total Count	5	10	11
Keystone Br. G.S. to Columbia R. Influence	1.5-0.3	10/21/04	19	20	15
		11/10/04	<u>8</u>	<u>17</u>	<u>9</u>
		Cumulative Total Count	27	37	24
River Mile 5.2		10/19/04	1	4	0
River Mile 8.0		10/19/04	1	10	0
Road Mile Marker 13		10/26/04	1	2	0
Road Mile Marker 15		10/26/04	<u>2</u>	<u>0</u>	<u>0</u>
		Cumulative Total Count	5	16	0
TOTAL			168	218	105

† One summer Chinook carcass recovered during 9/10 spring Chinook spawning ground survey.

Summer Chinook Redd Counts

Reach 1 RM 28.1 to 25.8

No redds were counted in Reach 1. Survey was conducted on October 22, 2004 (Table 5). Reach 1 accounted for 0.0% of the total redds found in the Entiat River.

Reach 2 RM 25.8 to 23.4

Nineteen redds were identified in 2004. Surveys were conducted on October 8 and 26, 2004 (Table 5). Reach 2 accounted for 11% of the total redds found in the Entiat River.

Reach 3 RM 23.4 to 21.3

Twenty-three redds were identified in 2004. Surveys were conducted on October 13 and 26, 2004 (Table 5). Reach 3 accounted for 14% of the total redds found in the Entiat River.

Reach 4 RM 21.3 to 18.7

Fourteen redds were counted in Reach 4. Surveys were conducted on October 12 and 27, 2004 (Table 5). Reach 4 accounted for 8% of the total redds found in the Entiat River

Reach 5 RM 18.7 to 16.2

Sixty-five redds were counted in Reach 5. Surveys were conducted on October 12 and 27, 2004 (Table 5). Reach 5 accounted for 39% of the total redds found in the Entiat River.

Road Mile Markers 13 and 15

Three redds were counted, one at mile marker 13 and two at marker 15. Redds were counted on 10/26/2004. This section accounted for 1.5% of the total redds counted in the Entiat River.

Mad River RM 0.2 to 0.0

Five redds were counted between old mill site bridge to the mouth. Survey was conducted on October 22, 2004 (Table 5). Mad River accounted for 3.0% of the total redds found in the Entiat River.

Mad River Confluence to Cooper's Store RM 10.1 to 10.0

One redd was counted between Mad River's mouth to Cooper's Store. Survey was conducted on October 22, 2004 (Table 5). Mad River Mouth to Cooper's Store accounted for 1% of the total redds found in the Entiat River.

River Mile 5.2 and 8.0

Two redds were counted, one at each site. Redds were counted on 10/19/2004. This section accounted for 1.5% of the total redds counted in the Entiat River.

Dinkleman Canyon Road Bridge to Fire Station RM 4.1 to 3.1

Four redds were counted from Dinkleman Canyon Road Bridge to Fire Station. Surveys were conducted on October 21 and November 10, 2004 (Table 5). This section accounted for 2% of the total redds found in the Entiat River.

Fire Station to Keystone Bridge Gauging Station RM 3.1 to 1.5

Five redds were counted from Fire Station to Keystone Bridge Gauging Station. Surveys were conducted on October 21 and November 10, 2004 (Table 5). This site accounted for 3% of the total redds found in the Entiat River.

Keystone Bridge Gauging Station to Columbia River Influence RM 1.5 to 0.3

Twenty-seven redds were counted from Keystone Bridge Gauging Station to Columbia River Confluence. Surveys were conducted on October 21 and November 10, 2004 (Table 5). This section accounted for 16% of the total redds counted in the Entiat River.

Summer Chinook Carcass Recoveries

A total of 105 summer Chinook salmon carcasses were recovered from the Entiat River. Sex ratio of the 105 carcasses was 53 (50%) females and 52 (50%) males. All 53 female carcasses

were examined for spawning success, 37 (70%) were completely spent, 13 (25%) did not spawn, and 3 (5%) were not sampled due to carcass decomposition. There was a notable difference in spawning success between hatchery and wild females. Only 38% of the hatchery females spawned successfully compared to 89% of the wild females.

Summer Chinook Age Composition

Through scale analysis it was determined that 67 (64%) of the 105 sampled carcasses were wild, 25 (24%) were hatchery and 13(12%) were not identifiable (Table 6).

Table 6. Summer Chinook age composition from Entiat River carcass recoveries, 2004.

Origin	Male	Age (N)	%	Reservoir Reared	Female (N)	%	Reservoir Reared	Total (N)	%
Hatchery		3/2	2	8		0	0	2	8
		4/2	12	48		1	4	13	52
		5/2	0	0		3	12	3	12
		6/2	<u>2</u>	<u>8</u>		<u>5</u>	<u>20</u>	<u>7</u>	<u>28</u>
			16	64		9	36	25	100
Wild		2/1	1	1.5		0	0	1	1.5
		3/1	2	3.0		0	0	2	3.0
		3/2	1	1.5	1	0	0	1	1.5
		4/1	2	3.0		3	4.0	5	7.0
		4/2	4	6.0	4	1	1.5	5	7.5
		5/1	12	18.0		20	30.0	32	48.0
		5/2	8	12.0	8	11	16.5	19	28.5
		6/1	<u>1</u>	<u>1.5</u>		<u>1</u>	<u>1.5</u>	<u>2</u>	<u>3.0</u>
		31	46.5		36	53.5	67	100	
Unknown		5			8		13		
Grand Total		52			53		105		

Summer Chinook Coded-Wire Tag Recoveries

All 105 recovered carcasses from the Entiat River were checked for missing adipose fins, 23 (22%) were identified as missing (Table 7).

Table 7. Coded-wire tag recoveries from summer Chinook salmon carcasses, recovered in the Entiat River, 2004.

Tag code	Brood Yr.	Release Agency	Hatchery	Recovered	Estimated
630470	99	WDFW	Turtle Rock SFH	1	3.8
630475	99	WDFW	Dryden Pond	1	3.8
630781	00	WDFW	Turtle Rock SFH	2	7.6
630893	01	WDFW	Turtle Rock SFH	1	3.8
630995	00	WDFW	Wells SFH	3	11.4
631006	99	WDFW	Turtle Rock SFH	1	3.8
631032	98	WDFW	Turtle Rock SFH	1	3.8
631151	98	WDFW	Dryden Pond	5	19.0
631271	00	WDFW	Dryden Pond	3	11.4
631272	00	WDFW	Dryden Pond	2	7.6
631587	01	WDFW	Dryden Pond	1	3.8
No tags				2	0.0
TOTAL				23	79.8

Bull Trout, Sockeye and Coho Salmon

Surveyors counted one bull trout redd, 39 sockeye salmon redds, 76 live and 3 carcasses, 5 coho salmon redds, 7 live and 2 carcasses.

Sockeye and Coho Coded-Wire Tag Recoveries

All sockeye and coho carcasses were sampled for coded-wire tags. Two adipose clipped sockeye were identified, only one had a coded-wire tag (Table 8). Both coho carcasses were adipose present, one had a coded-wire tag (Table 8).

Table 8. Coded-wire tag recoveries from sockeye and coho salmon carcasses, recovered in the Entiat River, 2004.

Species	Tag code	Brood Yr.	Release Agency	Hatchery	Recovered
Sockeye	630192	99	WDFW	Lk. Wenatchee Net Pens	1
Coho	054330	01	USFWS	Winthrop NFH	1

SUMMARY

The number of redds counted during the spring Chinook spawning ground surveys was 65 in the old index area, with an additional 61 redds found in the expanded area, for a total count of 126 redds. The index count of 65 redds is the fourth largest since 1994, with a high of 144 redds in 2001 and a low of one in 1995. The total redd count of 126 is the second highest since 1994, with a high of 202 redds in 2001 and a low of 13 in 1995 (Figure 2). The 43 recovered carcasses had a sex ratio of 56% female and 44% male and scale analysis determined that 35% were wild, 39% were hatchery and 26% were unidentifiable. Twelve (28%) of the 43 recovered carcasses had an adipose missing fin. Six recoveries were from Entiat NFH, one from Willamette SFH (ODFW), and 5 had no tags. The number of carcasses with an adipose clip and no coded-wire tag (5) correlates with Entiat NFH releasing spring Chinook smolts, starting in 2002, with 100% adipose fin clipped and 50% coded-wire tagged.

The number of redds counted during the summer Chinook spawning ground surveys was 168. The total redd count of 168 is the third highest since 1994, with a high of 309 redds in 2003 and a low of 15 in 1994 (Figure 2). Summer Chinook surveys have expanded over the years which could account for more redds being counted since 1994. The 105 recovered carcasses had a sex ratio of 50% female and 50% male and scale analysis determined that 64% were wild, 24% were hatchery and 12% were unidentifiable. Twenty-three (22%) of the 105 recovered carcasses had an adipose fin missing. Six recoveries were released from Turtle Rock SFH, twelve from Dryden Pond, three from Wells SFH, and two had no tags.

During the spring and summer Chinook spawning ground surveys one bull trout redd, 39 sockeye redds, and 5 coho redds were counted.

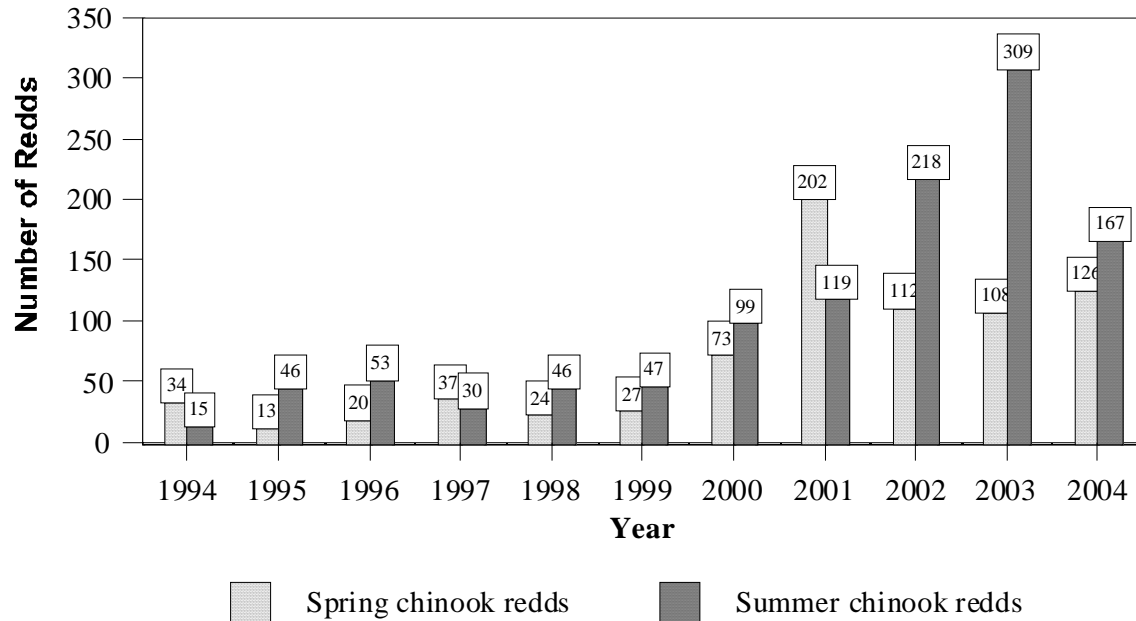


Figure 2. Total spring chinook and summer chinook salmon redds - Entiat River, 1994 to 2004.

DISSCUSSION

Mid-Columbia River Fishery Resource Office developed a plan, utilizing snorkeling, to examine if spring Chinook pre-spawn mortality was occurring at a high incidence in the Entiat River. Based on spring Chinook passage at Rocky Reach and Wells Dam, the date adults entered Entiat NFH, and Entiat River temperature and flow conditions, July 22, was selected. Personnel from Mid-Columbia River Fishery Resource Office, Wenatchee USFS and Wenatchee Ecological Services, snorkeled reaches 1-5 (river mile 28.1 through 16.2), using two snorkelers and one recorder in each reach. A total of 92 spring Chinook (86 adult and 6 jacks) were counted, including, one pre-spawned female mortality. Snorkeling continued on July 23 and 24, from Box Canyon to Fox Creek Camp Ground (river mile 29.2 to 28.1) counting an additional six adults and one jack. The snorkel surveyors counted a total of **99** spring Chinook (92 adults, including one mortality, and 7 jacks). The ninety-nine spring Chinook observed snorkeling accounted for only 34% of the estimate 302 spring Chinook that escaped to spawn in the Entiat River in 2004. With fewer fish observed than the total redd count, we were unsuccessful in determining any pre-spawn mortality. Our observations indicate that snorkel surveys started before most spring Chinook entered survey areas, suggesting several surveys throughout the summer are needed to quantify results. Also, depth, water clarity, debris jams, snorkeling down stream and stream width could have limited the snorkelers ability to accurately count spring Chinook adults.

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PERSONAL COMMUNICATIONS

- J. Sneva, 2004. Washington Department of Fish & Wildlife.
- P. Archibald, 2004. U.S. Forest Service.

APPENDIX

River mile index of the Entiat River from the mouth to Entiat Falls.

River Mile	Description
0.0	Mouth of <u>Entiat River</u> at river-mile 483.7 on Columbia River
0.3	Columbia River influence
1.5	Keystone Bridge
3.1	Entiat River Road Bridge (Fire Station Restoration Site)
4.1	Dinkleman Canyon Road Bridge (Dinkleman Canyon Road Restoration Site)
6.8	Entiat National Fish Hatchery
10.1	Mad River
15.2	Potato Creek
16.2	McKenzie Ditch and Diversion Dam (end of Reach 5)
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 (start of Reach 1)
28.6	Tommy Creek
28.9	Lake Creek Campground
33.8	Entiat Falls

mileage may not be exact

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