

# Tanana River Fall Season Digital Video Test Fish Wheel Index

## R&M# 09-08

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### 1. Introduction:

#### *Objectives:*

Use digital video technology at the Nenana test fish wheel site on the mainstem Tanana River to provide species composition, relative abundance based on catch rates, and run timing information primarily for inseason fisheries management of fall chum (*Onchorhynchus keta*) and coho salmon (*O. kisutch*).

### 2. Methods:

The test fish project at Nenana is the longest operating index fish wheel project in the Yukon River drainage. Data from the Nenana test wheel has been used since 1988 for estimating run strength and timing of Chinook, chum and coho salmon for use in fisheries management. Local fishermen from the community of Nenana have been hired annually to operate and maintain the fish wheel. In 2003, the fish wheel was converted to video monitoring which replaced the need to hold fish in live boxes. The project is operated 18 miles below the community of Nenana for purposes of being below the majority of the fishermen and the commercial outlets. The Nenana test fish wheel operated 24 hours a day except when maintenance and repairs were required. Summer season was funded using another source and operated from June 29 to July 29, then there is a break between fall season operations which operated from August 16 to September 27, 2008. Counts were based on an approximate schedule of midnight to midnight when video files were used because they break the day into four files and ends at midnight. When operating the fish wheel without the video typically for harvest purposes counts were calculated based on the time of the morning check each day and sometimes a combination of video and harvest but always estimated for 24 hours. Once the fish was scooped from the water and slid down the basket chute it was directed into the video monitoring box (video chute) by a large flap of rubber covering the axle. The fish entered the video chute, consisting of an enclosed space with a white plastic background which is aligned in view of a surveillance camera (12-volt). The fish exit the video chute through a swinging door and were deposited into the live box which has an escape hatch which is left open during times when fish are not being harvested. A magnetic switch triggered each time the chute door was opened. The trigger sent a signal to a 12-volt laptop computer (Panasonic Toughbook) and the software program Salmonsoft FishTick FishCap (version 1.4) and captured a preset number of frames from the video camera and stored them on the computer's hard drive. The digital video files (avi format) were then transferred from the computer to a removable IBM micro-drive for transportation and uploading to a desktop computer and each video frame was examined.

During the file review process the Salmonsoft FishTick FishRev software (version 1.3.5) allowed for enumeration by species and gender with an electronic tally. Determination of species and gender were based on visual estimation by the contractor. Aside from fish harvested for subsistence, the majority of the fish were released alive. A radio telemetry project for fall chum salmon marked 413 fish over the course of the run which had the opportunity to be intercepted by this fish wheel. The contractor reported presence or absence of tags. During harvesting periods the contractor provided the individual tag numbers and recovered the radio tag and these identifiers were used to determine migration rates of tagged fish or loss of radio tags from the pool that were potentially available for redeployment.

The electronic video counts were recorded in a log book as well as entered into a MS Excel file that calculates daily CPUE for each species (number of fish/24-hours). A MS Excel file was emailed to the Fairbanks ADF&G office each day containing the data used to chart relative abundance based on daily and cumulative CPUE counts by species. ADF&G compares the CPUE within season as well as to historical project performance to provide for inseason run assessment of salmon.

Mean proportions are calculated using fish per hour for each counting day:

$$n_{ij} = \sum_i n_j \quad (1)$$

where:  $n$  = the number of fish caught,  
 $i$  = the number of hours per day,  
 $j$  = the number of days sampled.

### 3. Results:

The 2008 summer season project operated for a total of 31 days from June 29 to July 29 counting primarily Chinook and summer chum salmon. Summer season operations were shortened slightly due to the forecast and arrival of flood waters. Fall season operated for a total of 40 days beginning August 16 and ending September 27 and counted primarily fall chum and coho salmon. The following results are based on the inseason report and are to be considered preliminary information until the data is double checked. The cumulative catch per unit effort (CPUE) was 1,410 Chinook, 2,135 summer chum, 8,056 fall chum and 9,022 coho salmon respectively (Tables 1 and 2). All cumulative CPUEs in 2008, except summer chum salmon, were above the 1988 to 2007 averages of 865 Chinook, 3,004 summer chum, 6,449 fall chum and 6,695 coho salmon (Tables 3 and 4). However based on the average CPUEs in Figures 1-4 all species were above average as selective data was used in the chart averages for summer season.

Run timing for Chinook salmon was three days earlier than average based on the mid-point occurring on July 9 and the summer chum salmon passage was near average with the mid-point occurring on July 24 (Table 3). Peak daily passage of Chinook salmon occurred on July 6 and for summer chum salmon occurred on July 24. Although the project was terminated three days prior to the end of September the fall chum salmon run timing was eight days later than average and the coho salmon was two days later than the long term averages from 1988 to 2007 (Table 4).

Peak daily passage of fall chum salmon occurred on September 27 and for coho salmon occurred on September 22 based on CPUE. As of September 13 the catch of coho salmon exceeded 50% of the catch through the end of operations and peaked at 70% on September 19 (Table 2 and Figure 5).

Non-salmon fish species captured throughout the operational period both summer and fall included a total of 218 whitefish (*Coregonus sp.*), 29 longnose suckers (*Catostomus catostomus*), five burbot (*Lota lota*) and three northern pike (*Esox lucius*) with 97% captured during the month of September. A total of 21 radio tagged fall chum salmon were observed going through the test fish wheel based on the presence of the external spaghetti tag on each fish. Total fall chum salmon examined for tags was 7,386. Release of tagged fish also began on August 16 on the Tanana River upstream of the confluence of the Kantishna River which is approximately three days travel time from the recovery site. The first tag captured downstream of Nenana by the test fish wheel was on August 24. Tag recovery was spread throughout the operational period with typically one tag recovered in a day, with three instances of two captures in one day, and one instance of three captured in one day. The radio telemetry project is funded by AYK-SSI.

Periodic updates were provided to individuals involved in and supporting this project, including USFWS who provided technical expertise on monitoring fish wheel catches using video techniques. Updates on the tagging project were provided during the Yukon River Drainage Fisheries Association teleconferences, via local radio announcement, email updates, and power point presentations.

- a. **Dates of Operation:** August 16 to September 27, 2008
- b. **Any Problems or Issues:** Funding was underestimated due to a combination of increased fuel prices, increased contract prices as well as indirect costs. In 2008, the project was terminated three days earlier than intended to remain within budget.
- c. **Attach any expected Report:** The following data was presented inseason to managers and will be incorporated into 2009's historical data notebooks. All of the historical data from the test fish wheel as well as the Tanana River commercial fisheries statistics was available to managers to make inseason comparisons to individual historical years.

Table 1. Historical Chinook and summer chum salmon daily and cumulative catch, test fish wheel project, located downstream from the community of Nenana, on the right (north) bank of the Tanana River, 1995-1999, 2001-2002, and 2004-2007 average, compared to 2008.

Chinook Salmon						Summer Chum Salmon					
95-99, 01-02, & 04-07 Average a			2008			95-99, 01-02, & 04-07 Average a			2008		
Date	Daily "Video" Expanded	Cumulative Count	Daily "Video" Expanded	Percent	Cumulative Count	Date	Daily "Video" Expanded	Cumulative Count	Daily "Video" Expanded	Percent	Cumulative Count
25-Jun	0	0				25-Jun					
26-Jun	0	0				26-Jun	0	0			
27-Jun	0	0				27-Jun	0	0			
28-Jun	0	1				28-Jun	0	0			
29-Jun	1	2	7	0.00	7	29-Jun	0	0	0	0.00	0
30-Jun	2	4	19	0.02	26	30-Jun	0	0	0	0.00	0
1-Jul	24	30	18	0.03	44	1-Jul	1	1	0	0.00	0
2-Jul	27	59	14	0.04	58	2-Jul	1	2	1	0.00	1
3-Jul	29	91	32	0.06	89	3-Jul	12	13	0	0.00	1
4-Jul	29	123	49	0.10	138	4-Jul	12	26	0	0.00	1
5-Jul	37	163	84	0.16	222	5-Jul	14	40	0	0.00	1
6-Jul	38	204	155	0.27	377	6-Jul	23	63	2	0.00	3
7-Jul	41	249	149	0.37	527	7-Jul	20	83	1	0.00	4
8-Jul	41	294	130	0.47	657	8-Jul	24	107	9	0.01	13
9-Jul	42	340	78	0.52	735	9-Jul	25	132	11	0.01	24
10-Jul	45	388	77	0.58	812	10-Jul	33	165	19	0.02	43
11-Jul	51	444	66	0.62	878	11-Jul	30	196	23	0.03	66
12-Jul	58	507	46	0.66	924	12-Jul	40	236	4	0.03	70
13-Jul	51	563	28	0.68	952	13-Jul	46	282	11	0.04	81
14-Jul	37	603	54	0.71	1,006	14-Jul	54	336	38	0.06	119
15-Jul	43	651	52	0.75	1,058	15-Jul	61	396	36	0.07	155
16-Jul	40	694	35	0.78	1,094	16-Jul	66	462	45	0.09	200
17-Jul	39	737	75	0.83	1,169	17-Jul	77	539	63	0.12	263
18-Jul	27	766	65	0.87	1,234	18-Jul	88	628	76	0.16	339
19-Jul	24	792	38	0.90	1,272	19-Jul	95	723	89	0.20	428
20-Jul	21	815	38	0.93	1,310	20-Jul	115	838	105	0.25	533
21-Jul	18	835	16	0.94	1,326	21-Jul	124	962	89	0.29	622
22-Jul	14	849	16	0.95	1,342	22-Jul	118	1,080	144	0.36	766
23-Jul	11	861	19	0.96	1,361	23-Jul	118	1,199	158	0.43	924
24-Jul	8	870	15	0.98	1,376	24-Jul	129	1,328	227	0.54	1,151
25-Jul	8	879	5	0.98	1,381	25-Jul	116	1,444	197	0.63	1,348
26-Jul	9	889	7	0.98	1,387	26-Jul	124	1,568	202	0.73	1,550
27-Jul	7	897	6	0.99	1,393	27-Jul	160	1,728	204	0.82	1,754
28-Jul	7	904	12	1.00	1,405	28-Jul	169	1,897	171	0.90	1,925
29-Jul	7	912	5 d	1.00	1,410	29-Jul	165	2,062	210 d	1.00	2,135
30-Jul	7	920				30-Jul	145	2,207			
31-Jul	5	926				31-Jul	137	2,331			
1-Aug	5	931				1-Aug	151	2,468			
2-Aug	3	934				2-Aug	114	2,572			
3-Aug	2	936				3-Aug	109	2,671			
4-Aug	1	938				4-Aug	104	2,765			
5-Aug	1	939				5-Aug	100	2,856			
6-Aug	1	753				6-Aug	141	4,031			
7-Aug	1	755				7-Aug	144	4,155			
8-Aug	1	724				8-Aug	157	4,551			
9-Aug	1	725				9-Aug	142	4,670			
10-Aug	1	727				10-Aug	58	3,567			
11-Aug	0	727				11-Aug	49	3,615			
12-Aug	1	728				12-Aug	47	3,662			
13-Aug	0	728				13-Aug	47	3,710			
14-Aug	1	729				14-Aug	67	3,777			
15-Aug	1	730				15-Aug	50	3,827			

a Differences in the termination dates of the project confounds computation of the historical daily cumulative percent and average. The historical daily cumulative percent and average were computed by assuming that 100 percent of the run was completed on the date of project termination.

b The box indicates the first to the third quartile of the cumulative catch. The median date of the cumulative catch is also highlighted.

c Last day of operation.

d Last day of operation. Wheel pulled due to extreme high water and large amounts of debris.

Table 2. Historical fall chum and coho salmon daily and cumulative catch and percent coho salmon, test fish wheel project, located downstream from the community of Nenana, on the right (north) bank of the Tanana River, 1988 to 2007 average, compared to 2008.

Fall Chum Salmon						Coho Salmon						Average	
Date	1988 to 2007 Average a			2008		Date	1988 to 2007 Average			2008		Percent Coho	Percent Coho
	Daily Catch	Percent	Cumulative Catch b	Daily Catch	Cumulative Catch		Daily Catch	Percent	Cumulative Catch b	Daily Catch	Cumulative Catch		
16-Aug	30	0.01	30			16-Aug	0	0.00	0			-	0%
17-Aug	50	0.02	79			17-Aug	0	0.00	0			-	0%
18-Aug	45	0.03	119			18-Aug	1	0.00	1			-	1%
19-Aug	34	0.03	154	23	23	19-Aug	1	0.00	1	0	0	0%	2%
20-Aug	39	0.04	193	18	41	20-Aug	1	0.00	2	0	0	0%	3%
21-Aug	36	0.05	209	11	52	21-Aug	1	0.00	3	1	1	8%	2%
22-Aug	40	0.06	249	29	81	22-Aug	2	0.00	5	0	1	0%	5%
23-Aug	39	0.06	276	59	140	23-Aug	2	0.00	6	1	2	2%	4%
24-Aug	42	0.07	318	83	223	24-Aug	2	0.00	8	2	4	2%	5%
25-Aug	50	0.09	368	60	283	25-Aug	3	0.00	11	0	4	0%	6%
26-Aug	62	0.10	429	83	366	26-Aug	5	0.00	16	2	6	2%	8%
27-Aug	64	0.12	493	86	452	27-Aug	7	0.01	22	2	8	2%	10%
28-Aug	75	0.13	568	89	541	28-Aug	8	0.01	30	5	13	5%	9%
29-Aug	93	0.15	661	55	596	29-Aug	12	0.01	42	3	16	5%	12%
30-Aug	108	0.17	769	63	659	30-Aug	18	0.01	60	6	22	9%	14%
31-Aug	134	0.19	903	55	714	31-Aug	26	0.02	86	12	34	18%	16%
1-Sep	142	0.21	1,045	63	777	1-Sep	43	0.02	129	15	49	19%	23%
2-Sep	159	0.24	1,204	72	849	2-Sep	49	0.03	178	20	69	22%	23%
3-Sep	149	0.26	1,352	100	949	3-Sep	60	0.04	238	18	87	15%	29%
4-Sep	150	0.29	1,503	61	1,010	4-Sep	59	0.05	297	47	134	44%	28%
5-Sep	153	0.31	1,656	106	1,116	5-Sep	67	0.05	349	57	191	35%	31%
6-Sep	146	0.33	1,802	141	1,257	6-Sep	95	0.07	444	112	303	44%	39%
7-Sep	161	0.36	1,956	181	1,438	7-Sep	123	0.08	567	118	421	39%	43%
8-Sep	197	0.39	2,153	195	1,633	8-Sep	134	0.10	701	114	535	37%	40%
9-Sep	221	0.42	2,375	191	1,824	9-Sep	154	0.12	855	112	647	37%	41%
10-Sep	226	0.46	2,601	182	2,006	10-Sep	158	0.14	1,013	116	763	39%	41%
11-Sep	235	0.49	2,835	182	2,188	11-Sep	166	0.17	1,179	143	906	44%	41%
12-Sep	223	0.52	3,058	186	2,374	12-Sep	178	0.20	1,357	153	1,059	45%	44%
13-Sep	218	0.56	3,276	171	2,545	13-Sep	240	0.24	1,598	175	1,234	51%	52%
14-Sep	225	0.59	3,500	161	2,706	14-Sep	280	0.28	1,878	207	1,441	56%	56%
15-Sep	198	0.62	3,698	206	2,912	15-Sep	265	0.32	2,143	255	1,696	55%	57%
16-Sep	195	0.65	3,893	153	3,065	16-Sep	293	0.37	2,436	297	1,993	66%	60%
17-Sep	192	0.68	4,085	186	3,251	17-Sep	294	0.41	2,730	322	2,315	63%	60%
18-Sep	198	0.71	4,274	182	3,433	18-Sep	314	0.45	3,028	361	2,676	66%	61%
19-Sep	186	0.73	4,451	261	3,694	19-Sep	323	0.50	3,355	616	3,292	70%	63%
20-Sep	204	0.76	4,645	325	4,019	20-Sep	326	0.55	3,644	617	3,909	65%	61%
21-Sep	196	0.79	4,840	463	4,482	21-Sep	350	0.61	3,995	784	4,693	63%	64%
22-Sep	217	0.82	5,047	582	5,064	22-Sep	345	0.67	4,322	914	5,607	61%	61%
23-Sep	203	0.85	5,229	562	5,626	23-Sep	354	0.71	4,641	634	6,241	53%	64%
24-Sep	206	0.87	5,415	662	6,288	24-Sep	364	0.76	4,968	806	7,047	55%	64%
25-Sep	188	0.89	5,584	670	6,958	25-Sep	336	0.80	5,271	890	7,937	57%	64%
26-Sep	182	0.91	5,739	632	7,590	26-Sep	300	0.84	5,526	615	8,552	49%	62%
27-Sep	171	0.93	5,884	459 e	8,049	27-Sep	310	0.87	5,790	470 e	9,022	51%	64%
28-Sep	207	0.95	6,060			28-Sep	287	0.90	6,034			-	58%
29-Sep	169	0.96	6,187			29-Sep	287	0.93	6,249			-	63%
30-Sep	119	0.97	6,276			30-Sep	206	0.95	6,404			-	63%
1-Oct	125	0.98	6,357			1-Oct	185	0.97	6,524			-	60%
2-Oct	87	0.99	6,405			2-Oct	155	0.98	6,602			-	64%
3-Oct	96	0.99	6,439			3-Oct	123	0.99	6,651			-	56%
4-Oct	26	1.00	6,446			4-Oct	47	0.99	6,665			-	64%
5-Oct	21	1.00	6,449			5-Oct	31	1.00	6,670			-	60%
6-Oct	60	1.00	6,452			6-Oct	26	1.00	6,671			-	30%
7-Oct						7-Oct						-	-
8-Oct						8-Oct						-	-

a Differences in the termination dates of the project confounds computation of the historical daily cumulative percent and average. The historical daily cumulative percent and average were computed by assuming that 100 percent of the run was completed on the date of project termination.

b The box indicates the first to the third quartile of the cumulative catch. The median date of the cumulative catch is also highlighted.

c Test fish catches from August 8 to 15 are from 1995 season only.

d Less than or greater than 24 hour count adjusted to 24-hour count.

e Last day of operation

Table 3. Chinook and summer chum salmon timing information from the Nenana test fish wheel, Tanana River, 1988-2008.

Year	Operation Period (days)	Chinook Salmon		Summer Chum Salmon		Percent Chinook Salmon
		Cumulative Catch	Midpoint	Cumulative Catch	Midpoint	
1988	41	245	13-Jul	1,146	20-Jul	18%
1989	45	235	15-Jul	3,575	28-Jul	6%
1990	52	603	12-Jul	4,046	23-Jul	13%
1991	32	475	17-Jul	5,383	29-Jul	8%
1992	31	549	17-Jul	699	25-Jul	44%
1993	a	-	-	-	-	-
1994	b	-	-	-	-	-
1995	42	683	12-Jul	7,000	29-Jul	9%
1996	44	428	11-Jul	7,464	20-Jul	5%
1997	36	2,143	10-Jul	1,748	20-Jul	55%
1998	46	1,151	14-Jul	1,619	29-Jul	42%
1999	32	661	16-Jul	775	27-Jul	46%
2000	33	184	11-Jul	446	30-Jul	29%
2001	44	904	17-Jul	71	21-Jul	93%
2002	36	1,601	12-Jul	1,074	18-Jul	60%
2003	32	2,828	4-Jul	388	23-Jul	88%
2004	36	944	12-Jul	2,558	28-Jul	27%
2005	28	464	13-Jul	4,366	1-Aug	10%
2006	38	761	12-Jul	10,472	29-Jul	7%
2007	44	711	8-Jul	1,245	26-Jul	36%
2008	31	1,410	9-Jul	2,135	24-Jul	40%
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1988-2007						
Median	37	672	12-Jul	1,684	26-Jul	28%
Average	38	865	12-Jul	3,004	25-Jul	33%

<sup>a</sup> Fish wheel began operations for fall season only on August 18.

<sup>b</sup> Fish wheel began operations August 1 and captured 890 chum salmon through August 15.

Table 4. Fall chum and coho salmon timing information from the Nenana test fish wheel, Tanana River, 1988-2008.

Year	Operation Period (days)	Fall Chum Salmon		Coho Salmon		Percent Coho Salmon
		Cumulative Catch	Midpoint	Cumulative Catch	Midpoint	
1988	39	5,114	10-Sep	6,403	16-Sep	56%
1989	44	9,228	12-Sep	4,606	19-Sep	33%
1990	44	4,625	21-Sep	1,347	24-Sep	23%
1991	41	6,082	15-Sep	3,396	17-Sep	36%
1992	32	4,161	10-Sep	4,014	16-Sep	49%
1993	46	4,228	14-Sep	2,553	22-Sep	38%
1994	38	3,831	1-Sep	1,272	14-Sep	25%
1995	47	7,556	12-Sep	2,051	24-Sep	21%
1996	48	3,613	4-Sep	1,628	18-Sep	31%
1997	50	1,619	8-Sep	1,401	18-Sep	46%
1998	52	1,326	13-Sep	980	21-Sep	42%
1999	51	1,269	8-Sep	838	20-Sep	40%
2000	48	1,200	8-Sep	1,735	22-Sep	59%
2001	50	1,853	6-Sep	4,950	14-Sep	73%
2002	52	4,063	14-Sep	7,776	18-Sep	66%
2003	48	14,265	11-Sep	28,324	18-Sep	67%
2004	46	5,025	18-Sep	19,259	23-Sep	79%
2005	49	18,096	14-Sep	12,605	20-Sep	41%
2006	49	14,192	17-Sep	20,505	23-Sep	59%
2007	47	17,627	20-Sep	8,253	13-Sep	32%
2008	40	8,056	20-Sep	9,022	22-Sep	53%
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1988-2007						
Median	48	4,427	12-Sep	3,705	18-Sep	42%
Average	46	6,449	11-Sep	6,695	19-Sep	46%

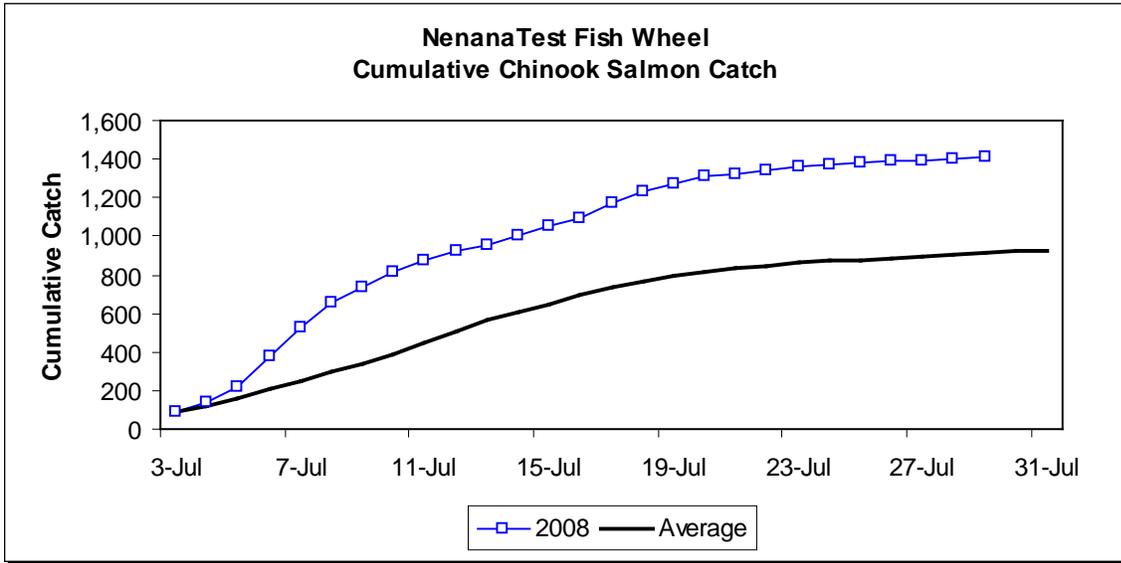
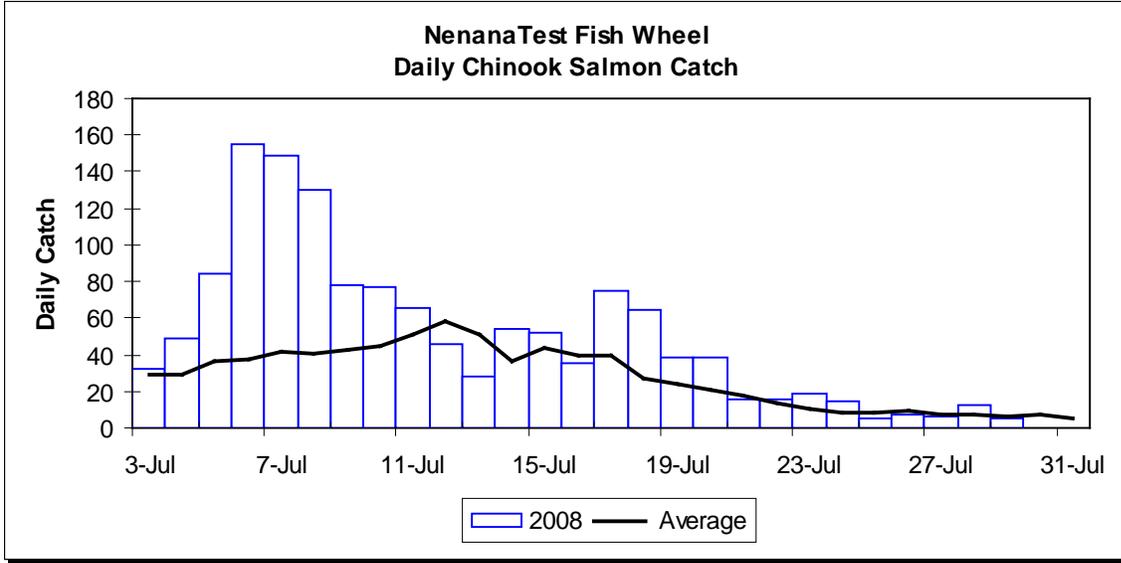


Figure 1. Chinook salmon daily and cumulative catch, test fish wheel project, located downstream from the community of Nenana, on the right (north) bank of the Tanana River, 1995-1999, 2001-2002, 2004 to 2007 average, compared to 2008.

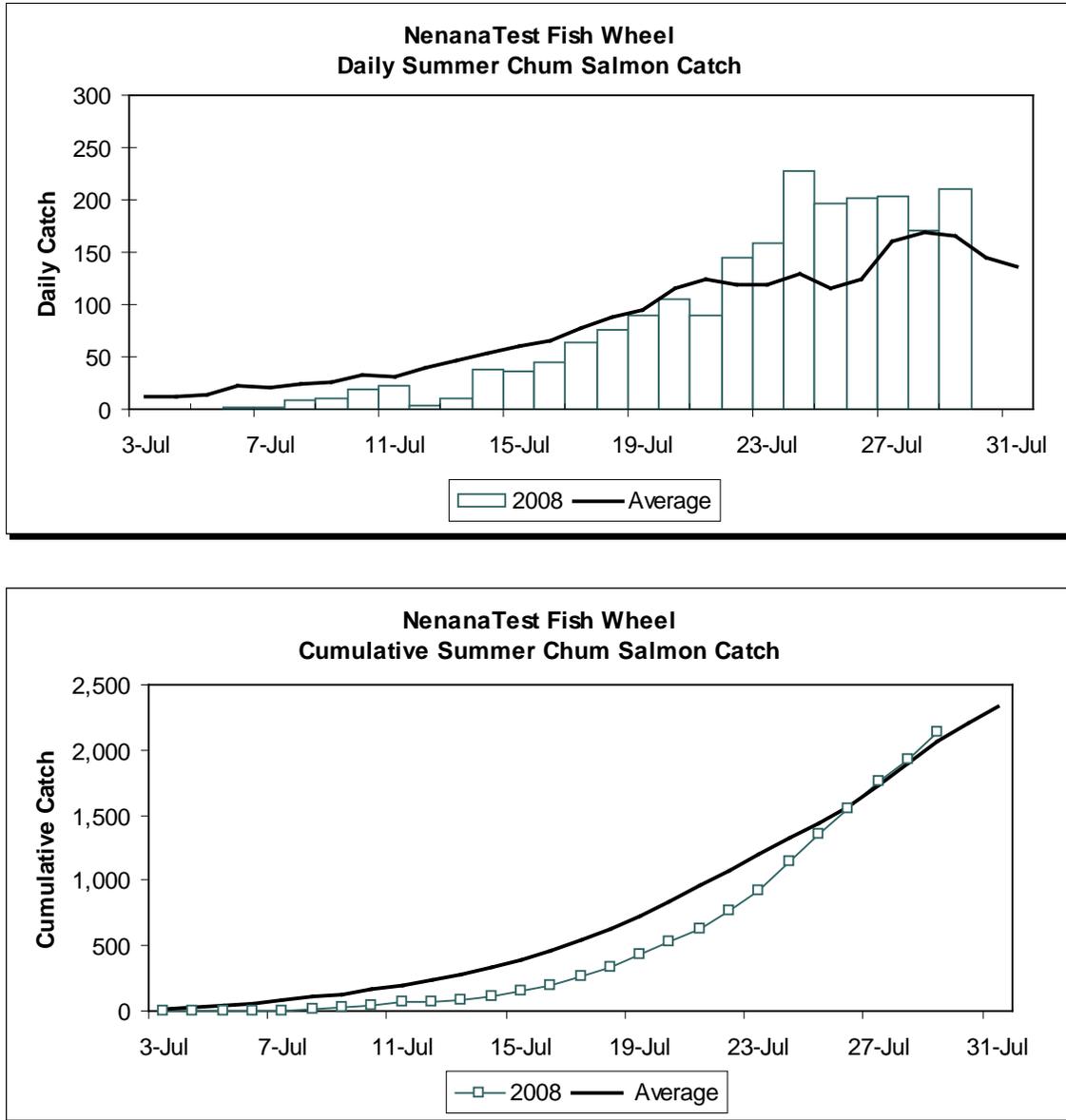


Figure 2. Summer chum salmon daily and cumulative catch, test fish wheel project, located downstream from the community of Nenana, on the right (north) bank of the Tanana River, 1995-1999, 2001-2002, 2004 to 2007 average, compared to 2008.

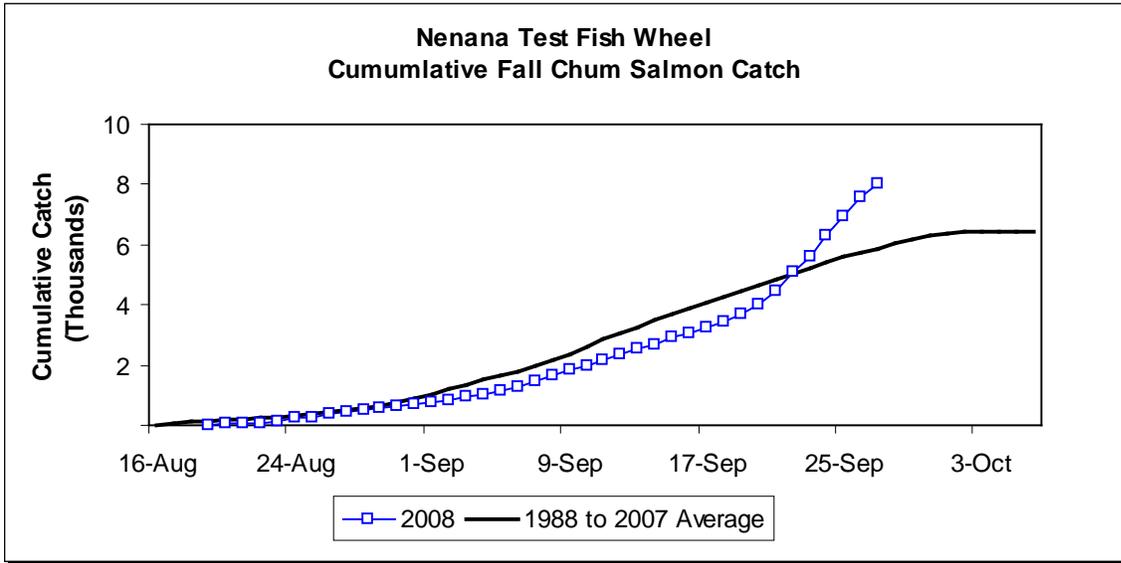
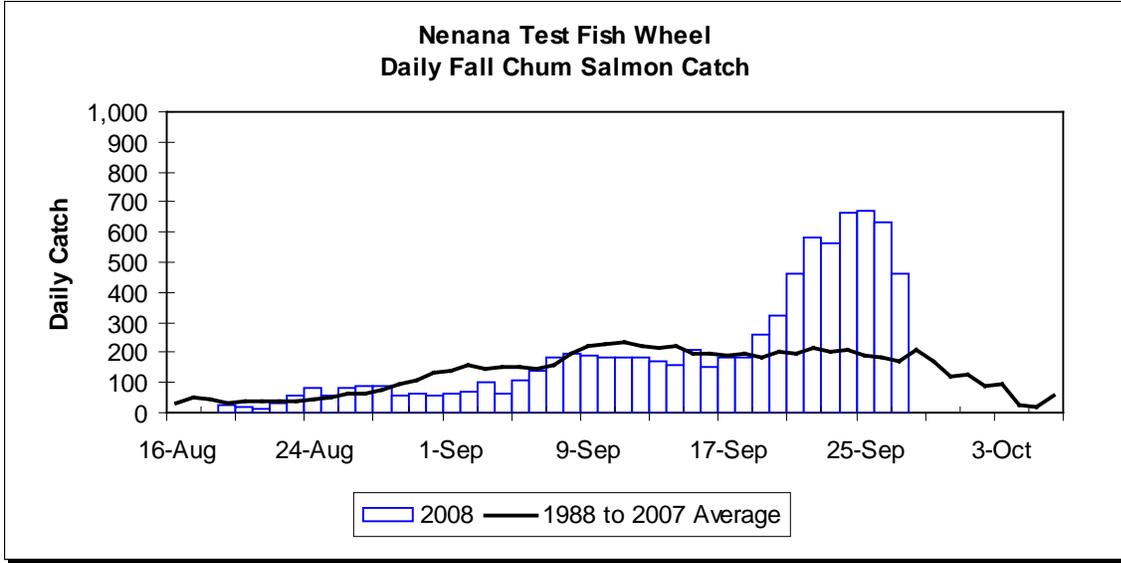


Figure 3. Fall chum salmon daily and cumulative catch, test fish wheel project, located downstream from the community of Nenana, on the right (north) bank of the Tanana River, 1988 to 2007 average, compared to 2008.

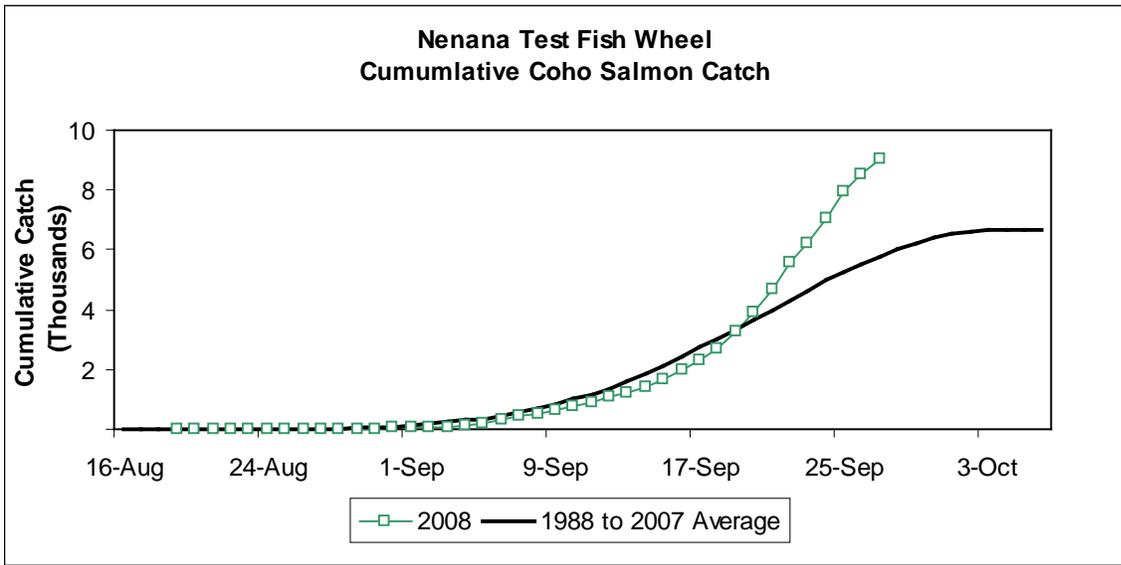
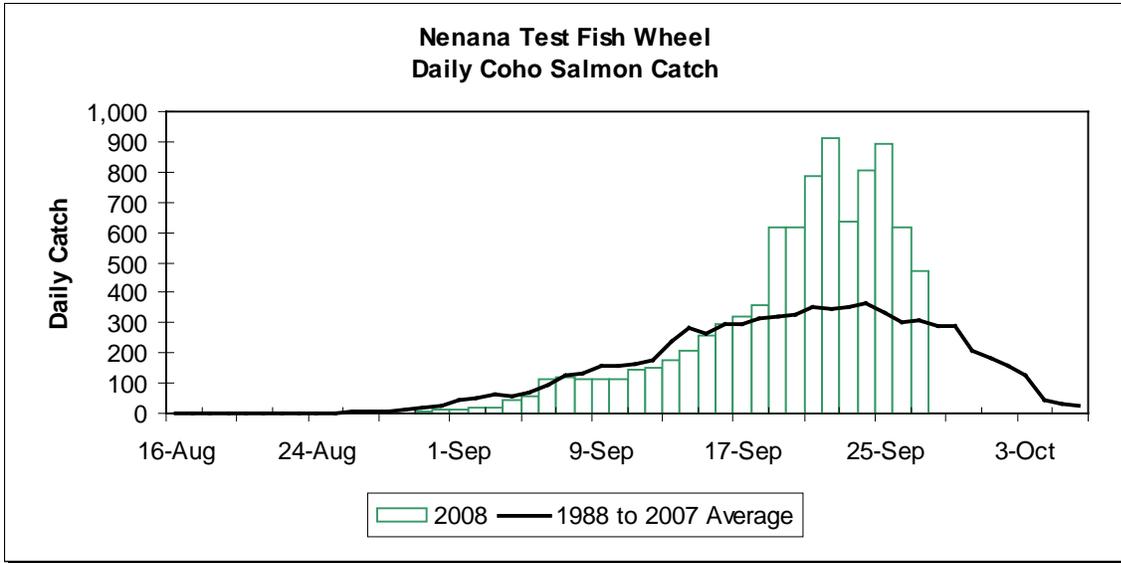


Figure 4. Coho salmon daily and cumulative catch, test fish wheel project, located downstream from the community of Nenana, on the right (north) bank of the Tanana River, 1988 to 2007 average, compared to 2008.

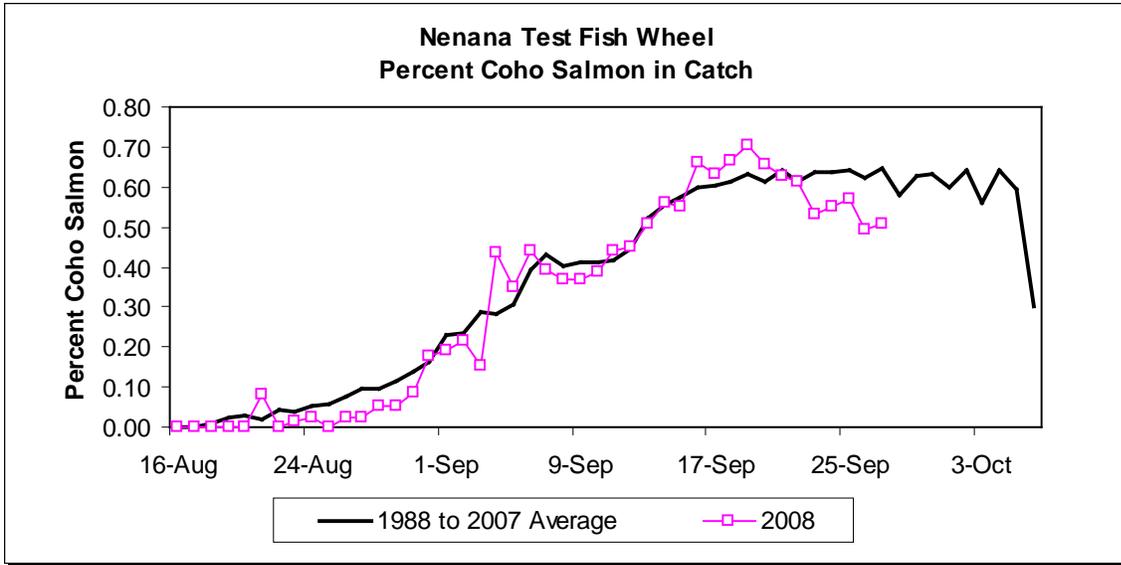


Figure 5. Percentage of coho salmon compared to fall chum salmon based on daily CPUE, test fish wheel project, located downstream from the community of Nenana, on the right (north) bank of the Tanana River, 1988 to 2007 average, compared to 2008.

**Report Prepared Date: January 27, 2009**