Minnesota
F29R (P)-Segment 32 (Year 2)
Study 3
Job 3

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
SECTION OF FISHERIES

SUPPLEMENTAL REPORT

Knife River Adult and Juvenile Fish Trap Report 2016

Completed by:
Nick Peterson

Knife River Adult Trap

The Knife River adult trap is used to capture adult fish migrating upstream from Lake Superior. The trap was opened on March 27 and closed on July 19, 2016 (115 days) for the spring steelhead run. The peak of the spring run occurred during the third week of April and coincided with water temperatures reaching 40-45°F. Steelhead were captured migrating upstream from March 28 through July 8, and approximately 60% (606) were captured from April 13 through April 18. The adult trap was operated from September 6 to November 16, 2016 (72 days) for the fall salmon and trout spawning runs. Run timing was random throughout the fall and fish were collected migrating upstream from September 8 through October 31 (Figure 1). In general, most fish were caught after water temperatures dropped below 50°F. All fish species captured in the adult trap in spring and fall were passed upstream, except for Kamloops Rainbow Trout. Kamloops are not passed upstream to limit reproductive and genetic risks associated with hybridization with steelhead (Close 1999; Negus 1999; Miller et al. 2004; Page et al. 2011). Operation dates and total annual catch by species is provided in Tables 1 and 2.

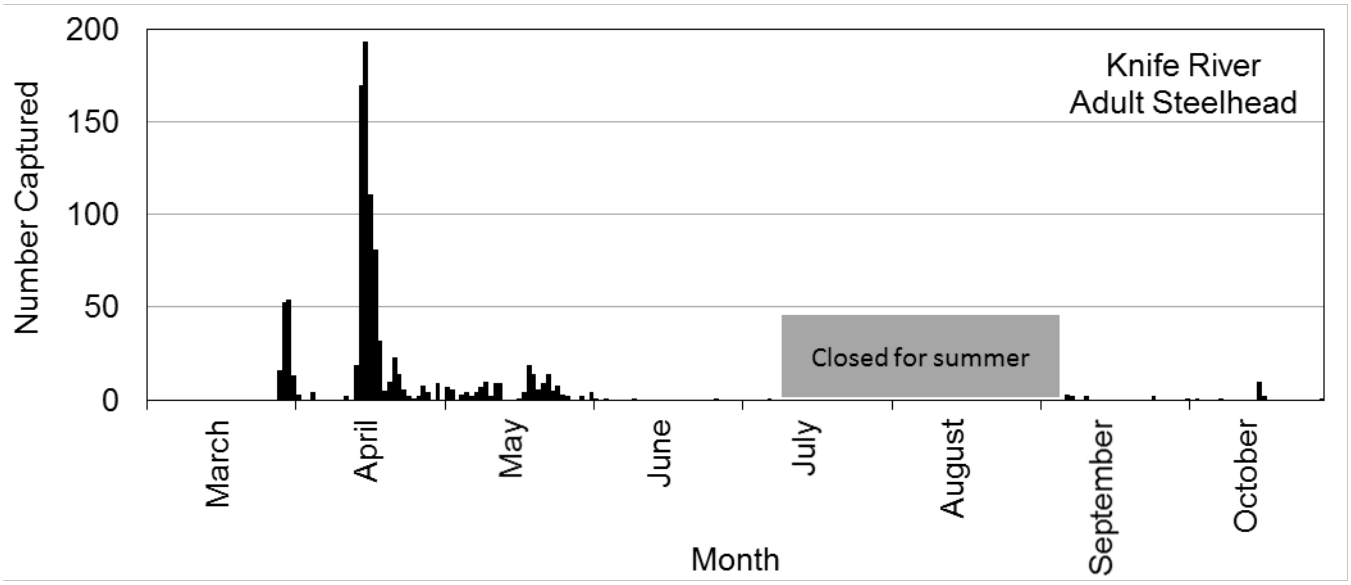

Figure 1. Adult steelhead migration through the Knife River adult fish trap between March and October, 2016.

An estimated 1,076 adult steelhead ran the Knife River in spring 2016. From this total, approximately 95% (1,029, 95% CI: 1,004-1,054) were unclipped, wild-produced fish. The return of wild steelhead 2016 surpassed the previous record set in 2015 (923) as the highest number to return since the trap began operation in 1996. Approximately 649 (95% CI: 632-666) were female and 429 (95% CI: 410-449) were male. Unclipped steelhead ranged from age-3 through age-14, and most were from the 2010 (age-6) and 2011 (age-5) year-classes. Average total length of females was 26 inches (range: 17-30) and males was 24 inches (range: 12-30). Approximately 3.4% had lamprey wounds, which was within the historic range observed at the Knife River trap (1%-9%). Approximately 47% (443) had a numbered Floy® tag from a previous year and 4.7% (45) had a tag stub or mark that indicated tag loss. An additional 22 unclipped steelhead were captured migrating upstream in the fall.

An estimated 47 (95% CI: 44-50) clipped (stocked) steelhead returned in spring 2016, and approximately 33 (95% CI: 31-34) were female and 15 (95% CI: 13-17) were male. Seventeen had a right-pelvic (RR) fin clip which indicated they were part of 59,338 frylings stocked in 2010 (of which only 59.5% were given a RR fin clip). All were from the 2010 year-class (age-6). Average total length of females was 27 inches (range: 24-29) and males was 26 inches (range: 23-29). The MN DNR internal report #661 can provide more information on the fryling program.

Sixteen steelhead had a right-maxillary (RM) clip and were Knife River captive broodstock from the French River Coldwater Hatchery that were tagged and released into Lake Superior. Thirteen were females and 3 were males. Average length of females was 26 inches (range: 23-29) and males was 24 inches (range: 23-25). Two more RM clipped steelhead were captured migrating upstream in the fall.

Four steelhead captured in the spring had a left-maxillary (LM) clip and were yearlings stocked between 2003 and 2007 as part of “Phase III” of the Knife River yearling stocking program. Two were females that measured 26 and 28 inches and were from the 2005 (age 11) and 2003 (age 13) year-classes, respectively. Two were males from the 2011 year-class (age-11) that measured 26 and 28 inches. One more LM clipped female was collected in the fall that measured 28 inches.

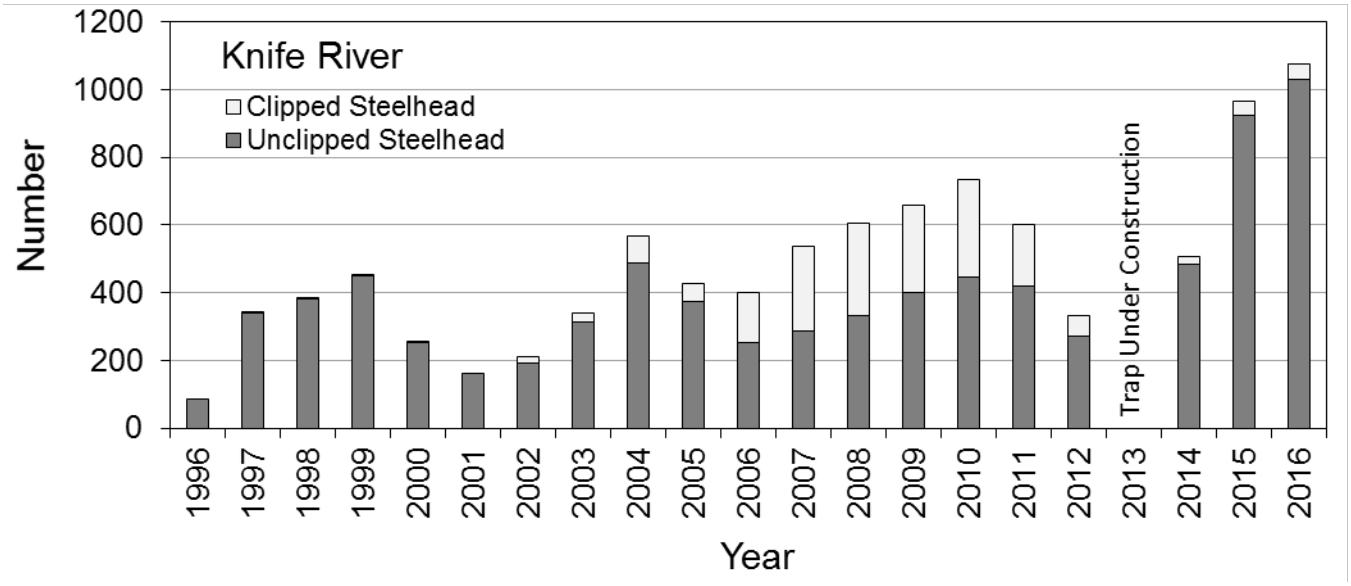

Figure 2. Number of clipped (stocked) and unclipped (wild) steelhead captured by year at the Knife River adult fish trap.

Nineteen Kamloops were captured in the spring run, which was the second lowest Kamloops catch at the Knife River trap since 1996. Seven were female, 10 were male and 2 were unknown (immature). Average length of females was 24 inches (range: 23-25) and males was 24 inches (range: 17-26). Ages ranged from age-1 through age-7, and most were age-6 from the 2010 year-class. No Kamloops were captured in the fall.

The adult trap captured 17 Coho salmon, 5 Brown Trout, 4 Pink salmon and 1 Brook Trout during the fall spawning run. The average length of Coho salmon was 20 inches (range: 12-25). Seven were female, 7 were male and 3 were unknown. Average length of females was 23 inches (range: 19-25) and males was 19 inches (range: 12-24). The average length of Brown Trout was 25 inches (range: 24-27). Only one was a female that was 24 inches and four were males that averaged 26 inches (range: 24-27). One male had a numbered Floy® tag from a previous year and one had a numbered Floy® tag from spring 2016. One male had a lamprey wound. The average length of Pink salmon was 19 inches (range: 16-21). Only one was a female that was 16 inches and four were males that averaged 19 inches (range: 18-21). The one Brook Trout was 9 inches and 0.2 pounds. No fish tagged in fall of 2016 were recaptured before the Knife River juvenile trap was closed for the winter.

Knife River Juvenile Trap

The Knife River juvenile trap is used to capture juvenile and adult fish emigrating downstream toward Lake Superior. The trap was opened for the spring on March 27 and closed on July 19, 2016 (115 days). Approximately 97% of all fish captured were juvenile steelhead. Juvenile steelhead were captured in the trap from March 28 through July 18, but over 80% (7,578) were captured between June 8 and July 8. The juvenile trap was also operated from September 6 to November 16, 2016 (72 days). A total of 273 juvenile steelhead were collected from September 8 through November 14, 2016. All fish captured in the juvenile trap in spring and fall were passed downstream (Figure 3).

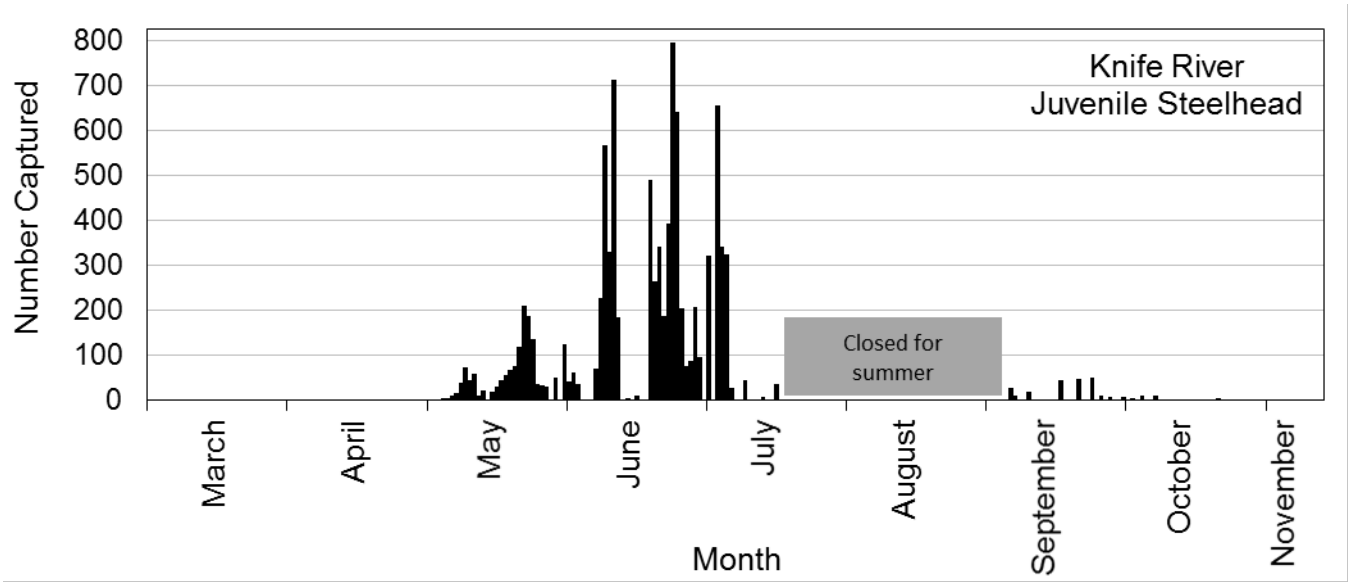

Figure 3. Juvenile steelhead migration through the Knife River juvenile fish trap between March and November, 2016.

The number of juvenile steelhead that emigrate per day is adjusted by multiplying the total number caught per day by the average trap efficiency from efficiency trials conducted in previous years (0.58) to account for flow conditions that might entice juvenile fish to swim around the trap. In days when the gauge height is greater than zero, the total number of smolts caught are multiplied by 0.58 and added to the daily catch. In 2016, the difference between the actual catch and the adjusted catch when the gauge height was below 0.20 was 2,422. Therefore, the adjusted total number of juvenile steelhead was likely overestimated, and the total number of smolts that emigrated was probably more close to what was actually caught in the trap in 2016. Both the total number caught in the trap and the

estimated number adjusted for flow are provided. Alternative methods for estimating daily smolt numbers should be evaluated in future years.

A total of 9,516 juvenile steelhead were captured in the juvenile trap in 2016, which was slightly below the historic average of 11,117. The estimated total after adjusting for flow conditions was 14,127, which was slightly above the historic average of 12,959. From the estimated total, 84% (11,927) were age-1, 15% (2,097) were age-2, and <1% were age-0 (95) and age-3 (9). The estimated number of age-1 emigrants was slightly higher than the historic average (9,785), and the number of age-2 and older emigrants was slightly lower than the historic average (2,614). Most of the age-2 and older juvenile steelhead were captured in May, and most age-1's were collected throughout June and early-July (Figure 4).

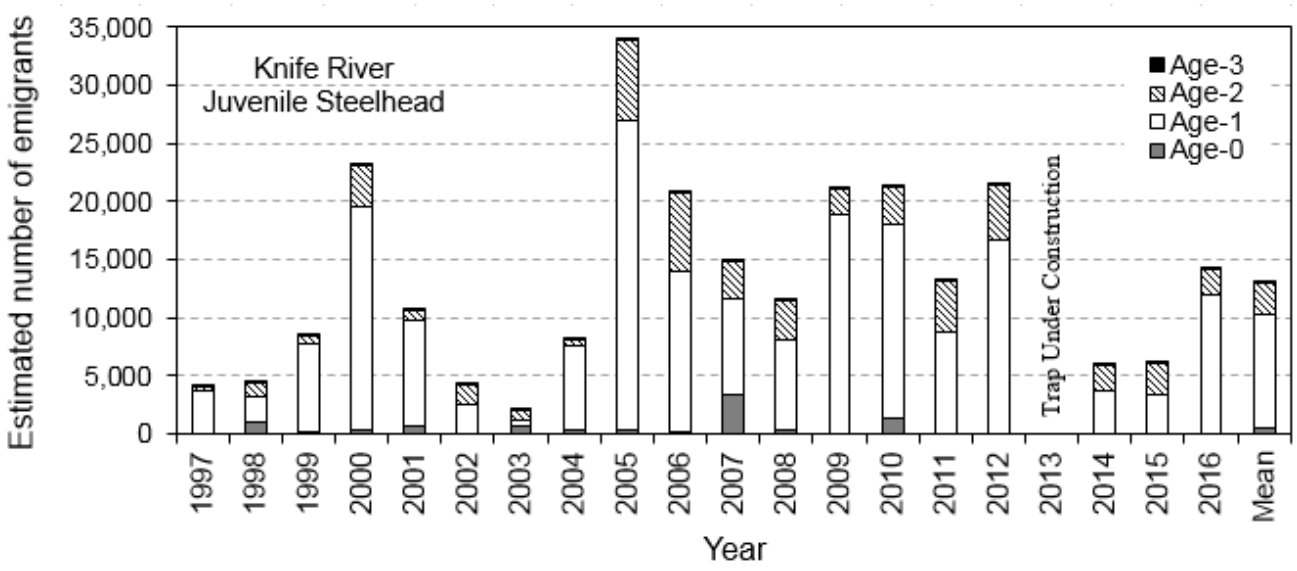

Figure 4. Estimated number of juvenile steelhead emigrants in the Knife River by year, including the historic average (Mean) from 1997 to 2016.

An additional 101 juvenile steelhead collected in the juvenile trap had a fin clip which indicated they were part of the Lake Superior Steelhead Associations' steelhead relocation program. Sixty-one had a left pectoral (LR) fin clip and 40 had a right pectoral (RF) fin clip. The average total length at capture of LR clipped fish was 6.4 inches (range: 3.9-9.0). The average total length at capture of RF clipped fish was 4.7 inches (range: 3.5-7.5). After adjusting for flow conditions, the estimated total with fin clips was 147.

An estimated 84 juvenile steelhead had a LR clip. Thirty-two of the LR clipped fish were age-1 with an average total length of 4.8 inches (range: 3.9-5.5), and 52 were age-2 with an average total length of 7.4 inches (range: 5.9-9.0). Age-1 fish were caught in the juvenile trap in June 2016, clipped and relocated to Tributary 9 of the Knife River, and then were caught again emigrating downstream in the same year. Age-2 fish were captured in the juvenile trap in spring 2015, clipped and relocated to Stanley Creek, and overwintered in the stream for an additional year.

An estimated 63 juvenile steelhead had a RF clip. Fifty-nine of the RF clipped fish were age-1 with an average total length of 4.6 inches (range: 3.5-5.5), and 4 were age-2 with an average total length of 6.2 inches (range: 5.5-7.5). Age-1 fish were caught in the juvenile trap in June 2016, relocated to the West Branch of the Knife River, and then were caught again emigrating downstream in the same year. Age-2 fish were captured in the juvenile trap in spring 2015, relocated to the West Branch of the Knife River, and overwintered in the stream for an additional year.

Two juvenile rainbow trout were collected with an adipose fin clip. Scale samples were sent to St. Paul which genetically verified them as immature Kamloops rainbow trout. Both fish were age-2 and stocked in either Lake Superior (at French River) or upstream in the Lester River in 2015. It is likely that these fish overwintered upstream in the Knife River. Length at age was similar to age-2 steelhead emigrants and well below the average length of age-2 Kamloops that overwinter in Lake Superior, and juvenile Kamloops were caught by anglers in the lower Knife River in fall of 2016.

Juvenile Brook Trout and Brown Trout accounted for only 3% of all juvenile fish captured in 2016. A total of 143 Brook Trout were captured and average total length at capture was 195 mm (range: 94-335). Approximately 55% (79) of juvenile Brook Trout were age-1, 41% (59) were age-2, and 3% (5) were age-3. A total of 152 Brown Trout were captured and average total length at capture was 131 mm (range: 70-361). Approximately 92% (140) of juvenile Brown Trout were age-1, 7% (11) were age-2, and <1% (1) was age-3.

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Knife River Adult and Juvenile Trap Report 2016

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Table 1. The date the Knife River adult trap was open and closed, the total number of days the trap was operated, and the number of all fish species collected in the spring trap season by year, including the historic averages (Average) from 1996 to 2016. The trap was being repaired and not operated in spring 2013.

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Average
Date trap was opened	4/23	4/14	3/25	4/7	3/26	4/18	4/14	4/21	4/7	4/10	4/6	4/15	4/16	4/12	3/28	4/18	3/25	—	4/28	4/13	3/27	4/9
Date trap was closed	6/5	6/30	6/22	6/30	6/30	6/30	6/30	6/28	6/30	6/30	5/25	6/26	6/30	6/22	5/31	6/20	6/1	—	7/7	7/6	7/19	6/24
Days trap was open	43	77	89	84	96	73	77	68	84	81	49	72	75	71	64	63	68	—	70	85	115	75
Brook Trout	0	3	3	7	3	11	1	0	0	0	1	0	0	0	0	4	6	—	0	7	39	4
Brown Trout	0	2	0	1	2	4	2	0	1	0	0	0	0	0	0	0	1	—	0	5	4	1
Chinook Salmon	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	—	0	0	0	0
Kamloops	37	48	48	82	65	108	44	72	120	97	27	22	21	46	26	29	20	—	29	17	19	49
Steelhead Rainbow Trout (clipped)	29	28	20	43	120	40	76	111	201	136	204	284	274	258	290	182	62	—	21	47	47	124
Steelhead Rainbow Trout (unclipped)[1]	87	345	409	452	287	171	234	385	540	423	329	287	332	401	449	419	271	—	483	923	1,029	413

[1] Numbers estimated using a mark-recapture population estimate.

Table 2. The date the Knife River adult trap was open and closed, the total number of days the trap was operated, and the number of all fish species collected in the fall trap season by year, including the historic averages (Average) from 1996 to 2016. The trap was being repaired and not operated in fall 2012 and 2013.

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004 [1]	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Average
Date trap was opened	8/19	8/18	8/17	8/9	8/4	8/13	8/16	9/8	9/8	9/5	9/5	9/5	9/2	9/21	9/13	9/19	—	—	9/9	9/9	9/6	8/30
Date trap was closed	11/8	11/7	11/6	11/12	11/10	11/16	11/8	11/7	11/5	11/4	11/4	11/2	11/7	11/7	11/5	11/4	—	—	11/6	11/18	11/16	11/8
Days trap was open	81	81	81	95	98	95	84	60	58	60	60	58	66	47	53	46	—	—	58	71	72	70
Brook Trout	0	2	3	1	0	3	2	0	3	2	0	1	1	0	0	1	—	—	1	1	1	1
Brown Trout	32	67	43	61	58	20	45	30	27	26	9	7	17	8	7	1	—	—	7	5	5	25
Chinook Salmon	4	1	9	9	2	0	2	0	0	0	0	11	5	0	0	0	—	—	1	3	0	2
Coho Salmon	6	16	37	10	5	1	16	0	3	3	0	9	11	9	71	0	—	—	0	8	17	12
Kamloops	4	0	12	1	4	1	0	0	0	0	0	5	7	0	3	10	—	—	0	2	0	3
Pink Salmon	0	9	20	39	48	0	3	0	0	2	7	10	0	2	258	103	—	—	0	1	4	27
Rainbow Trout - unknown type [2]	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	—	—	0	0	0	1
Splake	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	—	—	0	1	0	0
Steelhead Rainbow Trout (clipped)	2	0	16	6	9	0	2	0	0	7	0	22	10	5	2	0	—	—	0	5	3	5
Steelhead Rainbow Trout (unclipped)	60	16	105	17	37	19	23	6	49	9	1	50	49	21	18	2	—	—	8	155	22	35

[1] Fishway was operated in fall instead of the adult trap

[2] Specific clips/strains were not identifiable on videotape