

Minnesota
F-29-RP-33
Study 3
Federal Project Number: F17A00190

SECTION OF FISHERIES



SUPPLEMENTAL REPORT:

KNIFE RIVER FISH TRAP REPORT

2018

Report Completed by:
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The Minnesota Department of Natural Resources (MNDNR) Knife River fish trap is used to monitor the abundance and health of migratory fishes in Minnesota waters of Lake Superior (particularly of migratory Rainbow Trout [steelhead]), and to monitor Sea lamprey control efforts in Lake Superior. The trap captures both adult fish immigrating upstream in the Knife River and adult and juvenile fish emigrating downstream from the Knife River to Lake Superior. The adult trap is operated during annual spawning runs of steelhead in the spring and trout (Brook and Brown Trout) and salmon (Coho, Chinook, and Pink salmon) in the fall.

All adult fish are measured, weighed, and checked for external signs of disease and lamprey wounds. All adult steelhead Rainbow Trout, Brown Trout, or Brook Trout are given a uniquely numbered gray Floy[®] Tag to monitor growth and survival of individual fish. All Kamloops Rainbow Trout (clipped, hatchery product) and salmon species are given an unnumbered colored plastic tag to indicate when and where they were captured. Scales are collected from all fish for aging and genetics. All fish are passed upstream of the trap after workup, except for Kamloops Rainbow Trout. Kamloops are not passed upstream to limit reproductive and genetic risks associated with hybridization among naturalized steelhead populations. For more information visit <https://www.minnesotasteelheader.com/SGP.html>.

The 2018 trap season started later than normal because most rivers were covered with ice and not fishable until late-April or early-May. The adult and juvenile traps were operated for 68 days in the spring, from April 24 through July 5, and were closed from June 17-21 due to high water levels exceeding 2,200 cubic feet per second. The traps were operated for 63 days in the fall, from September 4 through November 7, and were closed for two days in mid-November due to high water levels that exceeded 1,800 cubic feet per second. Annual trap operation dates are provided in Tables 1 and 2.

Knife River Adult Trap

An estimated total of 603 (95% CI: 575-631) adult steelhead (clipped and unclipped) returned to Knife River in 2018, of which an estimated 554 (95% CI: 526-582) were unclipped, wild-produced fish (Table 1; Figure 1). Unclipped steelhead ranged from age-3 through age-11, and approximately 50% were from the 2012 (age-6) and 2013 (age-5) year-classes. Average total length of females was 25 inches (range: 16-29), and males was 24 inches (range: 15-30). Approximately 3.8% of unclipped steelhead had lamprey wounds, which was slightly higher than 2017 (2.5%) but low relative to the historic range observed at the Knife River trap since 1996 (1%-9%). Approximately 47% (240) had a numbered Floy[®] tag from a previous year, and 5.3% (25) had a tag stub or mark that indicated tag loss. An additional 35 unclipped steelhead were captured migrating upstream in the fall (Table 2). More than 80% of all adult steelhead that returned in 2018 were captured in the first 3 weeks of the trap season (April 26 through May 14).

A total of 48 clipped steelhead were captured in spring, of which 45 were Knife River broodstock with a right-maxillary (RM) clip, 2 were stocked frylings with a right-pelvic (RR) clip, and 1 had a right-pectoral (RF) clip (Table 1, Figure 1). The RF clipped steelhead was a female from the 2015 year-class (age-3) that measured 17.8 inches. This fish was one of 1,044 age-1 steelhead relocated to the West Branch of the Knife River in June 2016. Nine RM clipped Knife River broodstock and 1 with a left-pelvic (LR) clip were captured in the fall (Table 2). The LR clipped steelhead was a female from the 2015 year-class (age-3) that measured 21.9 inches. This fish was one of 546 age-1 steelhead relocated to the West Branch of the Knife River in June 2016. The RF and LR clipped steelhead were the first fish from the LSSAs Steelhead Relocation Project that returned as adults.

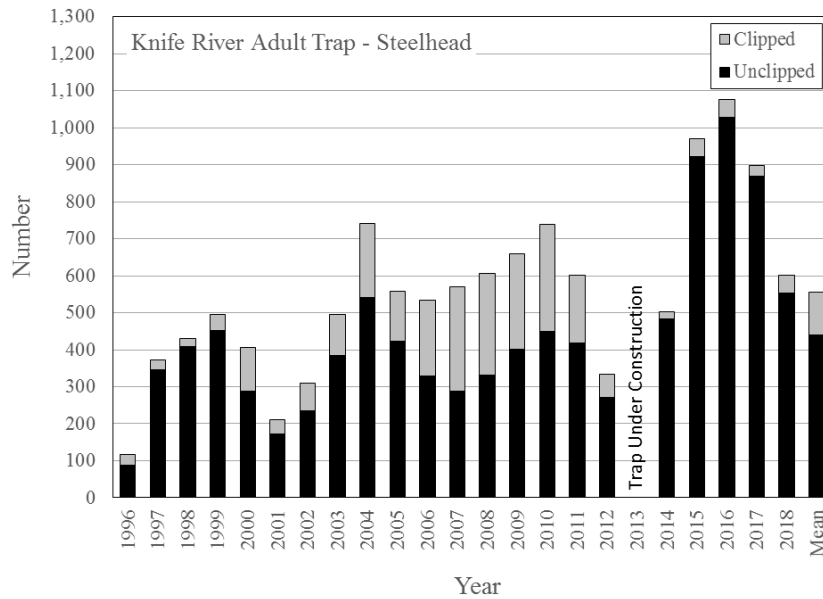


Figure 1. Number of clipped (stocked) and unclipped (wild-produced) steelhead captured at the Knife River adult fish trap in the spring spawning season by year.

Forty-three Kamloops were captured in the spring, 20 females and 23 males. Twelve percent of Kamloops captured in spring were from the 2015 year class (age-3), 63% from the 2014 year class (age-4), and 26% from the 2013 year class (age-5). One Kamloops was captured in the fall, a female from the 2013 year-class (age-5). Average total length of females was 24 inches (range: 20-27) and males was 24 inches (range: 18-27).

Fourteen Brook Trout were captured in the spring, 11 were from the 2016 year class (age-2) and 3 were from the 2015 year class (age-3). Average total length for Brook Trout captured in the spring was 9 inches (range: 7-12). Two large Brook Trout were captured in the fall. One measured 19.6 inches and was from the 2014 year class (age-4), and the other measured 18.1 inches and was from the 2015 year class (age-3). One had an adipose and left pelvic fin clip and was stocked into Wisconsin waters of Lake Superior by the Red Cliff Band of Lake Superior Chippewa.

Two Brown Trout were captured in the spring that measured 12 and 13 inches, and both were from the 2016 year class (age-2). Fifteen Brown Trout were captured in the fall, 3 were from the 2015 year class (age-3), 7 from the 2014 year class (age-4), 4 from the 2013 year class (age-5), and 1 was from the 2012 year class (age-6). Nine were females and 6 were males. Average total length was 20 inches (range: 16-25).

Catch of all other fish species in the fall included 53 Coho Salmon, 3 Chinook Salmon, 2 Pink Salmon, and 1 Splake (Lake Trout x Brook Trout Hybrid). The average length of Coho Salmon was 19 inches (range: 13-25), and 27 were females and 26 were males. The average length of Chinook Salmon was 26 inches (range: 24-28), 2 were males and 1 female. The average length of Pink Salmon was 14 inches (range: 12-17), and both were males. The Splake was a male that measured 22.5 inches.

Knife River Juvenile Trap

The number of juvenile steelhead captured in the trap each day is adjusted to account for daily flow conditions that might have allowed juvenile fish to swim around the trap. Based on gauge height and catch data from previous years, it was determined that a gauge height greater than or equal to 0.20 could allow juvenile salmonids to avoid the trap and pass over the falls (MNDNR, unpublished data). Therefore, when the gauge height was greater than 0.20 the total number caught per day was divided by the average trap efficiency from mark-recapture trials conducted in previous years (0.58). The total number caught in the trap and the estimates adjusted for flow conditions by species are provided in Table 3.

The Knife River juvenile trap was very busy in 2018! A total of 22,310 juvenile salmonids were captured, of which 99% (22,093) were steelhead and less than 1% were Brown Trout (117), Brook Trout (92) and Coho Salmon (20) (Table 3). Nearly all (99%; 22,005) juvenile fish were captured in May and June (Figure 2). Only 198 juvenile fish were captured in the fall, of which 68% (135) were steelhead, 26% (51) were Brown Trout, and 6% (12) were Brook Trout.

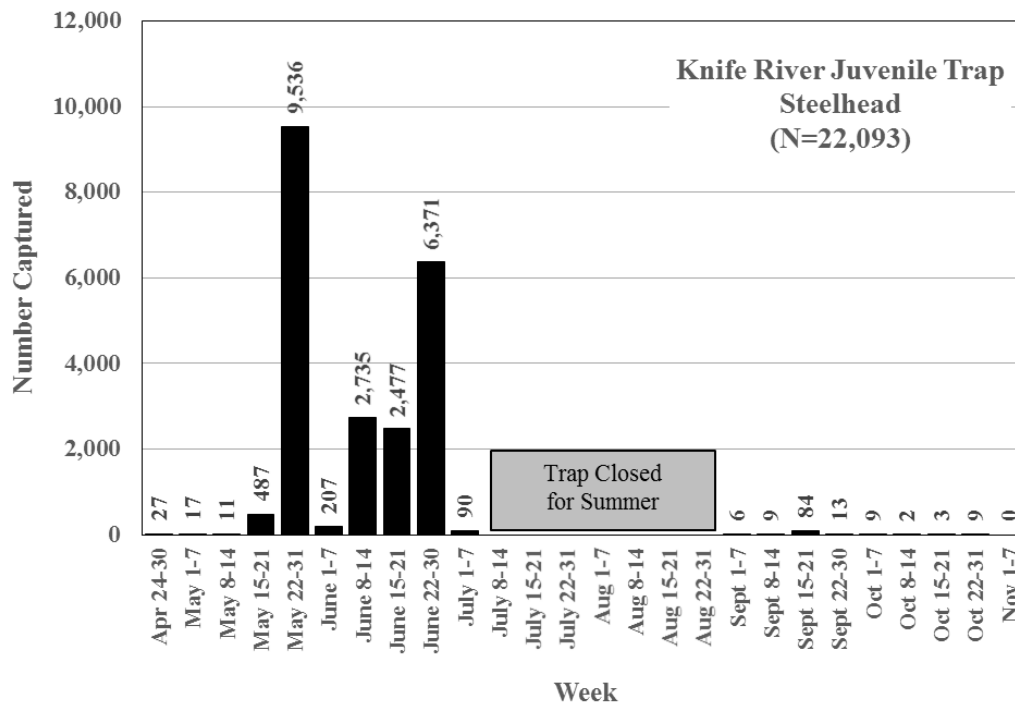


Figure 2. The number of juvenile steelhead captured in the Knife River juvenile fish trap by week in 2018.

A total of 22,025 unclipped juvenile steelhead were captured in 2018, which was 73% higher than the historic average of 12,716. The total after adjusting for trap efficiency was 25,783, which was 75% higher than the historic average of 14,734. Approximately 79% (20,251) were age-1, 21% (5,487) were age-2, and <1% were age-0 (29) and age-3 (16). The number of age-2 and older emigrants was 5,503, which was 80% higher than the historic average of 3,053 (Table 3, Figure 3). In the spring, average length-at-age was 4.3 inches for age-1 (range: 2.8 – 6.4), 6.5 inches for age-2 (range: 5.1 – 9.3), and 9.3 inches for age-3 (range: 7.6 – 10.8). In fall, average length-at-age was 3.7 inches for age-0 (range: 2.5 – 4.3), 5.4 inches for age-1 (range: 4.4 – 7.6), and 8.3 inches for age-2 (range: NA).

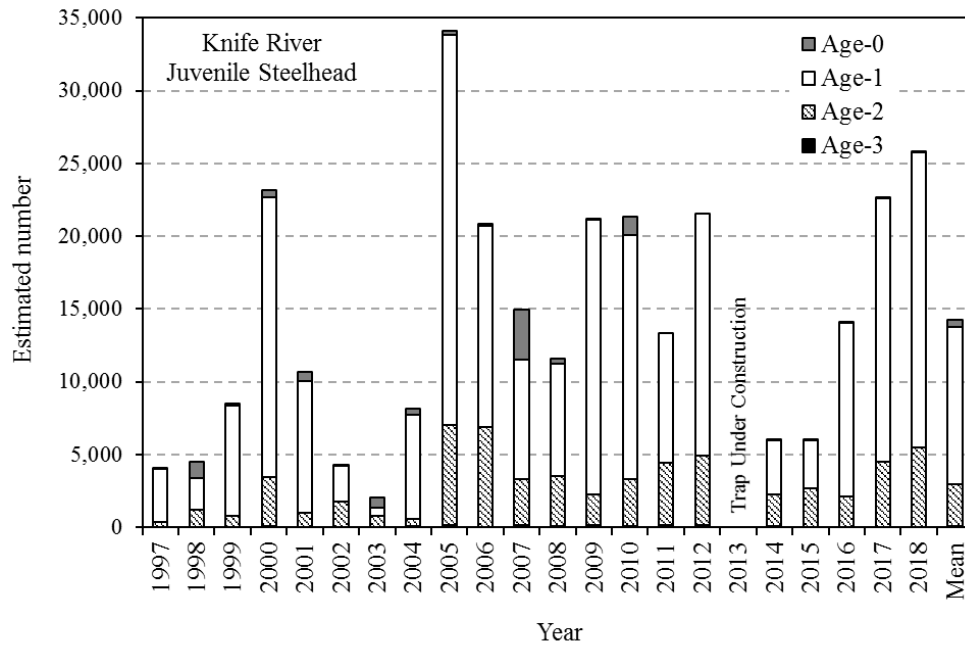


Figure 3. Estimated number of juvenile steelhead emigrants in the Knife River by year, including the historic average (Mean) from 1997 to 2018.

Fifty-six juvenile steelhead were captured from LSSAs Steelhead Relocation Program, 32 had a left pelvic (LR) fin clip and 24 had a right pectoral (RF) fin clip. After adjusting for trap efficiency, the estimated totals with fin clips was 36 with a LR clip and 25 with a RF clip. Twelve LR clipped juvenile steelhead were age-1s that were recaptured a second time this spring soon after being relocated to Trib. 9 of the Knife River; these fish were excluded from clipped fish counts (Table 3). Excluding the 12 age-1 recaps, all LR clipped steelhead were age-2 with an average total length of 6.6 inches (range: 5.3 – 7.8). These fish were captured in the juvenile trap in spring 2017, were clipped and relocated to Tributary 9 of the Knife River in June 2016, and survived one additional year in the river. All RF clipped steelhead were age-2 with an average total length of 6.6 inches (range: 5.5 – 8.1). These fish were caught in the juvenile trap in June 2017, relocated to the West Branch of the Knife River and survived one additional year in the river.

This was the last year that juvenile steelhead will be relocated back upstream in the Knife River for the LSSAs Steelhead Relocation Project. A total of 1,102 age-1 juvenile steelhead (all measured <130 mm TL) were brought from the juvenile trap to the French River Hatchery. All fish were given a LR fin clip on June 14 and were released into Tributary 9 to the Knife River on June 15.

Ninety-two Brook Trout were captured in 2018, 80 in the spring and 12 in the fall. Average total length was 7.6 inches (range: 4.8 – 10.6) in the spring and 7.9 inches (range: 6.2 – 10.5) in the fall. Approximately 9% (8) were age-1, 86% (79) were age-2, and 5% (5) were age-3. A small left rear pelvic fin clip was taken from most Brook Trout captured at the Knife River juvenile trap in 2018 for genetic analyses with Brook Trout captured during the 2018 MNDNR Coaster Brook Trout survey.

One-hundred seventeen Brown Trout were captured in 2018. Average total length was 6.1 inches (range: 3.8 – 9.6). Approximately 50% (59) were age-1, 49% (57) were age-2, and 1% (1) was age-3. Twenty Coho Salmon were captured, average total length at capture was 4.4 inches (range: 3.8 – 5.2), and all were age-1.

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Lake Superior Area Fisheries Supervisor:  Date: 5/29/2019


Regional Fisheries Supervisor:  Date: 6/2/19

Table 1. Operation dates and total number of adult fish collected at the Knife River adult trap in the spring by year and species, including the historic averages (Average) from 1996 to 2018. 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	2017	2018	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	4/5	4/24	4/10
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	7/14	7/5	6/25
Days trap was open	43	77	89	84	96	73	77	68	84	81	49	72	75	71	64	63	68	—	70	85	115	101	68	76
Brook Trout	0	3	3	7	3	11	1	0	0	0	1	0	0	0	0	4	6	—	0	7	39	5	14	5
Brown Trout	0	2	0	1	2	4	2	0	1	0	0	0	0	0	0	0	1	—	0	5	4	0	2	1
Chinook Salmon	0	0	0	0	0	0	0	0	0	0	1	0	0	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	44	43	48
Steelhead Rainbow Trout (clipped)	29	28	20	43	120	40	76	111	201	136	204	284	274	258	290	182	62	—	21	47	47	28	48	116
<i>Left-pelvic (LR)</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0	0
<i>Right-pectoral (RF)</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1
<i>Right-pelvic (RR)</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2
<i>Right-maxillary (RM)</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	45	45
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	870	554	440
All Species	153	426	480	585	477	334	357	568	862	656	562	593	627	705	765	634	360		533	999	1,138	947	661	610

¹ Numbers estimated using a mark-recapture population estimate.

Table 2. Operation dates and total number of adult fish species collected at the Knife River adult trap in the fall by year and species, including the historic averages (Average) from 1996 to 2018. 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	2017	2018	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	8/25	9/4	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	11/6	11/7	11/7
Days trap was open	81	81	81	95	98	95	84	60	58	60	60	58	66	47	53	46	—	—	58	71	72	74	63	70
Brook Trout	0	2	3	1	0	3	2	0	3	2	0	1	1	0	0	1	—	—	1	1	1	3	2	1
Brown Trout	32	67	43	61	58	20	45	30	27	26	9	7	17	8	7	1	—	—	7	5	5	0	15	23
Chinook Salmon	4	1	9	9	2	0	2	0	0	0	0	11	5	0	0	0	—	—	1	3	0	1	3	2
Coho Salmon	6	16	37	10	5	1	16	0	3	3	0	9	11	9	71	0	—	—	0	8	17	5	53	13
Kamloops	4	0	12	1	4	1	0	0	0	0	0	5	7	0	3	10	—	—	0	2	0	0	1	2
Pink Salmon	0	9	20	39	48	0	3	0	0	2	7	10	0	2	258	103	—	—	0	1	4	207	2	34
Rainbow Trout - unknown type ²	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	—	—	0	0	0	0	0	1
Splake (Brook Trout x Lake Trout)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	—	—	0	1	0	0	1	0
Steelhead Rainbow Trout (clipped)	2	0	16	6	9	0	2	0	0	7	0	22	10	5	2	0	—	—	0	5	3	1	10	5
<i>Left-pelvic (LR)</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1
<i>Right-pectoral (RF)</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0	0
<i>Right-pelvic (RR)</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0	0
<i>Right-maxillary (RM)</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	9	9
Steelhead Rainbow Trout (unclipped)	60	16	105	17	37	19	23	6	49	9	1	50	49	21	18	2	—	—	8	155	22	25	35	35
All Species	108	111	245	144	163	44	93	36	96	49	17	115	100	45	359	117			17	181	52	242	122	117

¹ Counts made from fishway and video surveillance; ² Specific clips/strains were not identifiable on videotape

Table 3. The total number of juvenile fish captured at the Knife River juvenile trap (N) and the estimated total number of fish that emigrated adjusted for daily trap efficiency (N^A) by age and species in 2018.

Species/Clip	N	Age				N^A	Age			
		0	1	2	3		0	1	2	3
Rainbow Trout (steelhead)	22,093	18	17,143	4,917	15	25,843	29	20,251	5,547	16
<i>No clip</i>	22,025	18	17,131	4,861	15	25,783	29	20,251	5,487	16
<i>Right Front (RF)</i>	24	0	0	24	0	25	0	0	25	0
<i>Left Rear (LR)</i>	32	0	12 ^a	32	0	36	0	12 ^a	36	0
Brook Trout	92	0	8	79	5	116	0	11	98	7
Brown Trout	117	0	59	57	1	151	0	78	71	2
Coho Salmon	20	0	20	0	0	21	0	21	0	0
All Species	22,310	18	17,218	5,053	21	26,132	29	20,361	5,717	25

^a Recaptured at trap in same year they were relocated upstream- excluded from abundance totals.

N = Total number captured.

N^A = Estimated total number captured adjusted for daily trap efficiency.