

SECTION OF FISHERIES



SUPPLEMENTAL REPORT:

KNIFE RIVER FISH TRAP REPORT

2019

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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 adult fish immigrating upstream 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 to limit reproductive and genetic risks associated with introgression into steelhead populations. More information on steelhead genetics is at <https://www.minnesotasteelheader.com/SGP.html>.

The number of juvenile steelhead captured in the juvenile trap each day is adjusted to account for daily flow conditions that might have allowed juvenile fish to bypass the trap. The total number of fish caught per day is adjusted using the average trap efficiency from all mark-recapture trials conducted in previous years (0.58) on all days when the gauge height at the trap was 0.20 or greater. Likewise, the number of adult steelhead captured in the trap is adjusted to account for fish that bypass the trap on their upstream migration. A population estimate is calculated during the spring spawning season using the number of adult steelhead tagged in the adult trap and put upstream, and the number of tagged and untagged steelhead recaptured in the juvenile trap headed back to Lake Superior after spawning. Population estimates are made for unclipped and clipped steelhead, but only unclipped steelhead population estimates are provided in this report.

The trap season started slightly later than normal in 2019 and many rivers remained covered with snow and ice and not fishable until mid-April. The traps were open for 99 days in the spring (April 5 - July 12), were closed for 48 days in mid-summer (July 13 – August 29), and then reopened for 62 days in the fall (August 30 - November 6). The traps were closed temporarily for 7 days in late-October (October 25 – 31) when staff were on Lake Superior for hydroacoustics and Lake Trout surveys; very few fish were captured before and after the closure. Annual trap operation dates are provided in Tables 1 and 2.

Knife River Adult Trap

A total of 445 unclipped (wild-produced) adult steelhead were captured in 2019 (excluding within year recaptures), and the estimated return after accounting for fish that bypassed the trap was 559 (95% CI: 519-598) (Table 1; Figure 1). Approximately 42% (189) of all unclipped steelhead returned in April, 45% (200) in May, and 12% (56) in June. Unclipped steelhead ranged from age-3 through age-10, and approximately 48% (214) were from the 2013 (age-6) and 2014 (age-5) year-classes. Average total length of females was 25 inches (range: 18-30), and males was 22 inches (range: 13-29). Approximately 5.2% of unclipped steelhead had lamprey wounds, which was slightly higher than 2017 (2.5%) and 2018 (3.8%), but within the historic range observed at the Knife River trap (1%-9%). Approximately 43% (189) had a numbered Floy[®] tag from a previous year, and 5.2% (23) had a tag stub or mark that indicated tag loss. An additional 53 unclipped steelhead were captured migrating upstream in the fall (Table 2).

A total of 71 clipped steelhead were captured in spring, of which 64 had a right-maxillary (RM) clip, 3 had a left-pelvic (LR) clip, 2 had a right-pectoral (RF) clip, 1 had a right-pelvic (RR) clip, and 1 had an adipose only clip (Table 1, Figure 1). All RM clipped steelhead were Knife River captive adult

broodstock released to Lake Superior in 2018 or earlier. All LR And RF clipped steelhead were adult returns from the Lake Superior Steelhead Associations Steelhead Relocation Project. Two LR clipped steelhead were from the 2014 year-class (age-5), one was a male that measured 20.2 inches and one was female that measured 21.7 inches, and the other was a female from the 2013 year-class (age-6) that measured 24.8 inches. One RF clipped steelhead was a female from the 2015 year-class (age-4) that measured 21.7 inches and was also captured at the Knife River in spring 2018 (repeat spawner). This fish was one of 1,044 age-1 steelhead relocated to the West Branch of the Knife River in June 2016. The other RF clipped steelhead was also a female from the 2013 year-class (age-6) that measured 27.1 inches, and was one of 712 age-1 steelhead relocated to the West Branch of the Knife River in June 2014. The RR clipped steelhead was a female that measured 28.8 inches and was from the 2010 year class (age-9); this fish was stocked as a fryling in 2010 and was also captured at the Knife River in 2017 (repeat spawner). The adipose only clipped steelhead was most likely illegally clipped by an angler in a previous year or was a stray from a clipping program in Ontario waters of Lake Superior.

Seven clipped steelhead were also captured in the fall. Three were RM clipped Knife River broodstock, of which two were recaptures from spring 2019. Two were RF clipped LSSA relocation project fish, one each from the 2015 (age-4) and 2016 (age-3) year classes. Two steelhead had adipose and left pelvic (ALR) fin clips and were the first fish to return from the new clipped steelhead program. Both of the ALR clipped steelhead were from the 2017 year class (2 years old) and were originally stocked above barriers in the French or Lester river in 2018. Both fish measured 14.9 inches, weighed approximately 1 pound, and were unknown sex (likely still immature) (Table 2).

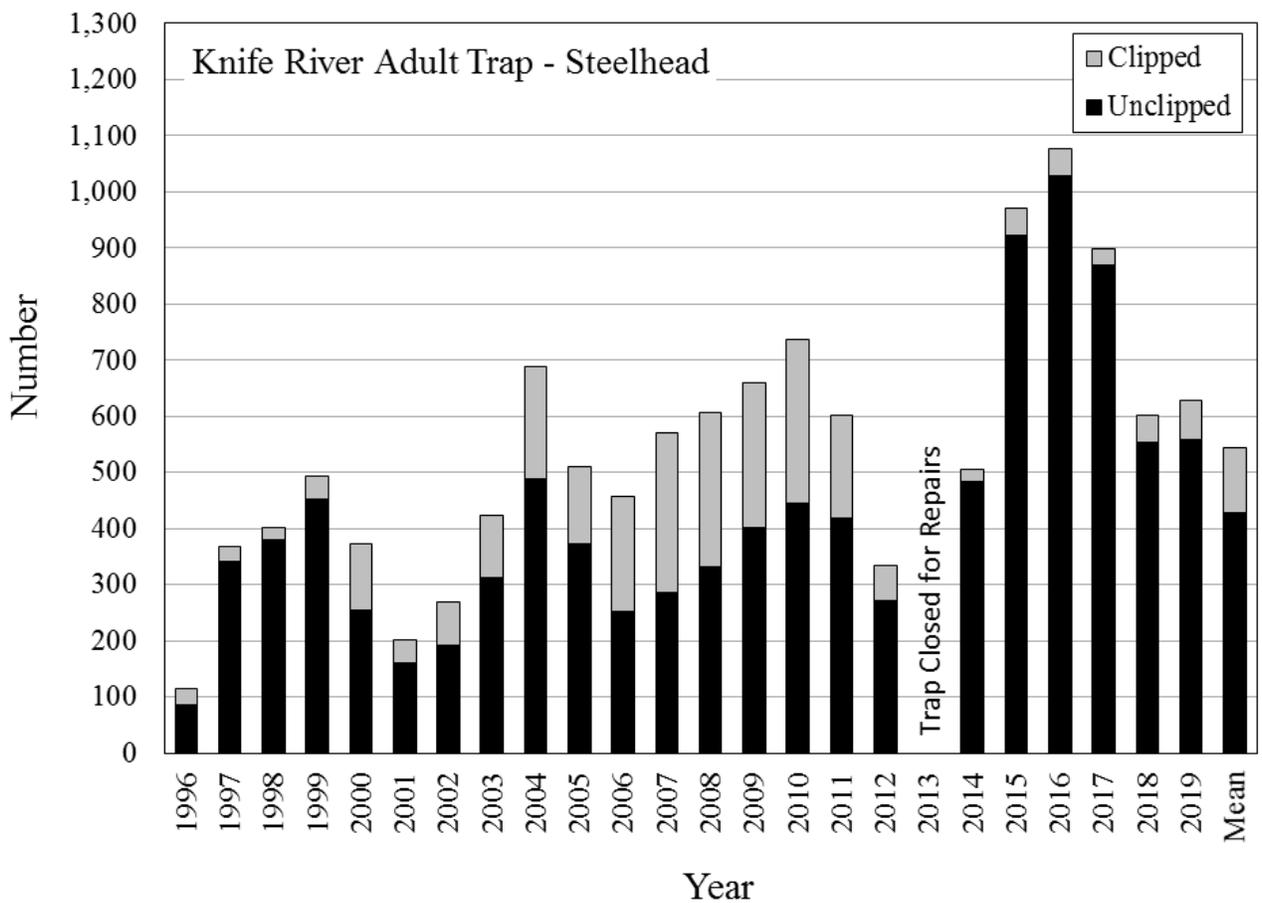


Figure 1. Number of clipped (stocked) and unclipped (wild-produced) steelhead captured at the Knife River adult fish trap in the spring by year.

Fifty-eight Kamloops were captured in the spring, 24 females and 34 males. Two Kamloops were from the 2016 year class (age-3), 48 were from the 2015 year class (age-4), 5 were from the 2014 year class (age-5), and 3 were from the 2013 year class (age-6). Average total length of females was 24 inches (range: 21-27) and males was 24 inches (range: 14-27). No Kamloops were captured in the fall.

Six Brook Trout were captured in the spring and all were from the 2017 year class (age-2). Three Brook Trout were captured in the fall and all were from the 2017 year class (age-2). Average total length for Brook Trout was 9 inches (range: 8–11) in the spring and 11 inches (11-11) in the fall. A small fin clip was collected from all Brook Trout captured in the adult trap for the Coaster Genetics Project (more information here: <https://www.minnesotasteelheader.com/CGP.html>).

No Brown Trout were captured in the spring. Twenty-three Brown Trout were captured in the fall, 15 were females and 8 were males. Ten were from the 2015 year class (age-4), 7 from the 2014 year class (age-5), and 6 from the 2013 year class (age-6). Average total length was 21 inches (range: 16-25). Eight Brown Trout were recaptures (repeat spawners) previously tagged at the Knife River trap in fall 2018.

Catch of all other fish species in the fall included 32 Coho Salmon, 1 Chinook Salmon, 10 Pink Salmon, and 4 Splake (Lake Trout x Brook Trout hybrid). The average length of Coho Salmon was 20 inches (range: 18-24), 16 were females and 16 were males, and all were from the 2017 year-class (age-2+). The Chinook Salmon was a male that measured 14 inches and was from the 2018 year-class (age-1+). The average length of Pink Salmon was 16 inches (range: 15-17), 4 were female and 6 were males, and all were from the 2018 year-class (age-1+). Three Splake were males, of which two were ripe (running milt), and one was a female that was green (eggs unable to be expatriated). Three Splake were from the 2016 year-class (age-3) and one was from the 2015 year-class (age-4). All splake had adipose only clips. All Splake were stocked in Lake Superior as yearlings by the Wisconsin DNR and strayed to Knife River.

Knife River Juvenile Trap

A total of 5,223 juvenile salmonids were captured in 2019, of which 98% (5,120) were Rainbow Trout and 1% or less were Brown Trout (86) and Brook Trout (17). Most (82%, 4,248) fish were captured in June (Figure 2). Only 98 juvenile salmonids were captured in the fall, of which 62% (61) were steelhead, 34% (33) were Brown Trout, and 4% (4) were Brook Trout (Table 3).

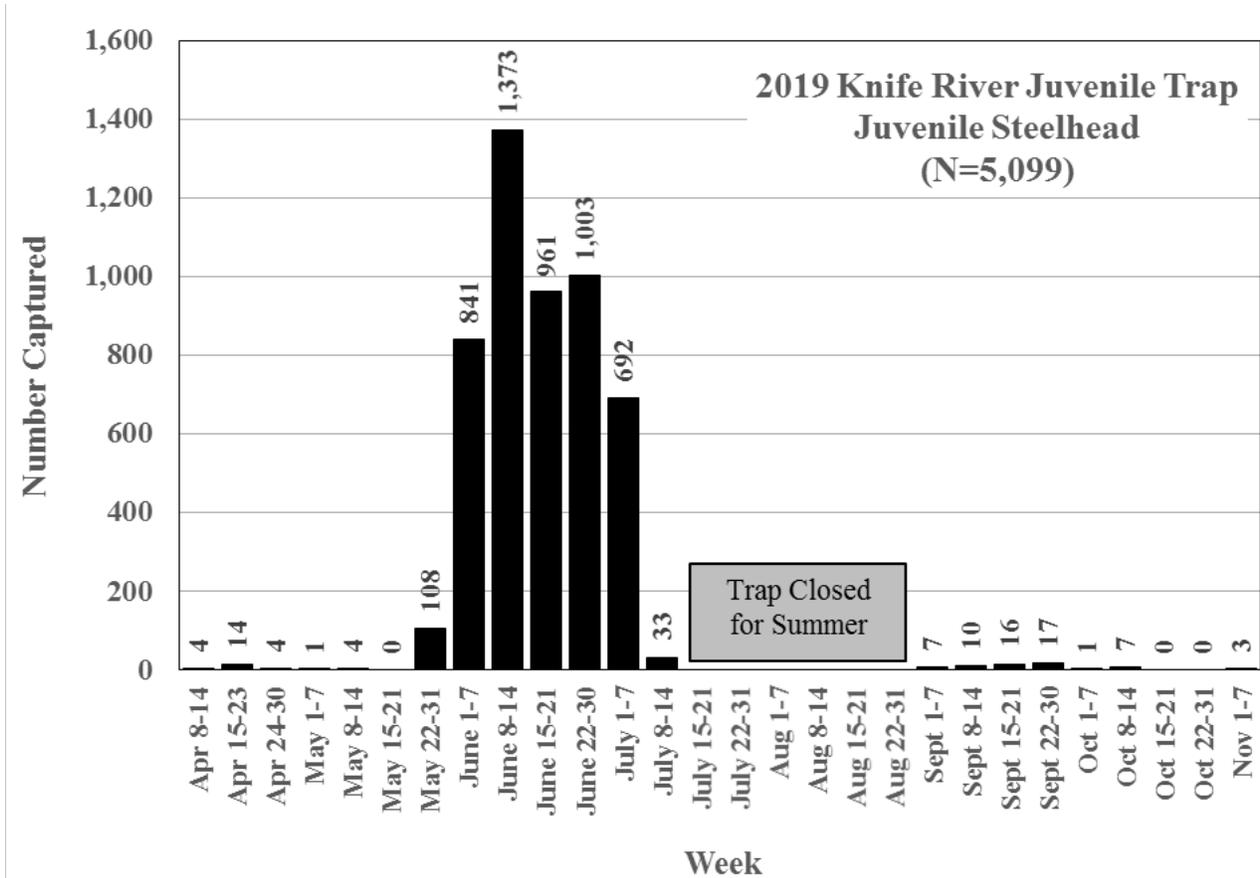


Figure 2. The number of unclipped (wild produced) juvenile steelhead captured in the Knife River juvenile fish trap by week in 2019.

A total of 5,099 unclipped (wild produced) juvenile steelhead were captured in 2019, which was much lower than the historic average of 12,353. The total after adjusting for trap efficiency was 6,134, which was much lower than the historic average of 14,324. Approximately 28% (1,746) were age-1, 70% (4,306) were age-2, and 1% or less were age-0 (67) and age-3 (15) (Table 3, Figure 3).

Age-2 and older steelhead smolts are very important because they will comprise most of the adult steelhead that return to Knife River. The estimated number of age-2 and older emigrants has been higher than the historic average (3,114) over the last three years (Figure 4). Total smolt production was high for the 2015, 2016 and 2017 year classes and corresponded to the three consecutive years of above average adult steelhead returns to Knife River. Adult steelhead returns to Knife River could be good in coming years if age-2 and older smolts from these year classes have average or better survival rates (average return of age-2 smolts = 12%, MNDNR unpublished data) (Figure 4).

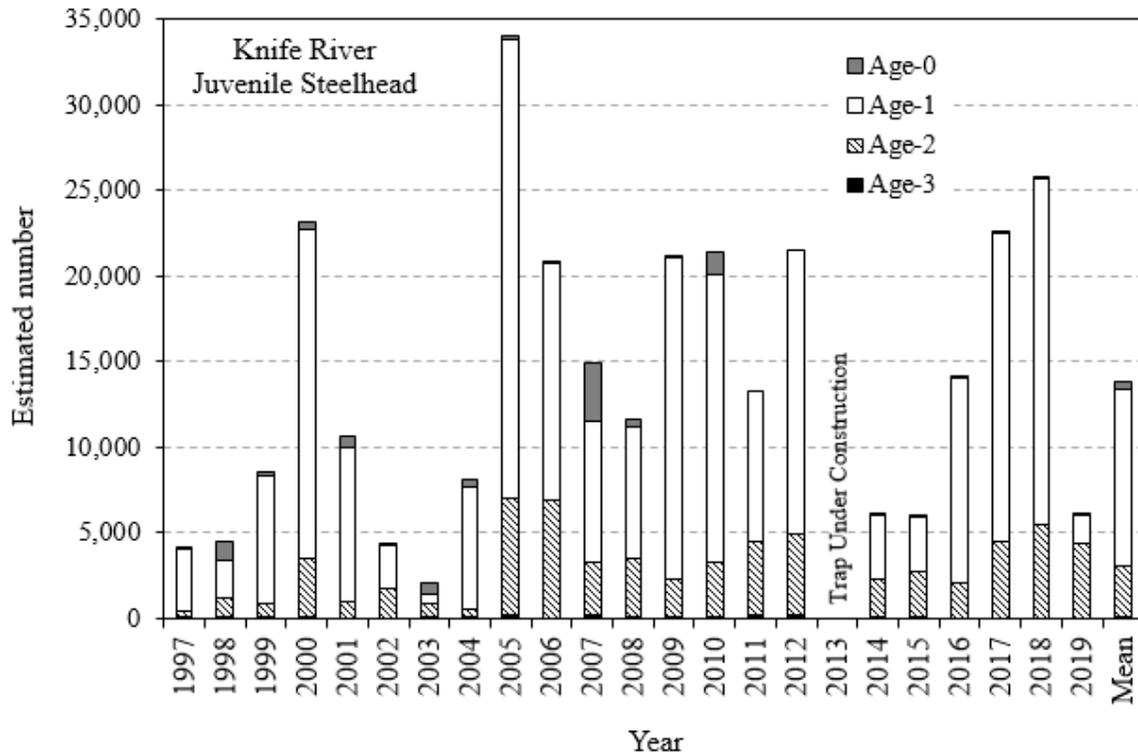


Figure 3. Estimated number of juvenile steelhead emigrants in the Knife River by year, including the historic average (Mean) from 1997 to 2019.

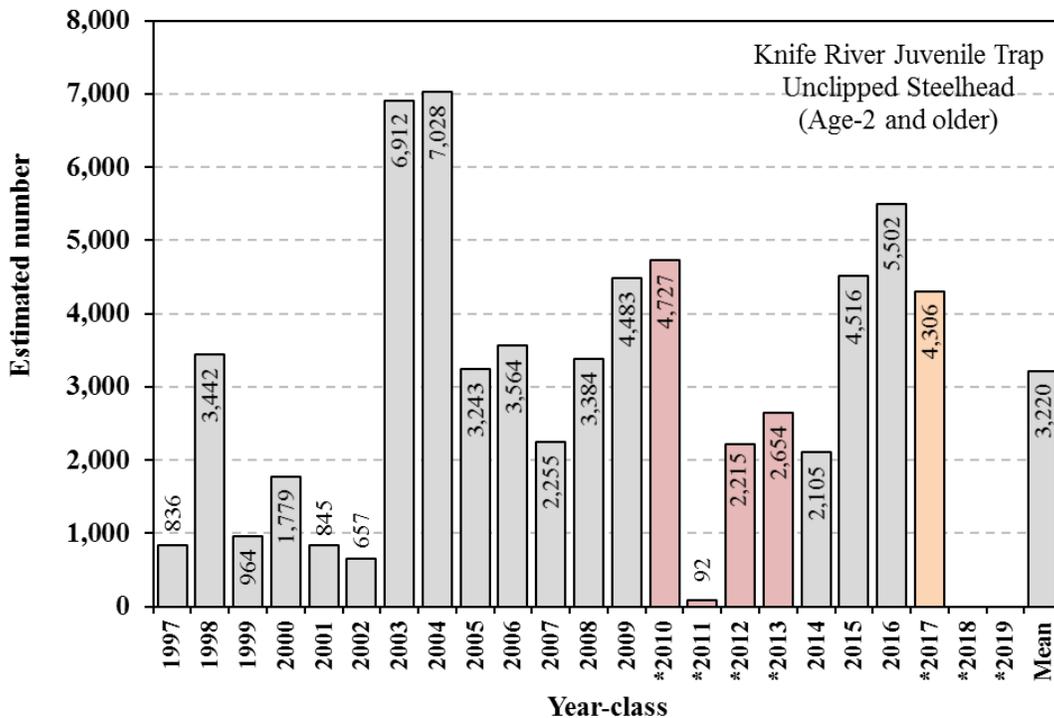


Figure 4. Estimated number of age-2 and older unclipped juvenile steelhead emigrants in the Knife River by year-class. The historic average (Mean) is shown from 1997 to 2019 and excludes all incomplete year-classes shown with an asterisks (*).

Twenty-one clipped juvenile steelhead were captured from LSSAs Steelhead Relocation Project in 2019. All clipped fish had a left pelvic (LR) fin clip. After adjusting for trap efficiency, the estimated total with LR fin clips was 25 (Table 3). All LR clipped steelhead were age-2 and average total length was 7.3 inches (range: 6.6 – 8.0). All LR clipped fish were captured between June 1 and June 23. All LR clipped fish were captured in the juvenile trap in June 2018, were clipped and relocated upstream to Tributary 9 of the Knife River, and then remained somewhere in the Knife River or its tributaries for one additional year before emigrating again. All LR clipped recaptures were released downstream. No right pectoral (RF) clipped steelhead that would be age-3 were recaptured in 2019. The Steelhead Relocation Project is now complete and a final report will be published on the MNDNR Lake Superior Area Fisheries website in spring 2020.

Twenty-four Brook Trout were captured in 2019, 17 (71%) in the spring and 7 (29%) in the fall. Average total length was 8.4 inches (range: 5.2 – 10.9). Six (33%) were age-1 and 18 (67%) were age-2. After adjusting for trap efficiency, the estimated total was 31 (Table 3). A small fin clip was collected from 7 Brook Trout for the Coaster Genetics Project (more information here: <https://www.minnesotasteelheader.com/CGP.html>).

Eighty-five Brown Trout were captured in 2019, 53 (62%) in the spring and 32 (38%) in the fall. Average total length was 6.3 inches (range: 4.1 – 11.0). Approximately 81% (69) were age-1 and 19% (16) were age-2. After adjusting for trap efficiency, the estimated total was 115 (Table 3).

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Area Fisheries Supervisor: _____ Date: _____

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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 2019. 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	2019	Mean
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	4/5	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	7/12	6/26
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	99	77
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	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	0	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	0
Kamloops (clipped)	37	48	48	82	65	108	44	72	120	97	27	22	21	46	26	29	20	—	29	17	19	44	43	58	49
Steelhead (clipped)	29	28	20	43	120	40	76	111	201	136	204	284	274	258	290	182	62	—	21	47	47	28	48	71	114
<i>Adipose-only (A)</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1
<i>Left-pelvic (LR)</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0	3	2
<i>Right-pectoral (RF)</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	2	2
<i>Right-pelvic (RR)</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	1	2
<i>Right-maxillary (RM)</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	45	64	55
Steelhead (unclipped) ¹	86	340	381	452	254	162	192	313	488	373	253	285	332	401	446	419	271	—	484	923	1,029	870	554	559	429
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	693	614

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 2019. 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	2019	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	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	11/6	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	62	69
Brook Trout	0	2	3	1	0	3	2	0	3	2	0	1	1	0	0	1	—	—	1	1	1	3	2	0	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	23
Chinook Salmon	4	1	9	9	2	0	2	0	0	0	0	11	5	0	0	0	—	—	1	3	0	1	3	1	2
Coho Salmon	6	16	37	10	5	1	16	0	3	3	0	9	11	9	71	0	—	—	0	8	17	5	53	32	14
Kamloops	4	0	12	1	4	1	0	0	0	0	0	5	7	0	3	10	—	—	0	2	0	0	1	0	2
Pink Salmon	0	9	20	39	48	0	3	0	0	2	7	10	0	2	258	103	—	—	0	1	4	207	2	10	33
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	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	4	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	7	5
<i>Adipose + Left-pelvic (ALR)</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0	2	1
<i>Left-pelvic (LR)</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	0	1
<i>Right-pectoral (RF)</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0	2	1
<i>Right-pelvic (RR)</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0	0	0
<i>Right-maxillary (RM)</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	9	3	6
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	53	35
All Species	108	111	245	144	163	44	93	36	96	49	17	115	100	45	359	117	—	—	17	181	52	242	122	130	118

¹Counts made from fishway and video surveillance; ²Specific 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 2019.

2019 Species/Clip	N	Age				N^A	Age			
		0	1	2	3		0	1	2	3
Rainbow Trout (steelhead)	5,120	49	1,652	3,409	10	6,160	67	1,746	4,332	15
<i>No clip (NC)</i>	5,099	49	1,652	3,388	10	6,135	67	1,746	4,306	15
<i>Right Front (RF)</i>	0	0	0	0	0	0	0	0	0	0
<i>Left Rear (LR)</i>	21	0	0	21	0	25	0	0	25	0
Brook Trout	24	0	6	18	0	31	0	8	23	0
Brown Trout	85	0	69	16	0	115	0	94	21	0
All Species	5,229	49	1,727	3,443	10	6,306	67	1,848	4,376	15

N = Total number captured.

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