

State: Minnesota
Project: F-29-R-27
Period: 4-15-07 to 11-02-07

Supplemental Report for the
Juvenile Fish Trap
on the Knife River
2007

Introduction

This report is an annual update to the comprehensive juvenile report completed in 2006. The purpose of this report is to present data that aid in the achievement of the goal to rehabilitate steelhead stocks using Minnesota strain fish to a level that will allow limited angler harvest largely supported by natural reproduction (Schreiner et al. 2006). The next comprehensive juvenile report will be combined with the adult trap report and completed in 2012. Annual supplemental reports will be completed each year in the interim. Trap location and sampling methods can be found in the 2006 juvenile trap report: *Results of Operating the Juvenile Fish Trap on the Knife River 1996-2006* (Ward and Blankenheim 2006). Specifications of the trap design can be found in Dexter and Schliep (2007).

2007 Trap Operations Summary

The juvenile trap was open for 201 days between April 15 and November 2, 2007. Throughout 2007, the trap captured all water flowing downstream 47% of the time, compared to the 97-06 mean of 63%. Above average discharge throughout October accounted for the difference in these percentages. However, 78% of the estimated steelhead emigrants were sampled while the trap was capturing the entire flow (mean of 62%). More juveniles were captured while the trap was capturing the entire flow in 2007 because juveniles primarily emigrate in spring and runoff was low compared to the long-term mean.

Between July 5 and July 27, unclipped age-0 steelhead were subsampled on thirteen days. A total of 2,519 were counted and not measured throughout this time period. Due to the abnormally high number of age-0 steelhead sampled throughout July, the first 50 age-0 individuals were measured and collectively weighed and the rest only counted. Age-1 though -3 juveniles were subsampled on four days throughout mid-June, on days when greater than 900 individuals were captured. Personnel measured between 350 and 650 individuals on each of the four days and counted the rest.

The French River Hatchery initiated a Knife River brood stock program in 2003, and between 250 and 350 juveniles from the Knife River are returned to the French River Hatchery annually to be reared to adults for the captive brood program. In mid-May 2007, 261 unclipped juvenile steelhead that were primarily age-1 (mean length of 131 mm), were returned to the French River Hatchery for this program.

In 2007, no steelhead fry were stocked in the Knife River or any of its tributaries, due to all returning adults being passed upstream of the trap. A total of 30,945 hatchery reared right maxillary clipped yearlings were stocked in the Knife River in 2007 directly downstream of the trap on May 14 (27,657) and June 13 (3,288). Individuals stocked June 13, were juveniles that were held an additional month to attain a greater size.

The non-game fish sampled by the Knife River juvenile trap in 2007 included 166 black bullhead, 9 blacknose dace, 1 brook stickleback, 10 central mudminnow, 381 common shiner, 45 creek chub, 66 fathead minnow, 6 finescale dace, 1 johnny darter, 2 log perch, 22 longnose dace, 5 northern redbelly dace, and 27 white sucker.

Determining Trap Efficiency

Knife River juvenile trap efficiency trials were conducted with unclipped juveniles ($n = 1,292$) from 1996 through 2002 and clipped juveniles ($n = 1,539$) from 2003 through 2006. Throughout these two efficiency trials, 57% and 61% of juveniles were recaptured, respectively. A detailed explanation of these trials can be found in Ward and Blankenheim (2006).

Efficiency trials were not conducted in 2007. The Little Knife River trap was no longer in operation, and hatchery reared clipped age-1 juveniles were not stocked upstream of the Knife River trap. On average, only thirteen juveniles were sampled per day from mid-April through late-May (primarily age-2 individuals). Due to minimal amounts of spring runoff, the trap was taking all water most days in June when higher numbers of age-1 juveniles were sampled. As a result of the low sample size and low spring discharge, efficiency trials were not conducted in

2007. Therefore, the efficiency percentage applied in 2007 was 60%, based on the 1997-2006 cumulative weighted recapture rate (Ward and Blankenheim 2006).

Results and Discussion

Unclipped Juvenile Steelhead

An estimated 14,980 juveniles emigrated throughout 2007, compared with the mean of 14,205. A total of 126 unclipped juveniles (0.8% of total estimated emigrants) were found dead in the trap in 2007, primarily during extreme temperature conditions. In 2007, an estimated 2,810 age-2 steelhead emigrated, which is the third highest number for this age-class since the trap was installed. The estimated numbers of age-0 (3,854) and age-3 (123) emigrants were higher than the mean, while the number of age-1 emigrants (8,193) was below the mean (Figures 1 and 2, Table 1). Of the complete year-classes monitored (i.e. those that have had age-0 through age-3 emigrate), the 1998, 1999, 2000, and 2004 year-classes have had the greatest number of emigrants since the trap became operational (Figure 2, Table 1).

One factor related to the number of juvenile steelhead that emigrate is the number of adult females estimated to be upstream of the trap spawning each spring, commonly referred to as the adult/smolt relationship (Figure 3). Factors that influence this relationship in the lake include predation, forage and habitat availability, and water temperature, among others. These lake factors control the likelihood these juvenile emigrants return as adults. The likelihood of an age-1 and age-2 juvenile emigrant returning is 0.3% and 12.8% in the Knife River, based on data collected thus far (Table 2).

Annual downstream movement of juvenile steelhead occurs primarily in the spring (April through June), with 88% of all juveniles sampled at this time. Almost all age-2 and age-3 individuals are annually sampled in the spring. In 2007, 100% of age-3, 98% of age-2, and 86% of age-1 juveniles were sampled in spring. Age-0 steelhead are primarily sampled in summer (July and August), with 86% of age-0 juveniles sampled at this time on average. In 2007, 98%

were sampled in summer, and 2% in fall, likely due to abnormally high water temperatures and low flows in summer resulting in juveniles migrating downstream prematurely in search of thermal refuge.

Knife River discharge again indicated that most juveniles that emigrate throughout the mid-May through early July time period do so during lags in discharge (Figure 4). This time period also corresponds with an increase in water temperature. The 2007 Knife River data indicate that the emigration of age-2 juveniles in spring starts when daily water temperatures exceed 15° C, and emigration of age-1 juveniles starts when mean daily water temperatures exceed 20° C (Figure 5). Emigration of age-1 individuals in the spring is likely a function of carrying capacity being exceeded upstream; as water depths decrease and water temperatures increase, juveniles are forced to seek habitat and thermal refuge downstream.

Clipped Juvenile Steelhead

A total of 70,675 clipped age-1 steelhead derived from Knife River adults from the 'catch and donate' program, were stocked into the Knife River both upstream and downstream of the current trap location in 1990, 1991, 1992, and 1993. This is referred to as 'phase one' of the yearling-stocking program (Schreiner 2003). Due to the Knife River adult trap not becoming operational until spring 1996, return rates of these stockings are inconclusive.

Approximately 20,000 clipped age-1 steelhead were annually stocked directly downstream of the Knife River trap in 1997, 1999, and 2001 in an attempt to increase the number of returning adult steelhead. This is referred to as 'phase two' of the yearling-stocking program (Schreiner 2003). These stockings resulted in return rates to the adult trap of 0.9%, 0.4%, and 1.4%, with a mean of 0.9% (Table 3).

In 2003, 'phase three' of the yearling-stocking program was initiated (Schreiner 2003). Phase three consisted of evaluating the most appropriate stocking location for hatchery reared

clipped steelhead yearlings in the Knife River. Approximately 20,000 hatchery yearlings were stocked upstream of the trap and 20,000 were stocked directly downstream of the trap annually from 2003 through 2006 (Table 3). Of the individuals stocked upstream, 37% were implanted with a coded wire tag (CWT). A magnetic sensor is used to detect the tag. As a result, 17.7% of all yearlings stocked possess a CWT. Coded wire tags were implanted to determine if upstream stocking increases the imprinting and/or survival rate prior to smoltification, which would decrease straying and increase the number of adults returning to the Knife River.

Of the 360 clipped adults that have returned from these stockings, 55 possessed coded wire tags (15.3%), which is less than the overall percentage of coded wire tagged fish stocked (17.7%). If stocking clipped juveniles upstream benefits imprinting or survival, the percentage of coded wire tagged fish observed from returning adults (15.3%) would be greater than the original percentage tagged (17.7%). At this point in the evaluation, stocking location appears to make little difference in the number of adults returning. The evaluation will be completed when all adults from these year-classes return by 2012.

Of the age-1 maxillary clipped yearlings stocked upstream of the trap from 2003 through 2006, an estimated 57% have emigrated past the juvenile trap (Tables 3 and 4). The majority of stocked clipped yearlings emigrated within one month of upstream stocking. Overall, an estimated 43% of clipped juveniles stocked upstream between 2003 and 2006 died prior to reaching the juvenile trap. Thus far, the 2003, 2004, and 2005 stockings have resulted in return rates to the adult trap of 0.4%, 0.1%, and 0.4% (Table 3).

Environmental Influences

Steelhead in streams on the Minnesota shore of Lake Superior are commonly subjected to adverse environmental conditions throughout their juvenile life stage. The environmental variables that are annually measured and related to juvenile steelhead survival in the Knife

River include precipitation, discharge, air and water temperature. In general, the two time periods when the most stressful conditions occur are winter and late summer.

Stressful conditions in winter occur when there are prolonged periods of sub-zero air temperatures and snow depths that are insufficient to insulate streams. These conditions often result in streams becoming frozen to the bottom in reaches, greatly reducing habitat for fish. In 2007, all of St. Louis, Lake, and Cook Counties were designated as being in extreme drought status throughout January and February. Cumulative precipitation amounts in January 2007 were less than every single January precipitation amount from 1970 through 2006. Numerous reports of stream reaches freezing to the bottom and water flowing on top of the ice were relayed to area fisheries offices along the Lake Superior shore throughout February 2007.

Stressful conditions in late summer are the result of low water levels and high water temperatures. In 2007, all of St. Louis, Lake, and Cook Counties were designated as being in either severe or extreme drought status from early August through September. Cumulative precipitation amounts throughout July and August 2007 were less than half that of long-term means. Mean monthly flows in the Knife River in July and August were less than one-quarter of the long-term mean. As a result, water temperatures recorded at the Knife River trap were at least one degree warmer than the long-term means in both July and August. Mean air temperatures were also 1° C warmer than July and August average air temperatures. The range of thermal stress for juvenile steelhead starts at 20° C, and based on water temperatures obtained at both traps, juveniles experienced stressful water temperatures in the lower reaches of the Knife River in 2007 for 82 days.

Brook trout

An estimated sixteen brook trout migrated in 2007, compared with a mean of 32 (Table 5). The majority (59%) of brook trout are annually sampled during spring when compared with summer (4%) and fall (37%). Downstream migration of brook trout in 2007 was 93% in spring, 13% in summer, and 25% in fall.

Brown trout

An estimated 152 brown trout migrated in 2007, compared with a mean of 310 (Table 6). The majority (77%) of brown trout are annually sampled during spring when compared with summer (7%) and fall (16%). Downstream migration of brown trout in 2007 was 73% in spring, 13% in summer, and 14% in fall.

References

- Dexter, Daniel J. and D.V. Schliep. 2007. Design of a compound inclined screen trap for anadromous salmonid smolts. *North American Journal of Fisheries Management* 27:885-890.
- Schreiner, D. R., J. J. Ostazeski, T.N. Halpern, and S. A. Geving. 2006. Fisheries management plan for the Minnesota waters of Lake Superior. Special Publication 163, Minnesota Department of Natural Resources, Duluth.
- Schreiner, Donald R. [ED]. 2003. Rainbow trout management plan for the Minnesota waters of Lake Superior. Minnesota Department of Natural Resources Special Publication #157, St. Paul, MN. 17 p.
- Ward, Matthew C., and J.E. Blankenheim. 2006. Results of Operating the Juvenile Fish Trap on the Knife River 1996-2006. Minnesota Department of Natural Resources, St. Paul, MN.

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ANNUAL REPORT

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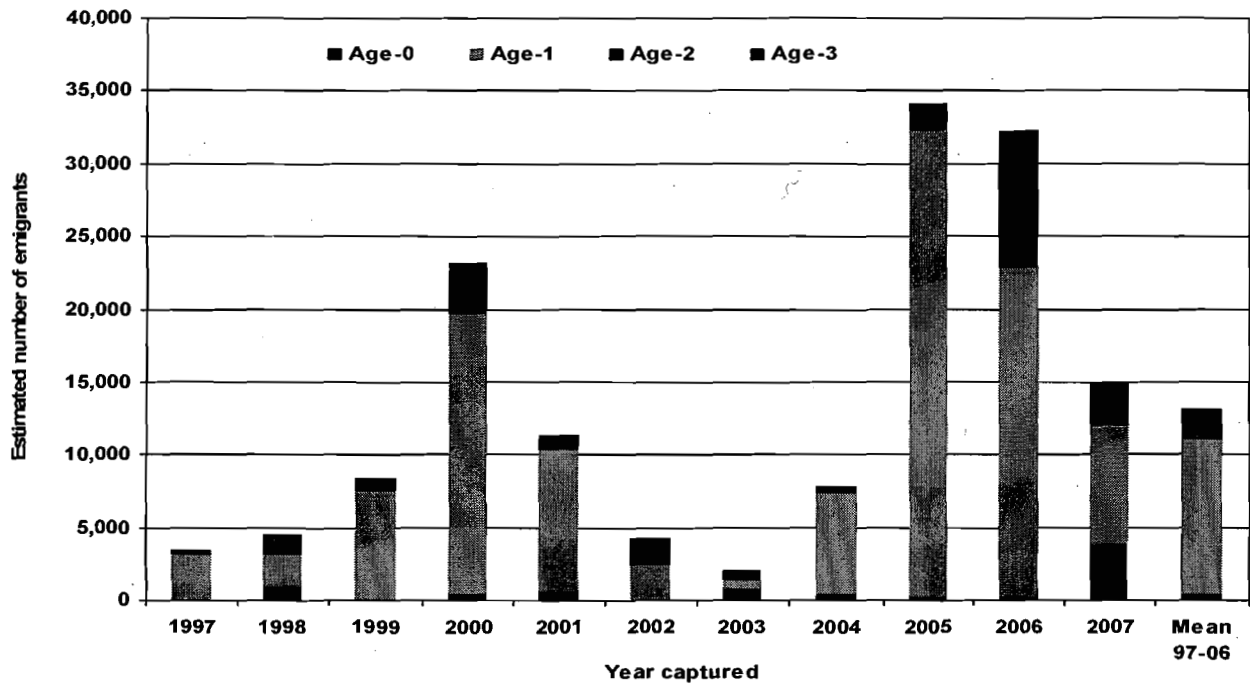


Figure 1. Estimated number of unclipped juvenile steelhead that emigrated down the Knife River from 1997 through 2007.

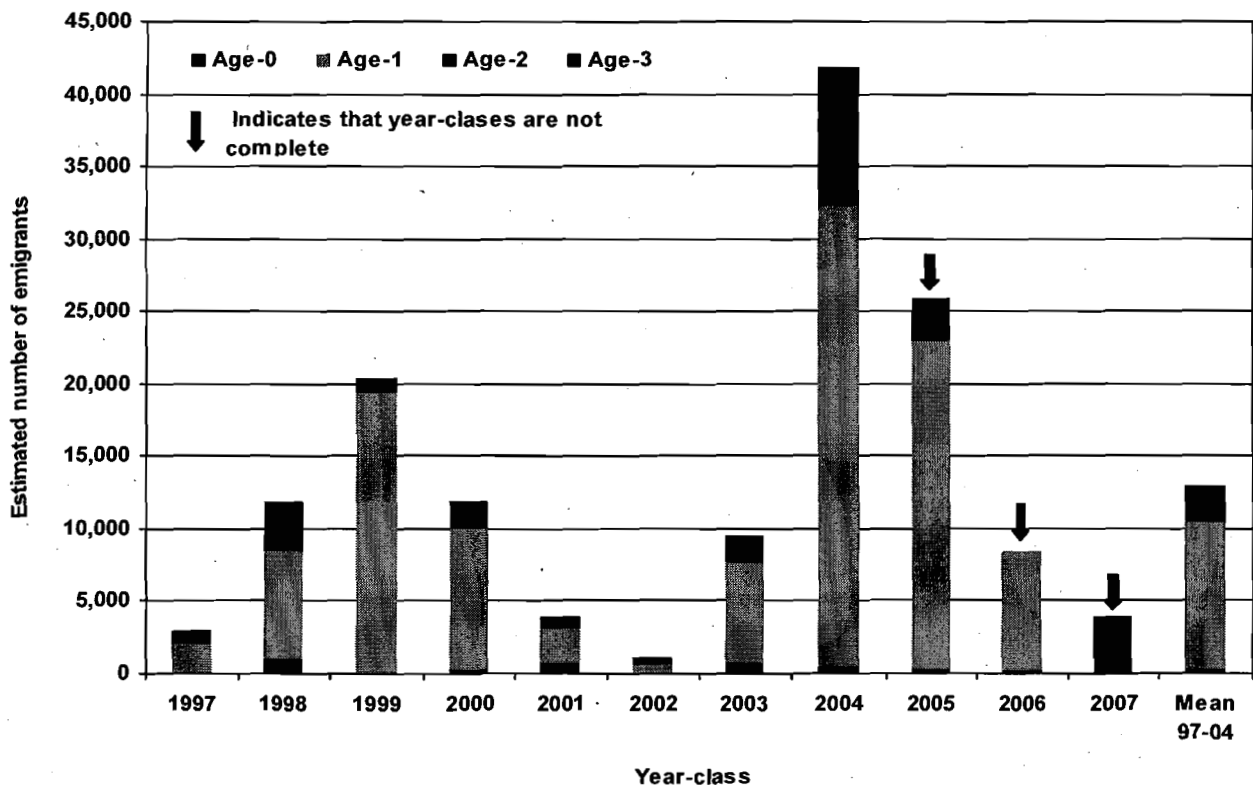


Figure 2. Estimated number of unclipped juvenile steelhead per year-class, that emigrated down the Knife River from 1997 through 2007.

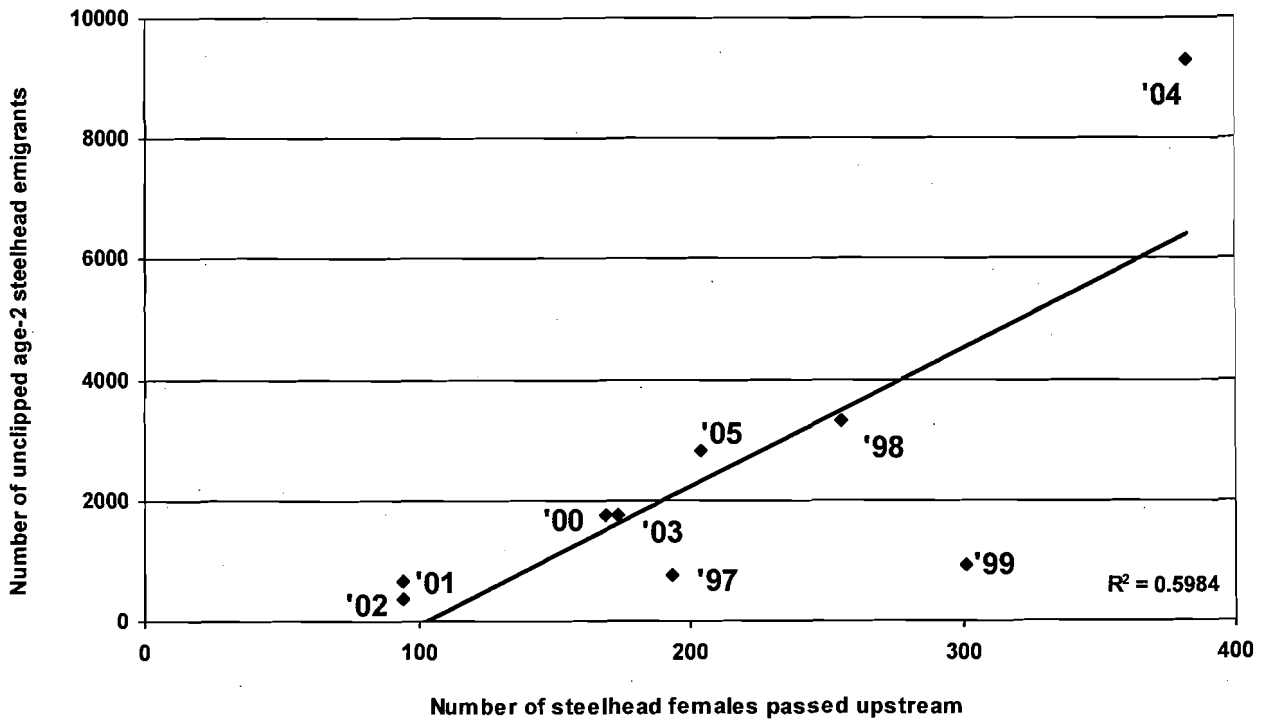


Figure 3. The relationship between the estimated number of female adult steelhead spawning upstream in the Knife River and the estimated number of age-2 unclipped juvenile emigrants by year-class for the Knife River from 1997 through 2004 (adult/smolt relationship).

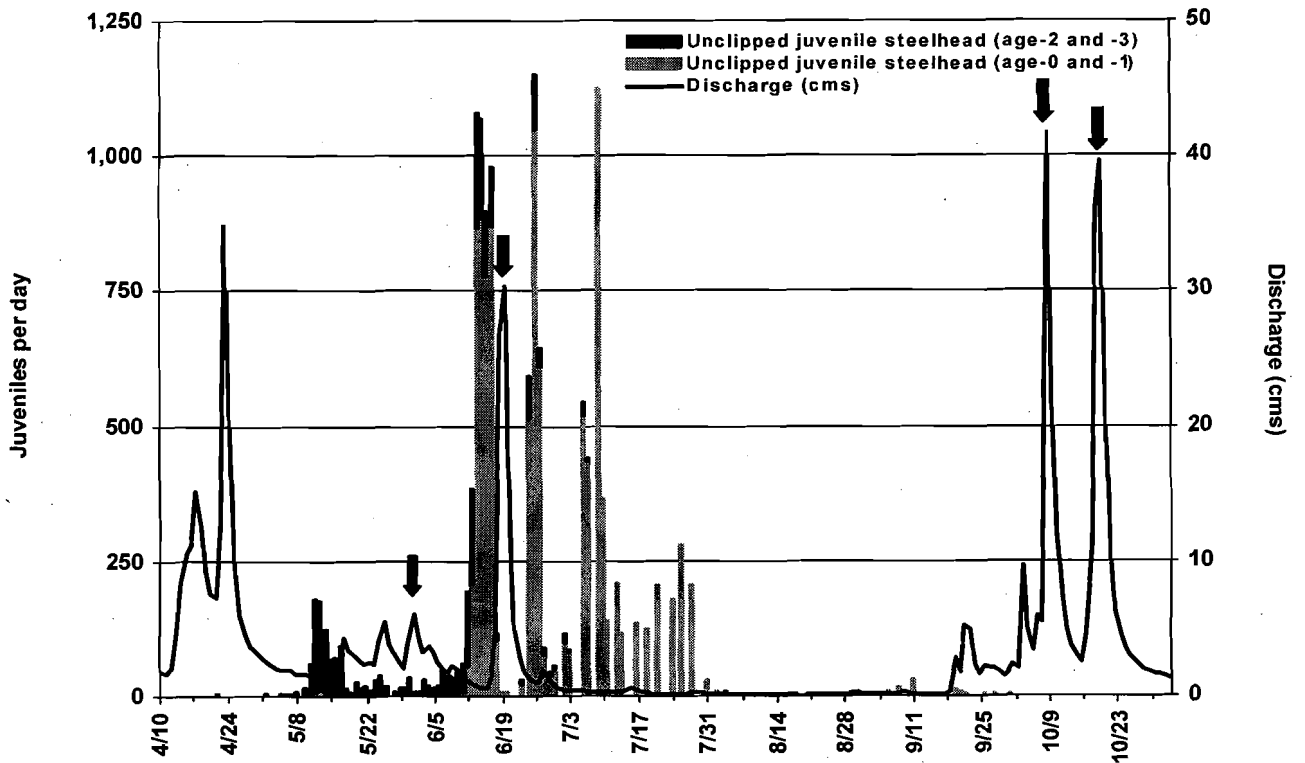


Figure 4. Number of juvenile steelhead captured by day in 2007 and the mean instantaneous daily discharge (cms) of the Knife River. Arrows indicate high discharge when low numbers of juveniles were sampled.

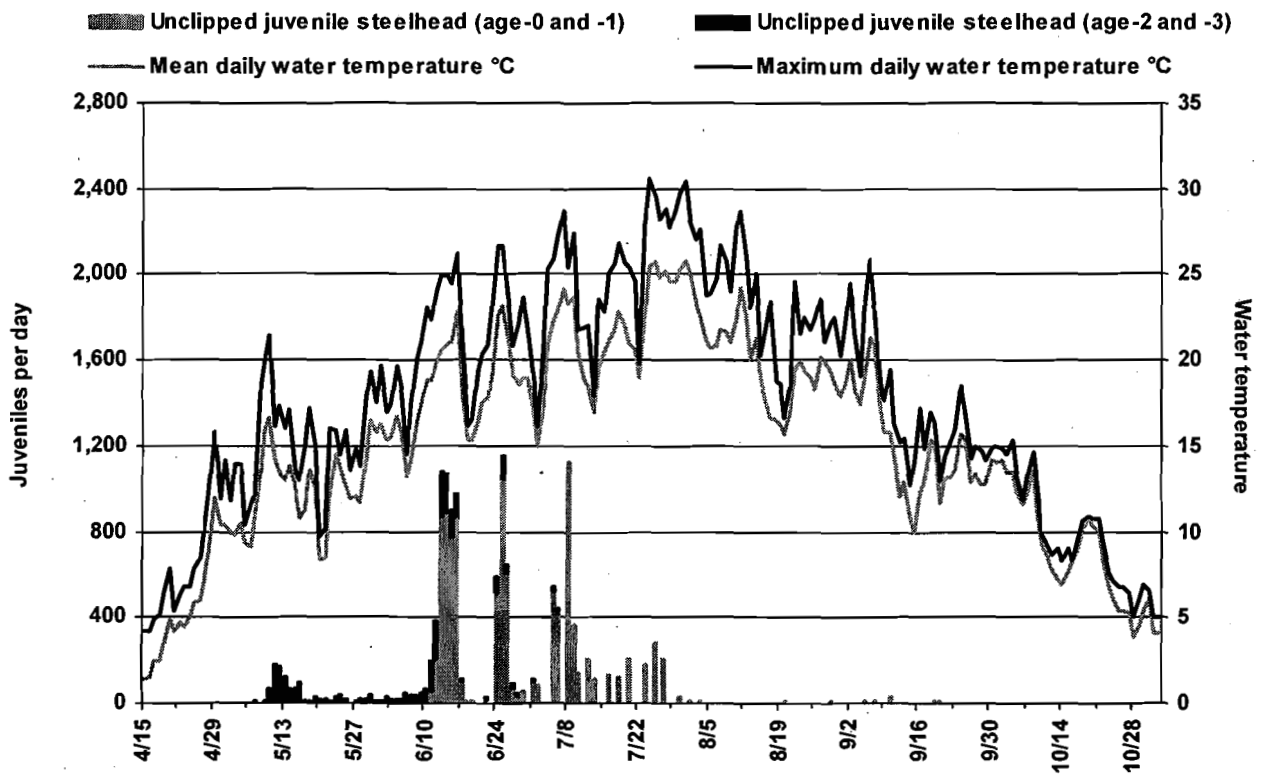


Figure 5. Number of juvenile unclipped and maxillary clipped steelhead captured in the Knife River juvenile trap compared with the mean and maximum daily water temperature (°C) throughout the 2007 trap season.

Table 1. Descriptive statistics (number (n) and percentage (%)) for Knife River unclipped juvenile steelhead emigrants from 1997 through 2007.

Year	1995		1996		1997		1998		1999		2000		2001		2002		2003		2004		2005		2006		2007		Mean 97-06	
Date trap was opened					4/14		3/25		4/7		3/26		4/18		4/14		4/21		4/7		4/10		4/6		4/15		4/8	
Date trap was closed					11/4		11/5		11/15		11/9		11/16		11/8		11/7		9/6		11/4		10/30		11/2		11/1	
Number days trap open					204		225		222		228		212		208		200		152		208		207		201		207	
Estimated emigrants by age	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Age-0					7	0%	1,085	24%	112	1%	450	2%	733	6%	38	1%	767	37%	484	6%	387	1%	233	1%	3,854	26%	430	3%
Age-1					3,177	92%	2,144	48%	7,484	89%	19,302	83%	9,651	85%	2,465	58%	592	29%	6,936	88%	31,926	93%	22,672	70%	8,193	55%	10,635	81%
Age-2					250	7%	1,210	27%	772	9%	3,322	14%	917	8%	1,751	41%	673	33%	366	5%	1,761	5%	9,291	29%	2,810	19%	2,031	15%
Age-3					22	1%	22	0%	29	0%	58	0%	13	0%	15	0%	29	1%	53	1%	73	0%	25	0%	123	1%	34	0%
Total number					3,455		4,461		8,396		23,133		11,314		4,269		2,061		7,840		34,147		32,221		14,980		13,130	
Est. emigrants by year-class	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i> ¹	(%) ¹
Age-0	**		**		7	0%	1,085	9%	112	1%	450	4%	733	19%	38	4%	767	8%	484	1%	387		233		3,854		460	4%
Age-1	**	3,177			2,144	72%	7,484	63%	19,302	95%	9,651	81%	2,465	63%	592	55%	6,936	73%	31,926	76%	22,672		8,193		**		10,063	78%
Age-2	250	1,210			772	26%	3,322	28%	917	5%	1,751	15%	673	17%	366	34%	1,761	19%	9,291	22%	2,810		**		**		2,357	18%
Age-3	22	29			58	2%	13	0%	15	0%	29	0%	53	1%	73	7%	25	0%	123	0%	**		**		**		49	0%
Total number	234**	3,941**			2,981		11,904		20,346		11,881		3,924		1,069		9,489		41,824		25,869**		8,426**		3,854**		12,927	

¹ numbers and percentages reflect the year-classes that have completely emigrated (1997 through 2004)

Table 2. The percent return of unclipped juvenile emigrants¹ of different ages from the Knife River. Age of emigration for adult returns is determined by scale increments. Numbers included are the estimated number of emigrants versus the actual number of returning adults.

Year-class	Number returning adults that emigrated at age-1	number age-1 emigrants	Percent	Number returning adults that emigrated at age-2	number age-2 emigrants	Percent	Number returning adults that emigrated at age-3	number age-3 emigrants	Percent
1995	No data			73	250	29.2%	9	22	40.9%
1996	42	3,177	1.3%	107	1,210	8.8%	12	29	41.4%
1997	18	2,144	0.8%	92	772	11.9%	39	58	67.2%
1998	15	7,484	0.2%	398	3,322	12.0%	57	13	>100%**
1999	27	19,302	0.1%	260	917	28.4%	14	15	93.3%
2000	12	9,651	0.1%	166	1,751	9.5%	8	29	27.6%
2001 ²	7	2,465	0.3%	59	673	8.8%	4	53	7.5%
2002 ²	2	592	0.3%	48	366	13.1%	10	73	13.7%
2003 ²	13	6,936	0.2%	59	1,761	3.4%	1	25	4.0%
2004 ²	15	31,926	0.0%	40	9,291	0.4%	0	123	0.0%
2005 ²	0	22,672	0.0%	3	2,810	0.1%	No data		
2006 ²	0	8,193	0.0%	No data			No data		
Cumulative 1996-00:	114	41,758	0.3%	1,023	7,972	12.8%	130	144	90.3%
Mean of 94-99 percents			0.6%			15.3%			50.5%

¹ Unclipped juveniles that were sampled in the Little Knife River juvenile trap between 1988 and 2003 were given a right maxillary clip, and were considered unclipped adults when they returned.

² All adults have not likely returned from these year-classes. Returns include adults captured through the fall of 2007.

** Errors associated with this percentage could occur when the scale reader determines how many years a returning adult remained upstream prior to emigrating, or when the scale reader ages the ages the juvenile emigrants.

Table 3. The adult return rate of clipped age-1 juveniles stocked in the Knife River through fall 2007. Numbers include the actual number of returning adults, not adjusted for efficiency.

Year stocked	Year class	Clip ²	Number juveniles stocked	Number juveniles stocked upstream	Number juveniles with coded wire tag	Percent juveniles with coded wire tag	Number of returning adults	Number adults with coded wire tag	Percent adults with coded wire tag	Return rate
1997	1996	AdRmLr	18,214				167			0.9%
1999	1998	AdRmRr	22,428				89			0.4%
2001	2000	AdRmLr	18,710				271			1.4%
2003	2002 ¹	Lm	42,481	19,653	8,317	19.6%	184	27	14.7%	0.4%
2004	2003 ¹	Lm	40,890	19,224	7,664	18.7%	31	4	12.9%	0.1%
2005	2004 ¹	Rm	38,565	17,864	5,947	15.4%	139	22	15.8%	0.4%
2006	2005 ¹	Lm	42,190	20,809	7,197	17.1%	6	2	33.3%	0.0%
2007	2006 ¹	Rm	30,945	0					0.0%	0.0%
Mean						17.7%				
Weighted return rate of 1997, 1999, and 2001 stockings										0.9%
Weighted return rate of 2003, 2004, 2005, and 2006 stockings										0.2%

¹ all adults have not likely returned from these year-classes

² AdRmLr: Adipose Right Maxillary Left Rear; AdRmRr: Adipose Right Maxillary Right Rear; Lm: Left Maxillary; Rm: Right Maxillary

Table 4. The estimated number of clipped juvenile steelhead emigrants adjusted for the Knife River juvenile trap efficiency, when only capturing partial stream flow. (*n* = number)

Year	Dates open	Clip ¹	Total number juveniles sampled	Year class	Juveniles captured while taking entire flow		Juveniles captured while taking partial flow		Estimated number and percentage of juveniles not sampled		Estimated number emigrants
					<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
2003	4/21 - 11/7	LMC	5,311	2002	2,942	55%	2,369	45%	818	13%	6,129
2004	4/7 - 9/6	LMC ²	726	2002	114	16%	613	84%	801	52%	1,528
2004	4/7 - 9/6	LMC ²	5,326	2003	832	16%	4,493	84%	5,874	52%	11,199
2005	4/11 - 11/4	LMC ²	36	2002	5	14%	31	86%	45	56%	81
2005	4/11 - 11/4	LMC ²	93	2003	12	13%	81	87%	119	56%	212
2005	4/11 - 11/4	RMC	6,511	2004	752	12%	5,759	88%	8,537	57%	15,048
2006	4/6 - 10/30	RMC	94	2004	32	34%	62	66%	85	47%	179
2006	4/6 - 10/30	LMC	6,545	2005	3,217	49%	3,328	51%	3,062	32%	9,607
2007	4/15 - 11/2	RMC	1	2004	0	0%	1	100%	2	67%	3
2007	4/15 - 11/2	LMC	3	2005	3	100%	0	0%	0	0%	3

¹LMC: Left Maxillary Clip; RMC: Right Maxillary Clip

43,989

²LMC: clipped steelhead stocked in 2004 were given the same clip as those stocked in 2003

Table 5. Descriptive statistics (number (*n*) and percentage (%)) for Knife River brook trout emigrants from 1997 through 2007.

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Mean 97-06														
Date trap was opened	4/14	3/25	4/7	3/26	4/18	4/14	4/21	4/7	4/10	4/6	4/15	4/8														
Date trap was closed	11/4	11/5	11/15	11/9	11/16	11/8	11/7	9/6	11/4	10/30	11/2	11/1														
Number days trap open	204	225	222	228	212	208	200	152	208	207	201	207														
Estimated Emigrants by age	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%										
Age-0	0	0%	0	0%	2	3%	3	18%	0	0%	1	6%	0	0%	0	0%	1	7%	0	0%	1	2%				
Age-1	34	74%	54	62%	29	63%	10	53%	32	79%	6	25%	3	33%	5	100%	17	55%	5	27%	2	13%	19	60%		
Age-2	12	26%	32	38%	14	30%	4	24%	8	21%	15	69%	3	33%	0	0%	12	40%	7	33%	12	75%	11	33%		
Age-3	0	0%	0	0%	2	3%	1	6%	0	0%	0	0%	3	33%	0	0%	2	5%	7	33%	2	13%	1	4%		
Total number	46		86		45		19		40		22		9		5		30		20		16		32			
Estimated Emigrants by year-class	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i> ¹	(%) ¹		
Age-0	0	0%	0	0%	2	7%	3	9%	0	0%	1	25%	0	25%	0	25%	0	25%	0	25%	1	25%	0	0%	1	3%
Age-1	54	78%	29	83%	10	60%	32	54%	6	67%	3	50%	5	50%	17	50%	5	50%	5	50%	2	50%	**	**	20	65%
Age-2	14	20%	4	17%	8	33%	15	31%	3	33%	0	0%	12	0%	7	0%	12	0%	12	0%	**	**	**	**	8	26%
Age-3	1	1%	0	0%	0	0%	3	6%	0	0%	2	25%	7	25%	2	25%	**	**	**	**	**	**	**	**	2	6%
Total number	69		33		20		53		9		6		24		26		17**		3**		0**		30			

¹ numbers and percentages reflect the year-classes that have completely emigrated (1997 through 2004)

** Numbers are incomplete for this year class

Table 6. Descriptive statistics (number (*n*) and percentage (%)) for Knife River brown trout emigrants from 1997 through 2007.

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Mean 97-06												
Date trap was opened	4/14	3/25	4/7	3/26	4/18	4/14	4/21	4/7	4/10	4/6	4/15	4/8												
Date trap was closed	11/4	11/5	11/15	11/9	11/16	11/8	11/7	9/6	11/4	10/30	11/2	11/1												
Number days trap open	204	225	222	228	212	208	200	152	208	207	7/19	207												
Estimated Emigrants by age																								
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%		
Age-0	6	3%	15	4%	8	2%	44	7%	1	0%	2	0%	0	0%	35	62%	2	2%	11	23%	0	0%	12	4%
Age-1	156	78%	120	30%	343	72%	345	52%	581	92%	37	7%	70	59%	16	29%	68	73%	14	30%	79	52%	175	56%
Age-2	34	17%	266	66%	122	26%	274	41%	48	8%	485	91%	41	34%	5	9%	19	20%	22	47%	73	48%	132	42%
Age-3	3	1%	1	0%	5	1%	0	0%	0	0%	9	2%	7	6%	0	0%	5	5%	0	0%	0	0%	3	1%
Age-4	0	0%	0	0%	0	0%	3	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Total number	199		402		479		666		630		534		118		56		94		48		152		310	
Estimated Emigrants by year-class																								
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i> ¹	(%) ¹
Age-0	6	3%	15	3%	8	2%	44	3%	1	2%	2	2%	0	0%	35		2		11		0		11	3%
Age-1	120	56%	343	51%	345	81%	581	51%	37	58%	70	58%	16	46%	68		14		79		**		216	58%
Age-2	122	41%	274	46%	48	14%	485	45%	41	40%	5	40%	19	54%	22		73		**		**		142	38%
Age-3	0	0%	0	0%	9	3%	7	0%	0	0%	5	0%	0	0%	0		**		**		**		3	1%
Age-4	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	**		**		**		**		0	0%
Total number	248		632		410		1,117		79		82		35		125**		89**		90**		0**		372	

¹ numbers and percentages reflect the year-classes that have completely emigrated (1997 through 2003)

** Numbers are incomplete for this year class