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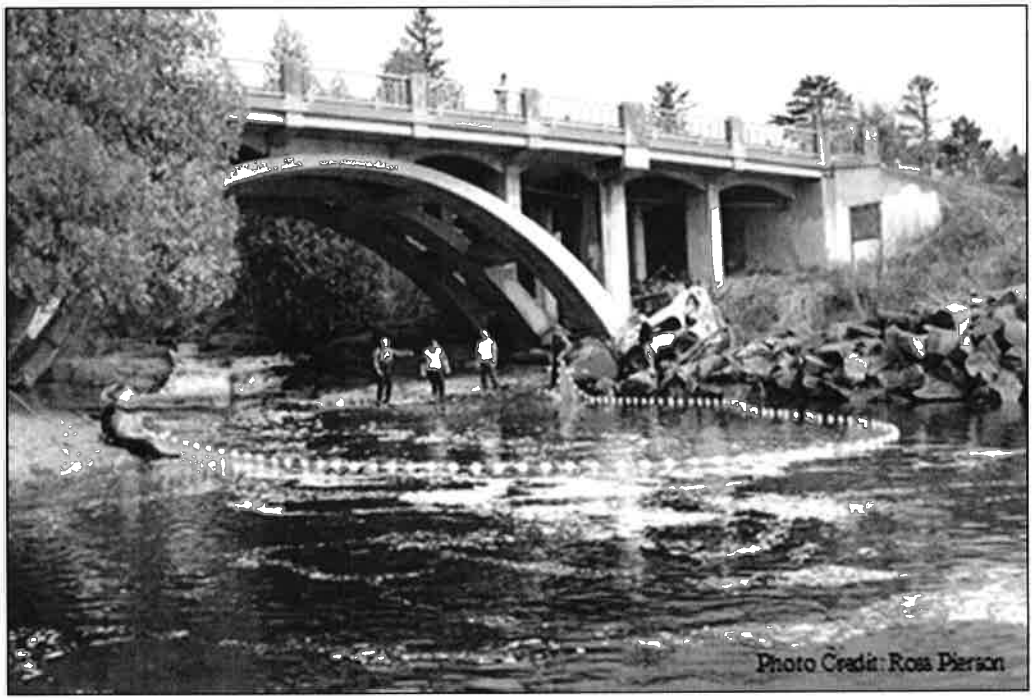
MINNESOTA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISH AND WILDLIFE
SECTION OF FISHERIES

SUPPLEMENTAL REPORT



Results of Operating the French River Juvenile and Adult Fish Traps 2015

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INTRODUCTION

This report provides an annual update of juvenile and adult fish trap operations at the French River. These traps have provided valuable information for assessment and management of Rainbow Trout in Minnesota Waters of Lake Superior. They have provided data to evaluate the Minnesota Department of Natural Resources (MNDNR) steelhead and Kamloops-strain Rainbow Trout stocking programs. The MNDNR steelhead stocking program was initiated to support rehabilitation of steelhead populations following significant declines in the mid to late 1900s, and to provide additional angling opportunities for steelhead in streams with minimal below barrier spawning habitat. The Kamloops stocking program was initiated in 1983 to provide harvest opportunities for Rainbow Trout while steelhead were rehabilitated.

The French River adult fish trap was installed approximately 0.1 miles upstream of the confluence of the French River in 1970, and was reconfigured to its current design in 1982. The adult trap has been used to evaluate adult returns from stocking events in the French River, and to collect gametes for the Kamloops and steelhead stocking programs. The French River juvenile fish trap was constructed approximately 0.2 miles upstream of the mouth of the French River in 1994 (Dexter and Schliep 2007). The juvenile trap has been used to gather information about juvenile fish survival, growth, mortality, and movement patterns, to evaluate stocking programs, and to determine how these metrics influence adult returns to French River. Sampling procedures for the juvenile and adult trap are described in Ward and Blankenheim (2006) and Blankenheim (2007).

METHODS

Study Area

The French River is an average size stream on the Minnesota shore of Lake Superior. It flows for 14.3 miles and enters Lake Superior approximately 14 miles northeast of Duluth, Minnesota (Figure 1). Anadromous management in the French River has been primarily managed for Rainbow Trout, but it has been experimentally managed for other species in Lake Superior in the past (Schreiner et al. 2006). The presence of Rainbow Trout juveniles upstream of mile 0.2 is solely the result of stocking, and the lower 9.4 miles of the river have been used as nursery habitat for stocked juvenile steelhead prior to their emigration to Lake Superior. The

French River is also currently managed to maintain native Brook Trout and introduced Brown Trout populations upstream of mile 0.2. More information about the French River fishery and its management can be found in the French River Stream Population Assessment Report (Pinkerton 2015) and French River Management Plan 2011.

RESULTS

Environmental Conditions

Environmental conditions and habitat (i.e., adequate water levels and cool water temperatures) are two primary factors that dictate whether steelhead will remain in tributaries for at least two years and reach an age/size that is needed to survive in Lake Superior. Ample precipitation in the fall and snowfall during the winter months helps to maintain overwintering habitat for fish by recharging water sources (e.g., wetlands) and insulating stream temperatures from excessive ice formation that can decrease overwinter survival.

Environmental conditions were not ideal for juvenile trout entering the winter of 2014/2015. Below average precipitation in the fall left many North Shore streams in abnormally or moderately dry drought conditions throughout the winter of 2014/15. However, the snowfall total for Duluth in 2014 (111.2 inches) was above average. Spring arrived on schedule in 2015 after two consecutive years of late ice and cold spring conditions in 2013 and 2014. Ice started to clear in streams near Duluth in early April, and all rivers shore wide were free of ice by late April. Above average snowfall in winter 2014/15 helped to counteract fall drought conditions and resulted in only slightly below-average spring discharge in many rivers for most of the spring season.

Stream conditions were favorable for juvenile trout during the summer and fall of 2015. Air temperatures and precipitation totals were similar to the historic averages throughout the summer (http://cdo.ncdc.noaa.gov/qclcd/QCLCD). Abnormally dry or moderate drought conditions reappeared in August. Frequent rain events provided average or above average discharge in the fall. Two significant runoff events occurred in September and November at the Knife River that were the highest mean daily discharge observed in those months since 2000. The North Shore was free of drought conditions from October through December.

Juvenile Trap Operations

The juvenile trap was open for 215 consecutive days (5,184 total hours) between April 15 and November 16, 2015 (Table 1). The trap captured the entire water discharge from the French River in 75% of all hours the trap was open in 2015, which was slightly lower than average (80%; Table 1). Seventy-nine percent of all juvenile trout captured in 2015 were caught when the trap was taking the entire flow of the French River. Approximately 75% of all juvenile trout emigrated in spring, 11% in summer, and 14% in fall. In general, the emigration pattern of juvenile trout in 2015 coincided with increases in stream water temperatures and decreasing stream discharge.

A total of 1,551 juvenile steelhead were captured in 2015, which was 65% lower than the historic average (3,512) and below the interquartile range (IR=1,666 - 4,610) (Table 2, Figure 2). Eighty percent of all juvenile steelhead were collected when the trap was taking all the flow of the French River. Seventy-eight percent of steelhead emigrated in spring (April-June), 11% in summer (July-August), and 11% in fall (September-November). Forty-five percent of all juvenile steelhead were caught in June (Figures 3 and 4). Of all juvenile steelhead that emigrated in 2015, 14% were age-0, 42% were age-1, 43% were age-2, and 1% were age-3 (Table 2; Figure 5). The survival of the 2013 year-class to age-2 was 1.2% (based on the total number of fish stocked in 2013), which indicates relatively good survival compared to other stocked year-classes (Table 2).

The number of steelhead stocked explains a significant amount variability in the number of age-2 and older juvenile steelhead that emigrate each year ($R^2 = 0.67$, $P < 0.001$; Figure 6). By removing the two years when 200,000 or more fish were stocked (1999 and 2004), this relationship remains highly significant but explains less of the variability ($R^2 = 0.59$, $P < 0.001$). Three fryling stocked year-classes have now completely emigrated from the French River (2009, 2011, and 2013). It appears that survival of juvenile steelhead is similar between fry and fryling stocked years (Table 2, Figure 6). However, frylings appear to have maintained larger lengths-at-age compared to stocked fry (Figure 7).

A small proportion of the total catch of trout species at the French River juvenile trap is Brook Trout and Brown Trout. Twenty-three Brook Trout and 38 Brown Trout were captured in 2015 and most were collected in late-summer and fall (Table 3). Approximately 9% of Brook Trout emigrated in the spring, 35% in summer, and 56% in fall; approximately 3% of Brown

Trout emigrated in the spring, 3% in summer, and 94% in fall (Figure 8). Nine other non-gamefish species were also captured in 2015 (Table 4).

Adult Trap Operations

The French River adult trap was opened on April 13th in 2015, near the mean start date for trap operation (Table 5). The trap was closed on June 12th, which was approximately two weeks later than normal. Seining in the pool downstream of the adult trap was conducted twice a week for the first month depending upon river conditions and the number of fish captured in the sampling efforts. Trapping and seining did not take place in the fall of 2015, as fall migratory runs are no longer monitored.

Kamloops

A total of 888 Kamloops were captured at the French River in the spring of 2015. This was essentially the same as the 23 year average (Mean=884; IR=450-1253; Table 6, Figure 9). Two unknown sex two year old Kamloops were captured and are reported here, but were not included in any further analyses. Survival of individual year-classes, as measured by adult returns to the trap, has varied considerably throughout time, ranging from 0.4 to 3.6% (Figure 10). The 2008 year-class had the highest percent of stocked Kamloops yearlings (3.6%) that have returned to the French River trap as adults. The returns of the 2009 and 2010 year-classes are already near the historic average (Table 6, Figure 10). The 2010 and 2011 cohorts made up most (80%) of the total number of Kamloops caught during trap operations at French River in 2015.

Historically, seventy-five percent of Kamloops returns at the French River are age-4 and age-5. Kamloops in 2015 ranged from age-2 to age-7, with 80% of the return consisting of age-4 (34%) and age-5 (46%) fish. An additional 11% of the spawning run was age-6 fish (Table 6, Figure 11). Females and males comprised 60% and 40% of Kamloops returns in 2015, respectively. Just over 5% of returning Kamloops were recaptures with a previous spring's tag, which was slightly higher than the long-term mean of 4.0% and within the interquartile range (IR= 2.4%-5.5%). Of the Kamloops that have returned to the French River to spawn more than one year, 90% returned only one additional year, 9% returned two additional years and 1% have returned three or more years (Table 6). The overall mean total length was 592 mm (23.3 in.) and

mean weight was 2.1 kg (4.6 lbs.). More Kamloops exceeding 600 mm (23.6 in.) were captured in 2015 than in 2014, but fewer were captured than 2012 or 2013 (Table 7, Figure 12).

Steelhead

One hundred-seventeen unmarked steelhead were captured at the French River in 2015, which is above the interquartile range (Mean=91, IR=50-113; Table 8, Figure 13). Additionally, 5 former Knife River brood stock steelhead were collected, but are excluded from the rest of the results and discussion. Unmarked steelhead collected in 2015 ranged from age-2 through age-9 (Table 8, Figure 11). Repeat spawning continues to be uncommon for steelhead at the French River. On average, 6% of the steelhead from the 1990-2007 year-classes returned to spawn in multiple years (Table 6). Sixteen percent (N=19) of the steelhead collected in 2015 had tags from previous years, which is a relatively high return of repeat spawners. Among the tags found, 84% (N=16) were applied in 2013, 11% (N=2) were applied in 2012, and 5% (N=1) were applied in 2014. The average length of steelhead was 609 mm (24.0 in.) and the average weight was 2.2 kg (4.8 lbs.) The maximum size collected was 762 mm (30 in., Table 7).

The percent of steelhead stocked in the French River that return to spawn as adults has been very low from 1990 to 2014 (Mean=0.08%, Range=0.01-0.15%; Table 8, Figure 14). The wide range in adult returns shows that stocking more fry does not necessarily guarantee more returning adults. For example, the 1990 and 1991 fry stockings were two of the largest, but yielded below average adult returns (Table 8, Figure 14).

Timing of Adult Returns

Both Kamloops and steelhead returns to the French River have historically started around the second full week of April. Thereafter, Kamloops returns gradually decline each week while steelhead numbers remain steady before declining after the first week of May. The spring thaw was near the average date in 2015 with fish first sampled on April 13th. Seventy-six percent of all Kamloops and 79% of all steelhead were captured by May 1st. Eighty-eight percent of all Kamloops and 93% of all steelhead were captured by May 16, 2015 (Table 9, Figure 15).

Smolt-Adult Relationship

The number of juvenile steelhead that emigrate at age-2 and age-3 and return to the French River as adults create the smolt-adult relationship. Fifteen years of juvenile and adult trap data has shown that only 0.3% of age-1 juvenile emigrants return as adults, compared to 9.5% for age-2 and 11.8% for age-3 emigrants (Table 10). The smolt-adult relationship displayed a positive trend that was statistically significant (P=0.0322), and age-2 and age-3 smolt production explained 28% of the variation in adult returns (R^2=0.2876; Figure 16). For an unknown reason, adult returns in 2005 were low which made this data point appear as an outlier in the dataset. Excluding the 2005 year-class, the smolt-adult relationship displayed a positive trend that was statistically significant (P=0.0021), and age-2 and age-3 smolt production explained 53% of the variation in adult returns (R^2=0.5298; Figure 17). This relationship indicates that age-2 and older juvenile steelhead emmigrants are the vast majority of fish that return as adults to the French River.

DISCUSSION

The number of adult Kamloops and steelhead that return per year-class are due to the combined differences in size when stocked, total number stocked, forage availability, predation, inter- and intraspecific competition, angler harvest and the annual water temperature of Lake Superior. Water temperature and stream discharge can greatly influence the number of fish caught in the spring spawning season. Generally, 60 to 70% of the Kamloops and steelhead spawning runs are captured when river water temperatures are between 4.4 and 9.9°C (40 and 50°F), and after peaks in discharge events. A weekly update of river conditions, fishing reports, and French and Knife river trap data are posted every Monday and Friday on the Lake Superior Area website (http://www.dnr.state.mn.us/areas/fisheries/lakesuperior/report.html).

Adult returns are dependent upon many factors that include the number of fry stocked and survival of those fry to adulthood. Steelhead production and stocking protocols were modified in 2009 to evaluate how stocking at a larger size influenced adult steelhead returns at French River. Steelhead frylings (approx. 1.5 inches) were stocked in the French River from 2009-2013; before 2009, steelhead were stocked as fry. No steelhead were stocked in 2010. The lower than average abundance of juvenile steelhead captured at the French River smolt trap in

recent years was anticipated given that only about half the number of frylings were stocked per year compared to fry, and because no fish were stocked in 2010.

Three year-classes of frylings have now completely emigrated from the French River and have produced 54% less age-2 and older emigrants each year compared to fry-stocked years. However, fryling emigrants showed slightly larger length-at-age than emigrants derived from fry stocking. Age-2 and age-3 emigrants maintain the steelhead fishery because they are approximately 30 times more likely to return as adults compared to their age-1 counterparts. Survival of frylings in the French River to age-2 has been highly variable (range: 0.1%-1.2%), and has not appeared to be better than survival of fry. The fryling stocking program ended in 2013 and fry stocking resumed in 2014.

One of many factors that influence the number, size and age of juvenile steelhead that emigrate from the French River is the number of fish stocked each year. The number of fry and frylings stocked in the French River has ranged from 39,856 to 250,100 since 1992; these fish were produced from Knife River captive broodstock and/or adults captured in the spring at French River. Although there is a significant relationship between the annual number of fish stocked and the number of age-2 and age-3 emigrants by year-class, the relationship shows considerable variability among years. This proves that the number and size of juvenile steelhead that emigrate in a given year is also highly influenced by factors other than the number of fish stocked.

The number of total emigrants is generally not as important as the number of age-2 and age-3 emigrants because these age-classes are most likely to return as adults. A total of 664 age-2 steelhead emigrated in 2015, which represented 1.2% of the number of fish stocked in 2013, and was similar to the number of age-2 juveniles that emigrated from other year-classes. Eleven age-3 steelhead emigrated in 2015 which is lower than average (mean=28). However, a low number of age-2 and age-3 steelhead emigrated from the 2009 (344) and 2011 (100) year-classes. The lack of age-2 and age-3 emigrants from these years, combined with the absent year-class of 2010, will likely limit adult steelhead returns to the French River in the next few years.

The smolt-adult relationship continues to show that adult steelhead returns are largely influenced by the number of age-2 juvenile emmigrants of a given year-class. This highlights how important it is to maintain (or restore) stream habitats that support the early-life stages of steelhead. The data point for the 2005 year-class was an outlier that significantly influenced the

smolt-adult relationship; it is unclear why so few adults returned from this year-class. Additional years of stocking more than 150,000 fish would provide a much better understanding of how stocking rate (number stocked) influences juvenile steelhead emigration and adult returns at the French River. Any variability not explained by the smolt-adult relationship is likely due to interacting factors such as Lake Superior water temperature, prey availability, predator abundance, and intra- and interspecific competition.

The number of adult Kamloops collected at the French River in 2015 was similar to the 22 year average. The 2009 to 2011 year-classes appear to be returning in average or above-average numbers, however returns are not yet complete. Although returns of Kamloops to the trap at French River have remained average or above-average in recent years, avid Kamloops anglers have continued to report poor fishing success for Kamloops in the same time period. The 2015 MNDNR Lake Superior spring creel survey supports angler concerns of reduced catch at some rivers (i.e., Lester River near Duluth), but not at the French River (Peterson 2016, *in review*). The poor fishing success for Kamloops at the Lester River highlighted the disconnect between adult Kamloops trap returns and angler catch. This disconnect is likely a cumulative result of recent changes to Kamloops production and stocking protocols, and annual fluctuations in prey availability and the environmental conditions in Lake Superior.

In 2010, the MNDNR was required to change Kamloops production and stocking protocols at the French River Coldwater Hatchery (FRCWH) because fish in Lake Superior tested positive for Viral Hemorrhagic Septicemia (VHS). After 2009, fish raised at the FRCWH were not allowed to be stocked above the first barrier falls to Lake Superior. Starting in 2010, a portion (approx. 75%) of the total annual production of Kamloops began to be reared at the Spire Valley Coldwater Hatchery (SVH). These fish were returned to the FRCWH prior to reaching smolt size (5.9 inches; Negus 2003) to allow them to imprint and return to the French River water source. Since 2010, Kamloops partially raised at SVH have been held in the FRCWH for as long as possible (dependent on source water temperatures from Lake Superior), and stocked near the mouth of the Lester River. Over the past five years in the new program, Kamloops grown at SVH have been smaller than fish reared entirely at the FRCWH and in some years have been equal-to or exceeded smolt size before they were stocked. Reports of Kamloops straying beyond the French and Lester rivers have increased in recent years. The MNDNR has received reports of adipose clipped Rainbow Trout caught in other jurisdictions including the St. Mary's

River in Michigan, the Brule River in Wisconsin, and rivers both on the upper North Shore of Minnesota and into Canada.

The decrease in catch of Kamloops and increased reports of Kamloops straying beyond the Lester and French rivers are concerns shared by MNDNR and anglers, particularly regarding potential impacts of introgression with naturalized steelhead. Negus (1999) found poorer survival of eggs from Kamloops x steelhead crosses compared to steelhead x steelhead crosses. If male Kamloops spawn unsuccessfully with female steelhead, then steelhead gametes are wasted. Kamloops have been shown to successfully spawn with steelhead in the wild and produce juvenile hybrids (Close 1999). Juvenile hybrids survive significantly less compared to juvenile steelhead in the stream environment (Miller et al. 2004), which is another form of gamete wastage. If hybrids did survive to reproduce, genetic introgression could occur which would decrease the fitness of wild steelhead. More recently, Page et al. (2011) modeled the effects of Kamloops stocking on wild steelhead populations and concluded that continual stocking of Kamloops greatly increases the risk of extinction of wild steelhead through non-introgressive hybridization.

In response to these concerns, the MNDNR has reconfigured the Kamloops stocking and production protocols. One of the changes included the use of differentiating clips between Kamloops raised at SVH and FRCWH and between stocking locations, which should allow a better assessment of the efficacy of alternative production and stocking strategies. The proposed changes should improve catch and catch-rates for Kamloops and decrease straying to other management jurisdictions. A full description of changes to the Kamloops program is described in Section 8.4.2 of the 2016 Lake Superior Management Plan (Goldsworthy et al. 2016, *in review*).

Above average steelhead returns at the French River in 2015 mimicked above average catch and catch-rates for steelhead in the Lake Superior spring fishing season (Peterson 2016, *in review*). High abundance of one or two individual year-classes can significantly influence the total annual return of adult steelhead at the French River. However, the return of individual year-classes continues to be highly variable and dependent on many environmental factors that are impossible to manage (e.g., Lake Superior water temperatures).

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FRENCH RIVER ADULT/JUVENILE
TRAP REPORT 2015

Table 1. Operation dates, total hours open (Hours open), and total number (Hours) and percent (%) of hours the French River juvenile trap captured the entire flow and partial flow by year.

Year	Operation Dates	Hours open	Captured Entire flow		Captured Partial Flow	
			Hours	%	Hours	%
1994	5/5 - 10/28	4,234	3,497	83%	737	17%
1995	4/13 - 11/2	4,881	3,144	64%	1,737	36%
1996	4/22 - 11/7	4,785	3,203	67%	1,582	33%
1997	4/18 - 11/4	4,809	4,182	87%	627	13%
1998	3/30 - 11/5	5,289	4,419	84%	870	16%
1999	4/5 - 11/15	5,385	3,760	70%	1,625	30%
2000	3/27 - 11/8	5,433	5,011	92%	422	8%
2001	4/18 - 11/16	5,097	4,251	83%	846	17%
2002	4/15 - 10/31	4,785	4,047	85%	738	15%
2003	4/25 - 11/7	4,714	4,448	94%	266	6%
2004	4/13 - 11/5	4,953	4,062	82%	891	18%
2005	4/11 - 11/4	4,977	3,976	80%	1,001	20%
2006	4/8 - 11/1	4,977	3,825	77%	1,152	23%
2007	4/15 - 11/02	4,656	3,814	82%	842	18%
2008	4/16 - 11/06	4,901	4,082	83%	819	17%
2009	4/17 - 11/06	4,869	4,047	83%	822	17%
2010	3/28 - 10/29	5,160	4,334	84%	826	16%
2011	4/18 - 11/03	4,272	3,580	84%	692	16%
2012	3/25 - 10/29	3,984	3,168	80%	816	20%
2013	5/7 - 11/07	4,440	3,286	74%	1,154	26%
2014	4/28 - 10/31	4,488	3,321	74%	1,167	26%
2015	4/15 - 11/16	5,184	3,864	75%	1,320	25%
Mean	**4/14 - 11/4**	**4,831**	**3,878**	**80%**	**952**	**20%**

Table 2. Descriptive statistics (number [n] and percentage [%]) for juvenile steelhead data collected at the French River juvenile trap by year. Frylings were stocked instead of fry in 2009 and 2011-2013.

Year	2005[2]		2006		2007[2]		2008		2009		2010		2011		2012		2013		2014		2015		Mean 1994 - 2015	
Date trap was opened	4/11		4/8		4/15		4/16		4/17		3/28		4/18		3/25		5/7		4/28		4/15		4/14	
Date trap was closed	11/4		11/1		11/2		11/6		11/6		10/29		11/3		10/29		11/7		10/31		11/16		11/5	
Number of days trap was open	207		207		194[3]		204		203		215		178[4]		166[5]		185		187		215		200	
Emigrants by Age	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**
Age-0	122	2%	537	12%	408	9%	382	12%	173	4%	0	0%	0	0%	176	15%	50	7%	4	0%	217	14%	297	8%
Age-1	5,032	84%	2,132	46%	2,795	61%	2,064	66%	3,140	79%	1,844	57%	0	0%	976	84%	623	84%	1,204	67%	659	42%	2,453	70%
Age-2	785	13%	1,887	41%	1,347	29%	659	21%	609	15%	1,338	42%	333	95%	0	0%	71	10%	558	31%	664	43%	734	21%
Age-3	18	0%	37	1%	65	1%	14	0%	29	1%	34	1%	18	5%	11	1%	0	0%	29	2%	11	1%	28	1%
Age-4	0	0%	0	0%	0	0%	0	0%	1	0%	0	0%	1	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Total	**5,957**		**4,593**		**4,615**		**3,119**		**3,952**		**3,216**		**352**		**1,163**		**744**		**1,795**		**1,551**		**3,512**	
Emigrants by Year-Class	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**	***N***[1]	**(%)**[1]
Age-0	122	3%	537	13%	408	13%	382	8%	173	7%	--	--	0	0%	176	13%	50	--	4	--	217	--	344	9%
Age-1	2,132	59%	2,795	70%	2,064	66%	3,140	64%	1,844	78%	--	--	976	91%	623	46%	1,204	--	659	--	**		2642	71%
Age-2	1,347	37%	659	16%	609	20%	1,338	27%	333	14%	--	--	71	7%	558	41%	664	--	**		**		724	19%
Age-3	14	0%	29	1%	34	1%	18	0%	11	0%	--	--	29	3%	11	1%	**		**		**		28	1%
Total	**3,615**		**4,020**		**3,115**		**4,878**		**2,361**		**----**		**1,076**		**1,368**		**1,918****		**663****		**217****		**3,738**	
Percent Emmigrants per Year-Class																								
Number of fry stocked	135,202		122,776		121,740		109,324		53,214		0		55,013		55,032		55,596		39,856		99,908		100,162[1]	
Number of fry stocked/ha	18,093		16,430		16,291		14,630		7,121		0		7,362		7,364		7,440		5,334		13,321		13,404[1]	
Age-0	0.1%		0.4%		0.3%		0.3%		0.3%		-----		0.0%		0.3%		0.1%		0.0%		0.2%		0.3%[1]	
Age-1	1.6%		2.3%		1.7%		2.9%		3.5%		-----		1.8%		1.1%		2.2%		1.7%		**		2.7%[1]	
Age-2	1.0%		0.5%		0.5%		1.2%		0.6%		-----		0.1%		1.0%		1.2%		**		**		0.7%[1]	
Age-3	0.0%		0.0%		0.0%		0.0%		0.0%		-----		0.1%		0.0%		**		**		**		0.0%[1]	
Cumulative Survival Index	**2.7%**		**3.3%**		**2.6%**		**4.5%**		**4.4%**		**-----**		**2.0%**		**2.5%**		**2.3%**		**0.0%**		**0.2%**		**3.8%**[1]	

[1] Values shown for only the year classes that have completely emigrated

[2] Some individuals were subsampled in 2005 and 2007

[3] The trap was closed for 8 days for dredging of the reservoir

[4] The trap was closed for 21 days in July due to the government shutdown

[5] The trap was closed for 6 days from June 20th-25th due to a major flood, and then for 47 days from August 8th - September 23rd for gravel removal from the reservoir

** Data not yet complete for the given year-class

Table 3. Descriptive statistics (number [n] and percentage [%]) for juvenile Brook and Brown Trout data collected at the French River juvenile trap by year.

Year	2011		2012		2013		2014		2015		Mean 1994-2015	
Date trap was opened	4/18		3/25		5/7		4/28		4/15		4/14	
Date trap was closed	11/3		10/29		11/7		10/31		11/16		11/5	
Number days trap open	178[2]		166[3]		185		187		215		200	
Brook Trout												
Emigrants by age	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**
Age-0	0	0%	52	68%	4	25%	4	33%	9	39%	**21**	**36%**
Age-1	3	33%	18	23%	9	56%	8	67%	3	13%	**30**	**50%**
Age-2	1	11%	5	6%	3	19%	0	0%	10	43%	**7**	**12%**
Age-3	5	56%	2	3%	0	0%	0	0%	1	4%	**1**	**2%**
Total	**9**		**77**		**16**		**12**		**23**		**60**	
Emigrants by year-class	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**
Age-0	0	0%	52	84%	4	**	4	**	9	**	**24**	**38%**
Age-1	18	86%	9	15%	8	**	3	**	**	**	**32**	**50%**
Age-2	3	14%	0	0%	10	**	**	**	**	**	**7**	**11%**
Age-3	0	0%	1	2%	**	**	**	**	**	**	**1**	**2%**
Total	**21**		**62**		**22****		**7****		**9****		**64**	
Brown Trout												
Emigrants by age	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**
Age-0	0	0%	1	3%	0	0%	0	0%	36	95%	**3**	**16%**
Age-1	1	7%	32	86%	1	17%	0	0%	2	5%	**12**	**55%**
Age-2	12	86%	2	5%	4	67%	5	83%	0	0%	**5**	**24%**
Age-3	0	0%	1	3%	1	17%	1	17%	0	0%	**1**	**3%**
Age-4	1	7%	1	3%	0	0%	0	0%	0	0%	**0**	**2%**
Total	**14**		**37**		**6**		**6**		**38**		**21**	
Emigrants by year-class	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**
Age-0	0	0%	1	14%	0	**	0	**	36	**	**2**	**10%**
Age-1	32	86%	1	14%	0	**	2	**	**	**	**13**	**61%**
Age-2	4	11%	5	71%	**	**	**	**	**	**	**5**	**24%**
Age-3	1	3%	0	0%	**	**	**	**	**	**	**1**	**4%**
Age-4	0	0%	0	0%	**	**	**	**	**	**	**0**	**2%**
Total	**37**		**7**		**0****		**2****		**36****		**20**	

[1] Determined from the 1994 - 2009 time period when all complete year classes have been sampled

[2] The trap was closed for 21 days due to the government shutdown

[3] The trap was closed for 6 days in June due to a major flood, and then for 47 days from August 8th - September 23rd for gravel removal from the reservoir

** Numbers are incomplete for particular year class

Table 4. Other non-game fish species collected in the French River juvenile trap in 2015.

Species	Number Caught
Creek Chub	53
Fathead Minnow	26
Blacknose Dace	23
Longnose Dace	18
Northern Redbelly Dace	6
Brook Stickelback	5
Central Mudminnow	4
White Sucker	2
Pearl Dace	1
Total	**138**

Table 5. Opening date, closing date, and days of operation of the French River adult trap by season and year.

Spring				Fall			
Year	Opening date	Closing date	Days of operation	Year	Opening date	Closing date	Days of operation
1993	4/12	5/17	37	1993	8/18	11/10	85
1994	4/18	5/23	36	1994	9/13	11/21	70
1995	4/17	5/26	40	1995	9/7	11/21	76
1996	4/26	6/14	50	1996	9/6	11/13	69
1997	4/16	6/2	48	1997	9/16	11/6	52
1998	4/5	5/26	52	1998	9/14	11/3	51
1999	4/12	5/17	36	1999	9/6	11/9	65
2000	3/27	5/22	57	2000	9/1	11/15	76
2001	4/16	5/23	38	2001	9/10	11/15	67
2002	4/16	5/20	35	2002	9/9	11/12	65
2003	4/23	5/28	36	2003	9/11	11/4	55
2004	4/13	5/19	37	2004	8/31	11/8	70
2005	4/11	5/27	47	2005	9/7	11/17	72
2006	4/6	5/19	44	2006	9/1	10/30	60
2007	4/15	5/25	41	2007	9/6	11/3	59
2008	4/17	5/24	35	2008	8/28	11/10	75
2009	4/21	5/29	39	2009	9/8	11/6	60
2010	3/28	5/18	52	2010	Closed		
2011	4/18	5/27	40	2011			
2012	3/26	5/16	52	2012			
2013	5/6	6/7	33	2013			
2014	5/5	7/3	60	2014			
2015	4/13	6/12	60	2015			
Mean (1993-2015)	4/14	5/27	44	Mean (1993-2009)	9/5	11/10	66

Table 6. Annual returns, number of repeat spawners, and year-class strength indices of Kamloops Rainbow Trout collected at the French River.

Year of Sampling																														
Year	2001		2002		2003		2004		2005		2006		2007		2008		2009		2010		2011		2012		2013		2014		2015		Mean 1993-2015	
Age	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M
Age-2	0	40	0	14	0	126	0	3	0	11	0	0	0	52	0	2	2	15	0	47	0	4	0	17	0	50	0	3	0	47	**0**	**35**
Age-3	74	82	9	16	33	72	57	77	14	0	12	11	121	93	39	41	6	15	15	47	148	104	59	77	46	173	12	26	4	22	**43**	**54**
Age-4	332	271	219	96	364	273	326	172	711	463	58	59	180	72	142	53	190	102	108	54	261	108	624	258	478	258	175	114	193	108	**285**	**156**
Age-5	57	18	57	37	195	127	345	205	208	119	190	155	65	29	24	6	45	8	71	27	117	66	119	52	148	40	39	40	287	122	**133**	**79**
Age-6	21	0	5	0	41	10	125	21	194	138	53	16	26	10	5	1	13	10	23	4	18	8	20	14	**44**	13	15	13	48	49	**48**	**21**
Age-7	7	0	2	0	20	55	14	3	49	27	29	3	0	5	2	1	1	1	3	3	11	5	2	0	5	9	0	0	5	1	**14**	**10**
Age-8	2	8	0	8	22	0	9	0	6	2	3	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**4**	**1**
Age-9	0	0	0	0	13	0	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**0**
Sex total	493	419	292	171	688	663	880	484	1182	760	345	244	394	261	212	104	257	151	220	182	555	295	824	418	721	543	241	196	537	349	**527**	**356**
Grand total	912		463		1351		1364		1942		589		655		316		408		402		850		1242		1264		437		886		**884**	

1x repeat	48	11	30	80	76	46	24	14	22	12	19	55	61	19	40	**30**
2x repeat	2	3	2	5	12	11	1	1	2	3	0	6	9	1	5	**3**
3x repeat	0	0	1	0	0	1	1	0	0	1	0	0	1	1	0	**0**
4x repeat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Fall tag	4	0	2	0	57	36	4	2	4	0	0	0	0	0	0	**5**
K.R. tag	6	3	1	0	7	5	0	3	1	0	1	0	0	2	0	**3**

Complete Year-classes									
Year-class	2001	2002	2003	2004	2005	2006	2007	2008	90-08 mean
Stocked	52,850	61,871	49,906	49,772	45,796	36,474	33,337	36,589	**50,064**
Returned	1818	236	344	504	551	417	676	1,403	**882**
% return[2]	3.44%	0.38%	0.69%	1.01%	1.20%	1.14%	2.03%	3.64%	**1.77%**

Incomplete Year-classes						
Year-class	2009	2010	2011	2012	2013	2014
Stocked	61,032	45,906	30,050	39,712	36,374	55,111.00
Returned	1052	934	389	29	47	0
% return[1]	1.72%	2.03%	1.29%	0.07%	0.13%	0.00%

[1]: percent return of stocked yearlings returned to the French River trap as adults

Table 7. Length-frequency distribution of all fish measured by species at the French River in adult trap operations 2015.

Length Group (10 mm)	Kamloops Rainbow Trout	Steelhead Rainbow Trout	White Sucker
300			
310			
320			
330	2	1	
340	1		
350			
360		1	
370	1		
380	4		1
390	4		
400	10	2	
410	7	1	
420	7		
430	8	1	
440	7		
450			
460	1		
470	2		
480	2		
490	3		
500	5	1	
510	2	3	
520	7	2	
530	8	2	
540	17	3	
550	29	3	
560	54	5	
570	67	6	
580	88	6	
590	100	6	
600	99	7	
610	86	6	
620	65	14	
630	56	10	
640	41	8	
650	36	1	
660	26	6	
670	20	6	
680	12	3	
690	6	2	
700	4	6	
710		2	
720			
730	1	1	
740		1	
750			
760		1	
Total	888	117	1

Table 8. Annual returns, number of repeat spawners, and year-class strength indices of unclipped steelhead Rainbow Trout collected at the French River adult trap.

	Year of Sampling																													
Year	2001		2002		2003		2004		2005		2006		2007		2008		2009		2010		2011		2012		2013		2014		2015		Mean (93-15)	
Age	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M
2	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	**0**	**0**
3	0	8	0	7	0	9	0	1	1	0	1	13	2	9	0	0	0	1	1	2	0	0	0	3	0	6	0	2	0	1	**1**	**4**
4	2	1	6	5	10	12	8	6	7	4	3	4	24	21	7	7	4	3	0	1	8	8	7	8	6	9	6	3	1	4	**7**	**7**
5	6	6	14	3	20	21	27	10	34	19	12	4	10	9	26	14	29	15	6	6	14	9	27	30	32	27	5	1	12	5	**17**	**12**
6	6	5	6	2	14	8	50	25	32	23	14	5	9	3	5	4	4	10	35	9	12	8	19	8	33	9	3	4	26	16	**17**	**9**
7	7	2	1	2	3	3	21	20	13	4	8	7	7	4	1	0	3	1	10	18	12	9	2	1	11	7	0	0	18	12	**8**	**6**
8	2	0	0	1	0	0	12	3	2	3	1	1	3	0	1	1	2	0	2	3	3	2	1	0	1	0	0	0	13	4	**3**	**2**
9	0	0	0	0	0	0	1	1	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	1	**1**	**0**
10	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
Sex total	23	22	27	20	48	53	120	66	91	53	39	35	55	47	40	26	42	31	54	40	49	36	56	50	83	58	14	10	74	46	**54**	**40**
Total	45		47		101		186		144		74		102		66		73		94		85		106		141		24		117		**94**	

	Complete year-classes																		
Year-class	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Mean (90-07)
Stocked	233,720	277,585	179,981	129,685	56,928	98,637	42,571	60,669	100,281	201,156	109,427	48,311	64,932	117,596	250,100	135,202	122,776	121,740	**130,628**
Returned	34	88	124	132	85	74	56	84	143	133	100	44	42	139	131	42	67	117	**91**
% return[1]	0.01%	0.03%	0.07%	0.10%	0.15%	0.08%	0.13%	0.14%	0.14%	0.07%	0.09%	0.09%	0.06%	0.12%	0.05%	0.03%	0.05%	0.10%	**0.08%**
1x repeat	3	5	6	9	5	1	7	7	7	6	4	0	3	5	5	1	6	15	**5**
2x repeat	0	0	1	1	0	0	0	0	2	0	2	0	0	1	0	0	0	4	**1**
3x repeat	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	**0**

	Incomplete year-classes							
Year-class	2008	2009	2010	2011	2012	2013	2014	2015
Stocked	109,324	53,214	0	55,013	55,032	55,596	39,856	99,908
Returned	98	62	32	7	1	2	--	--
% return[1]	0.09%	0.12%	--	0.01%	0.00%	0.00%	--	--
1x repeat	10	4	0	0	--	--	--	--
2x repeat	2	0	0	0	--	--	--	--
3x repeat	1	0	0	0	--	--	--	--

Table 9. Total catch by date for all fish species collected during the French River adult trap operations in 2015.

	Species			
Date	All Species	Kamloops Rainbow Trout	Steelhead Rainbow Trout	White Sucker
4/13/2015	202	189	13	0
4/15/2015	184	163	21	0
4/16/2015	29	27	2	0
4/17/2015	100	83	17	0
4/20/2015	53	45	8	0
4/22/2015	43	36	7	0
4/27/2015	99	83	16	0
4/29/2015	57	48	9	0
4/30/2015	1	1	0	0
5/4/2015	31	29	2	0
5/6/2015	19	15	4	0
5/12/2015	14	12	2	0
5/13/2015	51	43	7	1
5/15/2015	8	7	1	0
5/18/2015	9	8	1	0
5/19/2015	43	37	6	0
5/26/2015	31	31	0	0
6/1/2015	26	25	1	0
6/5/2015	3	3	0	0
6/9/2015	3	3	0	0
Total	1006	888	117	1

Table 10. The numbers and percentages of steelhead from the 1992 to 2013 year-classes that emigrated at age-1, age-2, or age-3 and returned to the French River as adults.

Year-Class	Age-1 Emmigrants	Adult Returns	Percent Return	Age-2 Emmigrants	Adult Returns	Percent Return	Age-3 Emmigrants	Adult Returns	Percent Return
1992	--	--	--	1,010	113	11.2%	47	2	4.3%
1993	2,746	13	0.5%	1,366	114	8.3%	35	4	11.4%
1994	3,253	23	0.7%	448	59	13.2%	46	3	6.5%
1995	2,644	13	0.5%	454	60	13.2%	17	1	5.9%
1996	280	9	3.2%	266	42	15.8%	5	5	100.0%
1997	3,207	12	0.4%	560	67	12.0%	35	5	14.3%
1998	3,760	14	0.4%	1,019	124	12.2%	56	4	7.1%
1999	4,558	11	0.2%	919	117	12.7%	23	5	21.7%
2000	6,001	17	0.3%	1,073	78	7.3%	28	5	17.9%
2001	401	3	0.7%	289	38	13.1%	26	2	7.7%
2002	1,953	3	0.2%	422	35	8.3%	18	3	16.7%
2003	2,895	3	0.1%	785	130	16.6%	37	4	10.8%
2004	5,032	5	0.1%	1,887	121	6.4%	65	4	6.2%
2005	2,132	3	0.1%	1,347	35	2.6%	14	3	21.4%
2006	2,795	1	0.0%	659	69	10.5%	29	3	10.3%
2007 [1]	2,064	5	0.2%	609	117	19.2%	34	4	11.8%
2008 [1]	3,140	11	0.4%	1,338	91	6.8%	18	5	27.8%
2009 [1]	1,844	20	1.1%	333	39	11.7%	11	4	36.4%
2010 [2]	0	15	--	0	16	--	0	1	--
2011 [1]	976	2	0.2%	71	5	7.0%	29	0	0.0%
2012 [1]	623	1	0.2%	558	0	0.0%	11	0	0.0%
2013 [1]	1,204	2	0.2%	664	0	0.0%	--	--	--
Total (94-06)	**41,657**	**130**	**0.3%**	**11,494**	**1,089**	**9.5%**	**434**	**51**	**11.8%**
Weighted Average (94-06)	**0.3%**			**9.5%**			**11.8%**		
Average return rate (94-06)	**0.5% (0.2%)**			**11.1% (1.1%)**			**19.0% (6.9%)**		

[1] All adults have not likely returned from these year-classes

[2] No stocking occurred in 2010

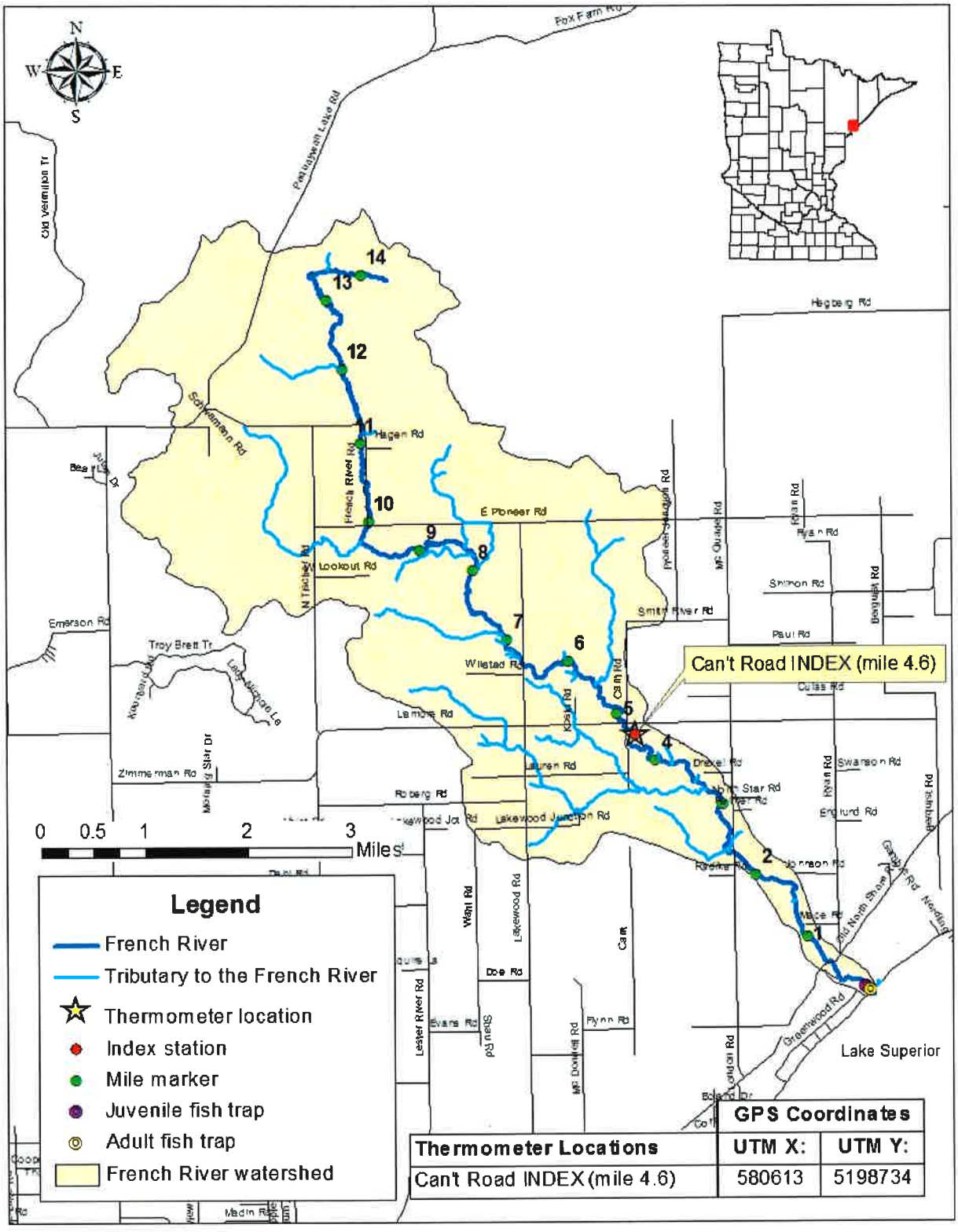

Figure 1. Map of the French River and the locations of the adult and juvenile fish traps.

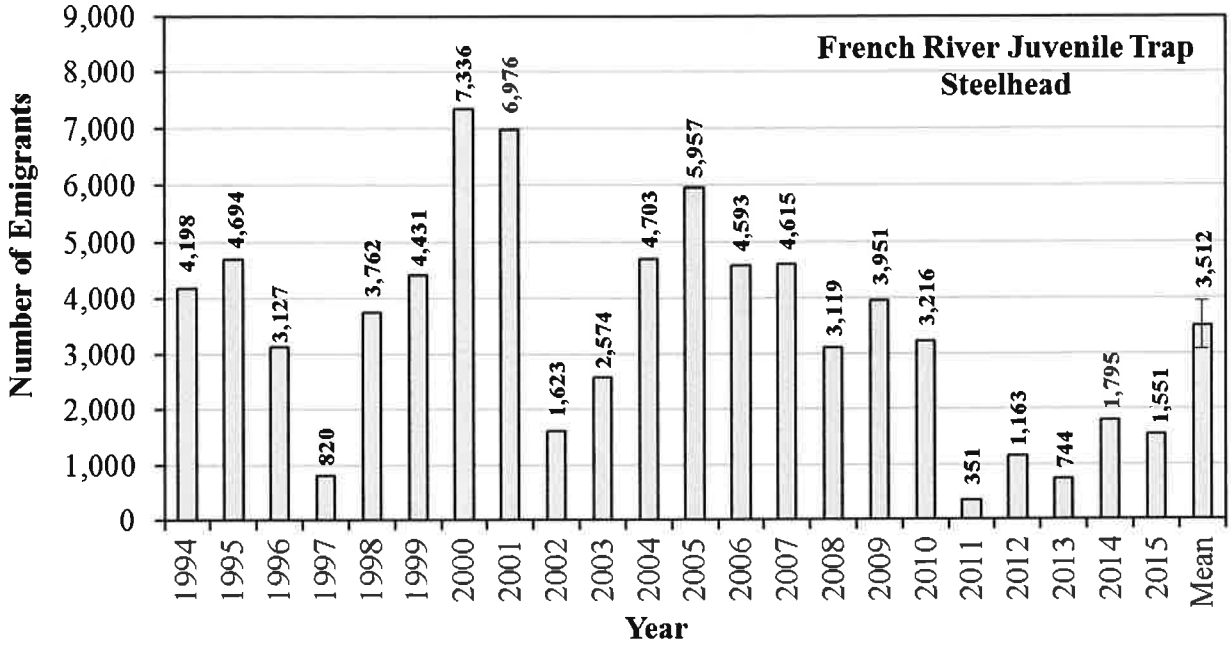

Figure 2. Number of juvenile steelhead emigrants captured in the French River juvenile trap by year. The historic average from 1994-2015 (Mean ± 1 standard error) is also provided.

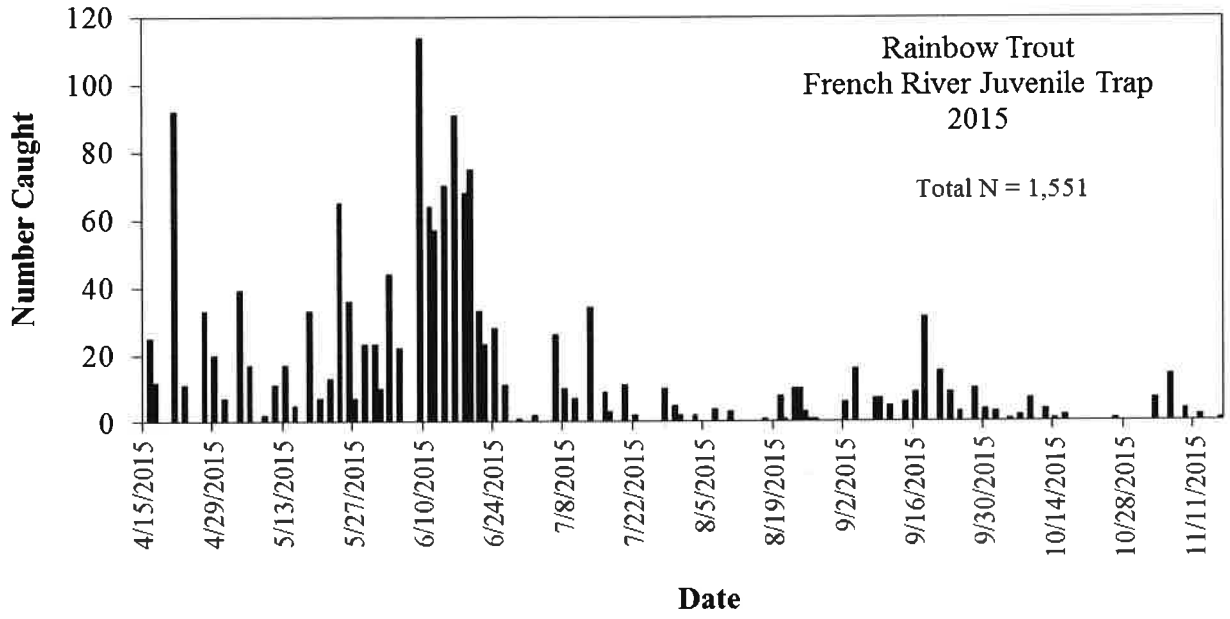

Figure 3. The number of juvenile steelhead Rainbow Trout captured in the French River juvenile trap by day in 2015.

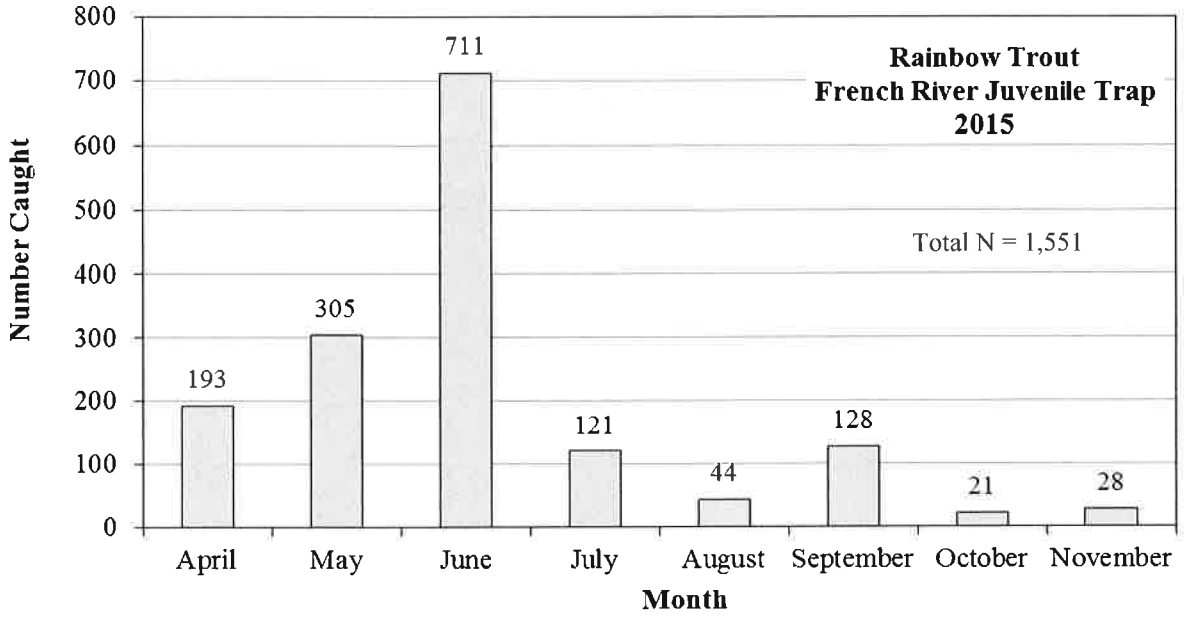

Figure 4. Number of juvenile steelhead collected in the French River juvenile trap by month in 2015.

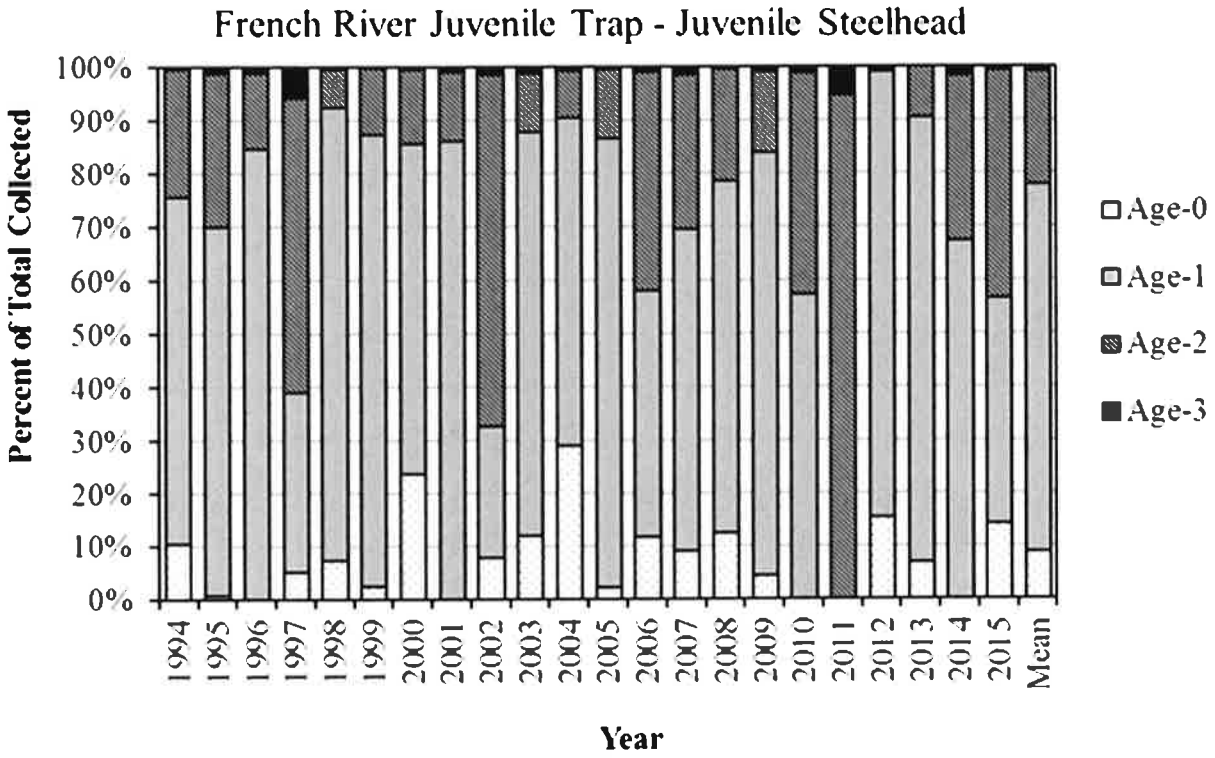

Figure 5. The percentage of the total number of juvenile steelhead collected in the French River juvenile trap that were age-0, age-1, age-2, and age-3 by year.

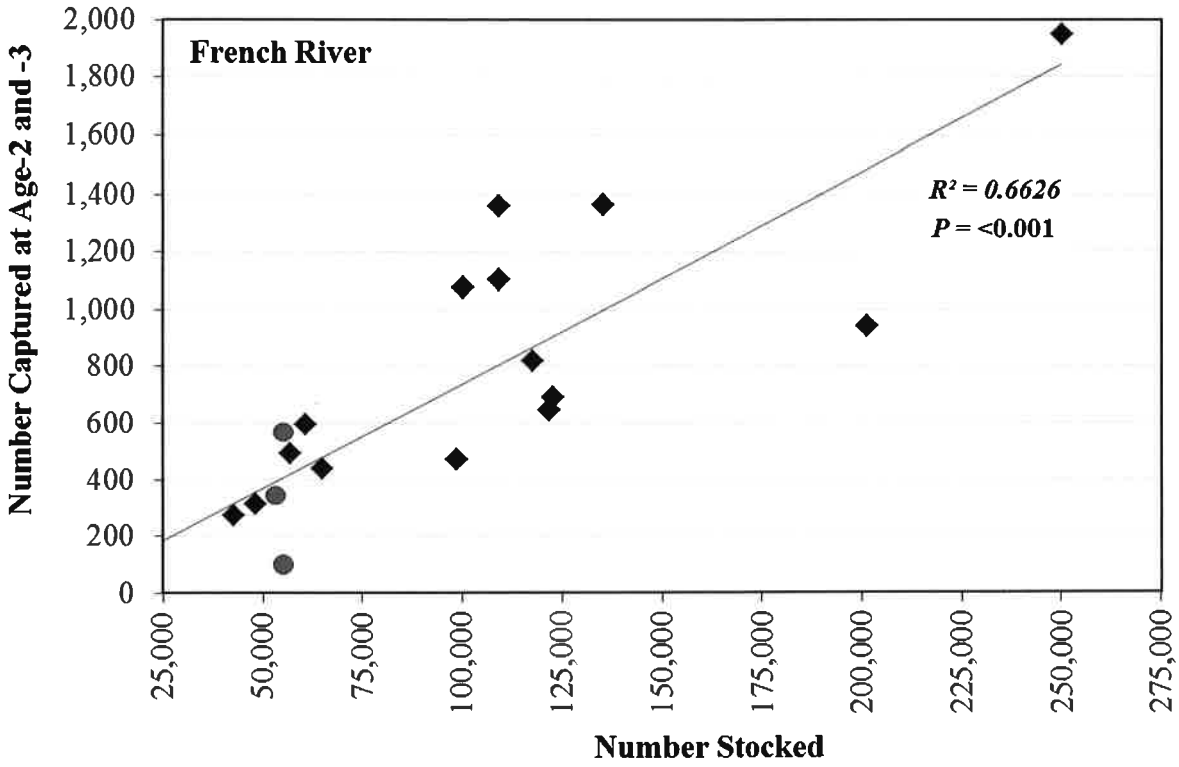

Figure 6. The relationship between the number of steelhead stocked and the number of age-2 and age-3 juvenile emigrants by year-class for the French River from 1994-2012; year-classes stocked as frylings (2009, 2011-2012) are shown as red circles.

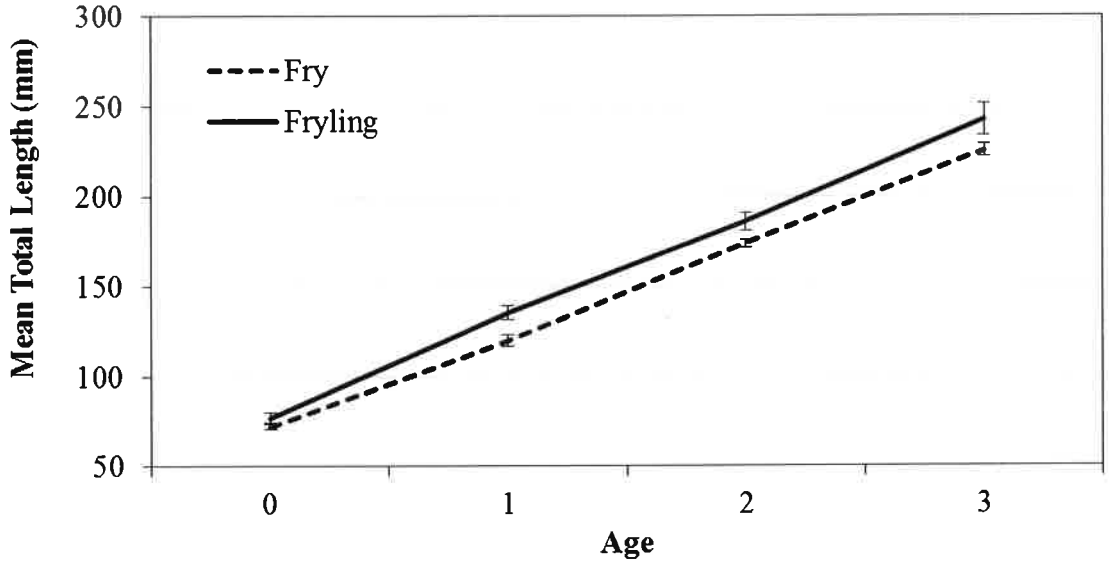

Figure 7. The mean total length-at-age (± 1 standard error) of juvenile steelhead collected in the French River juvenile trap that were stocked as fry and frylings (approx. 1.5 inches total length).

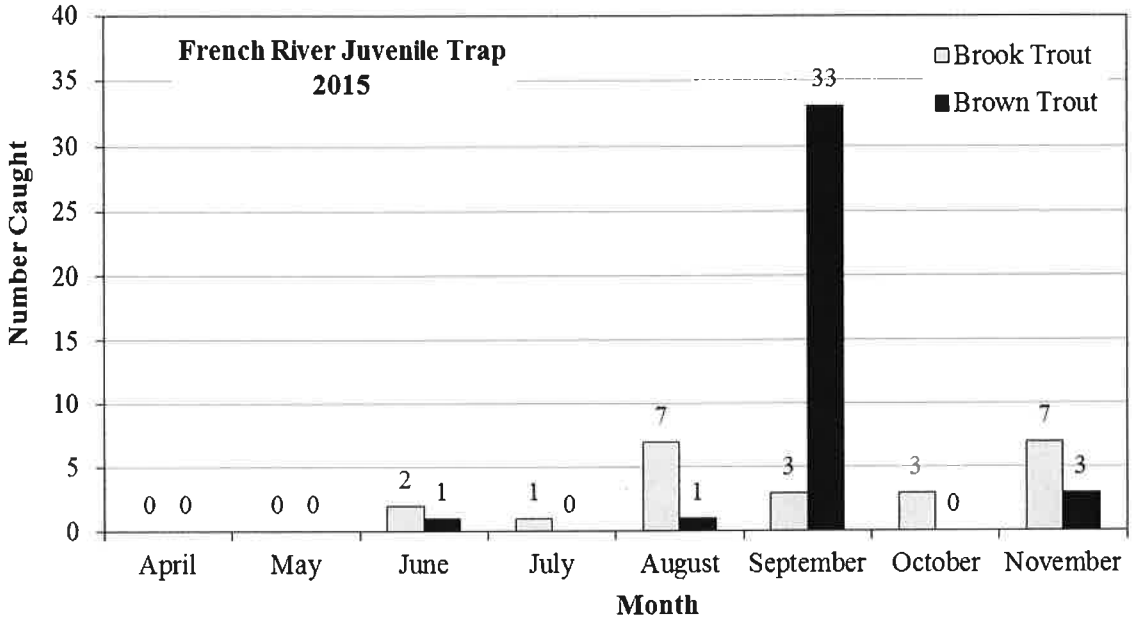

Figure 8. The number of Brown Trout and Brook Trout caught in the French River juvenile trap by month in 2015.

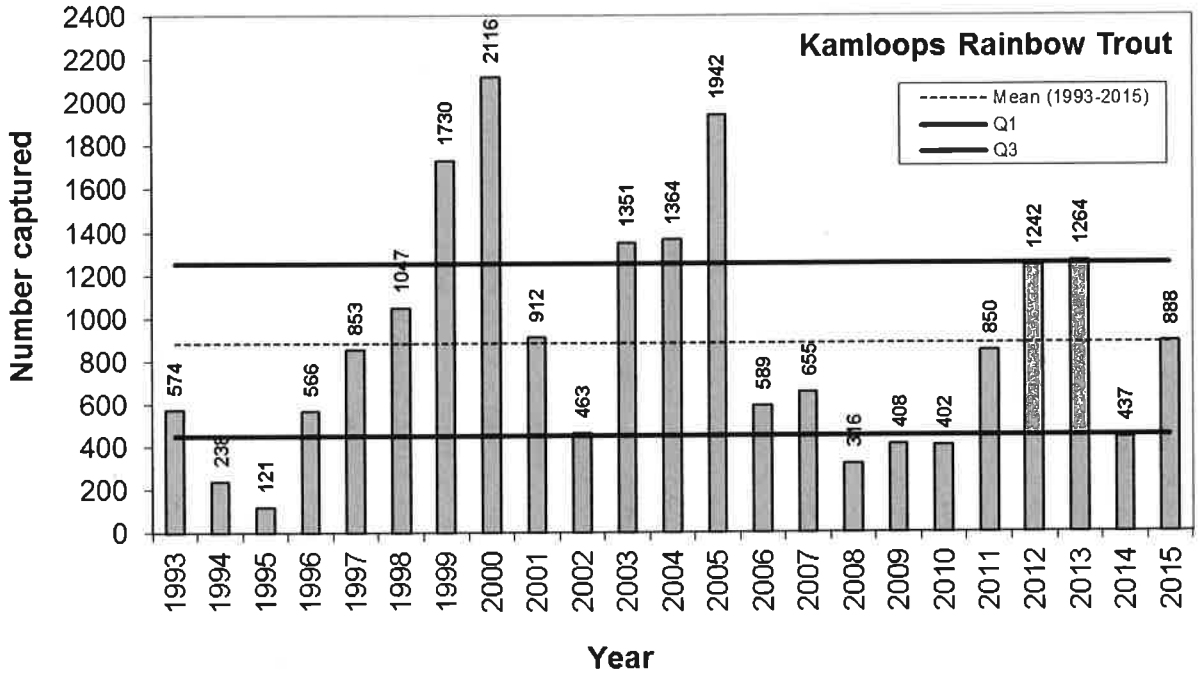

Figure 9. Number of adult Kamloops Rainbow Trout captured at the French River from 1993 to 2015.

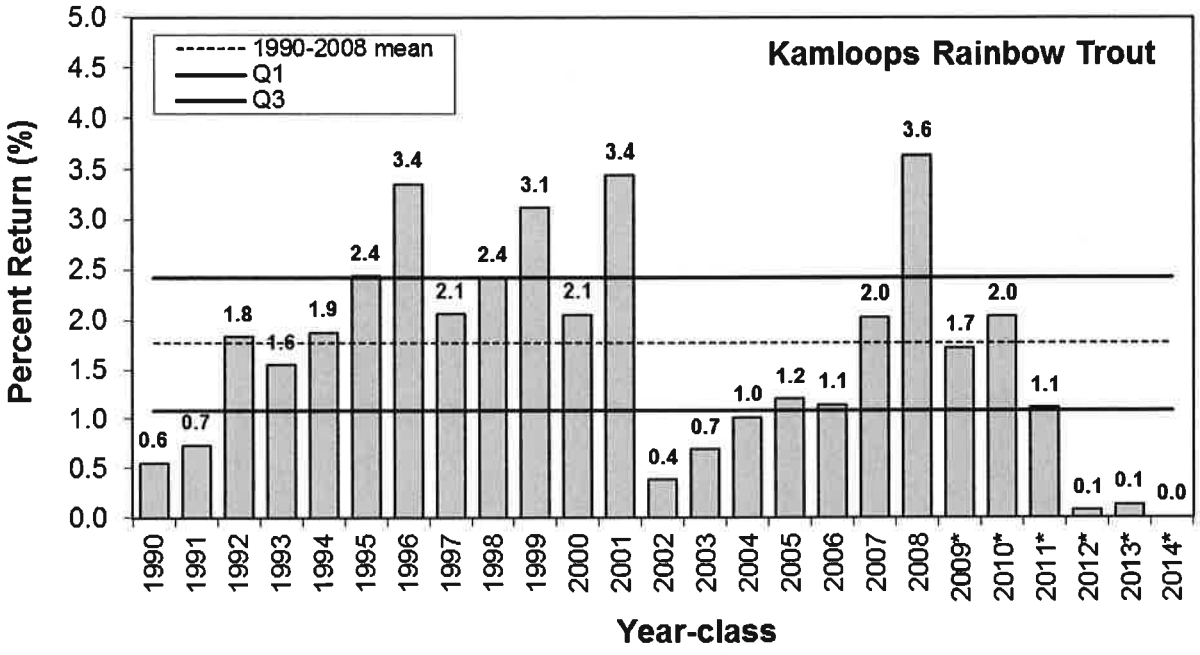

Figure 10. Percent of Kamloops Rainbow Trout that returned to the French River from the 1990-2014 year-classes. Incomplete year-classes are indicated by (*).

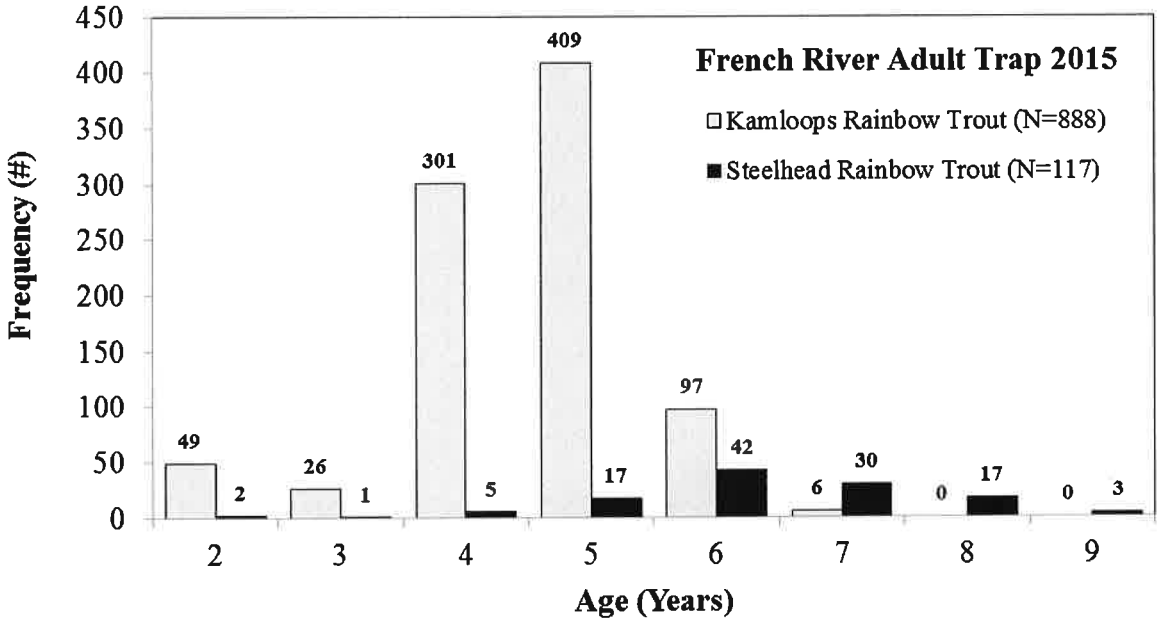

Figure 11. Age-frequency distributions of Kamloops and steelhead Rainbow Trout collected at the French River adult trap in 2015.

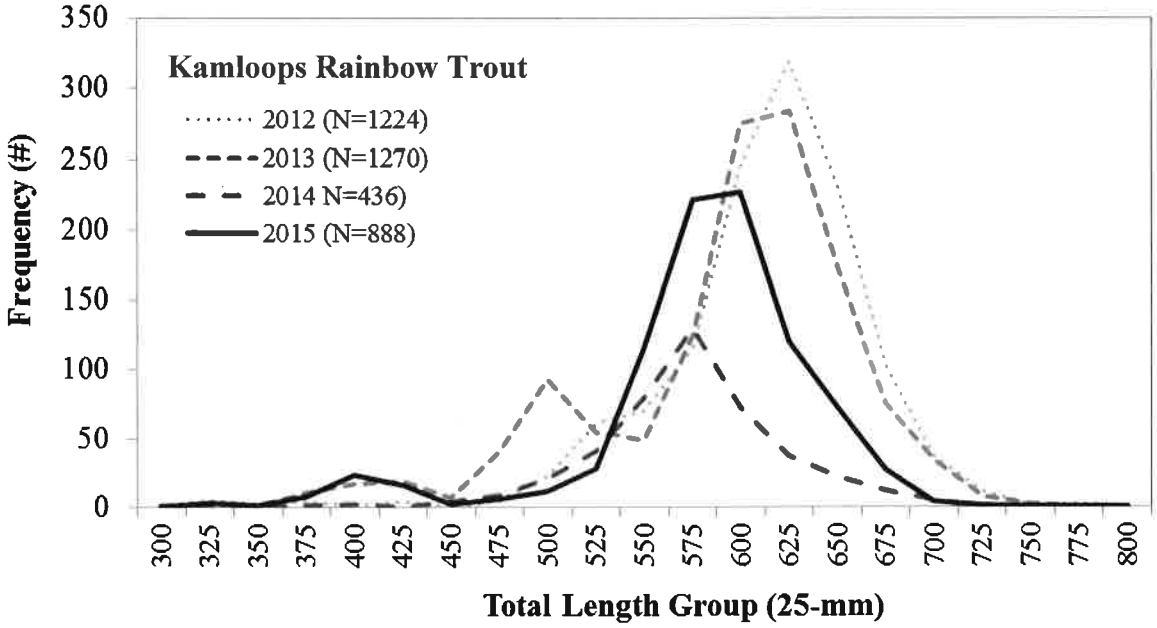

Figure 12. Length-frequency distributions of Kamloops Rainbow Trout captured in the spring at the French River in 2012, 2013, 2014, and 2015.

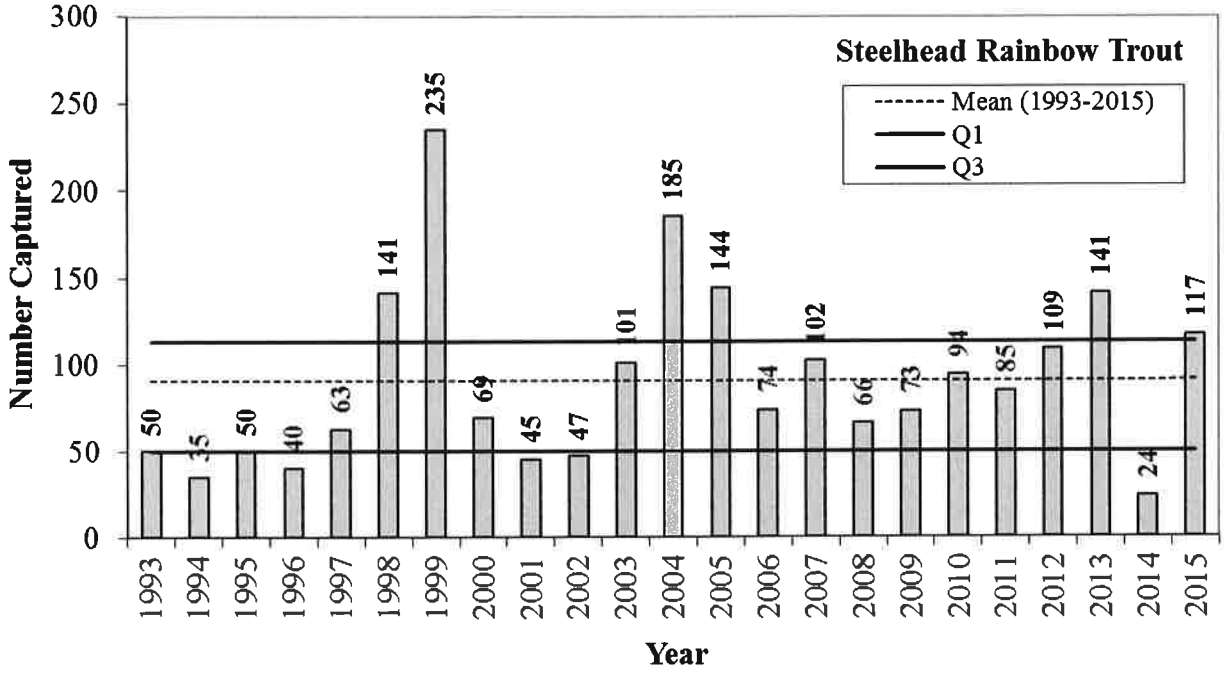

Figure 13. Number of steelhead Rainbow Trout collected at the French River from 1993 to 2015. The historic average (Mean) with 25th (Q1) and 75th (Q3) percentiles are also provided.

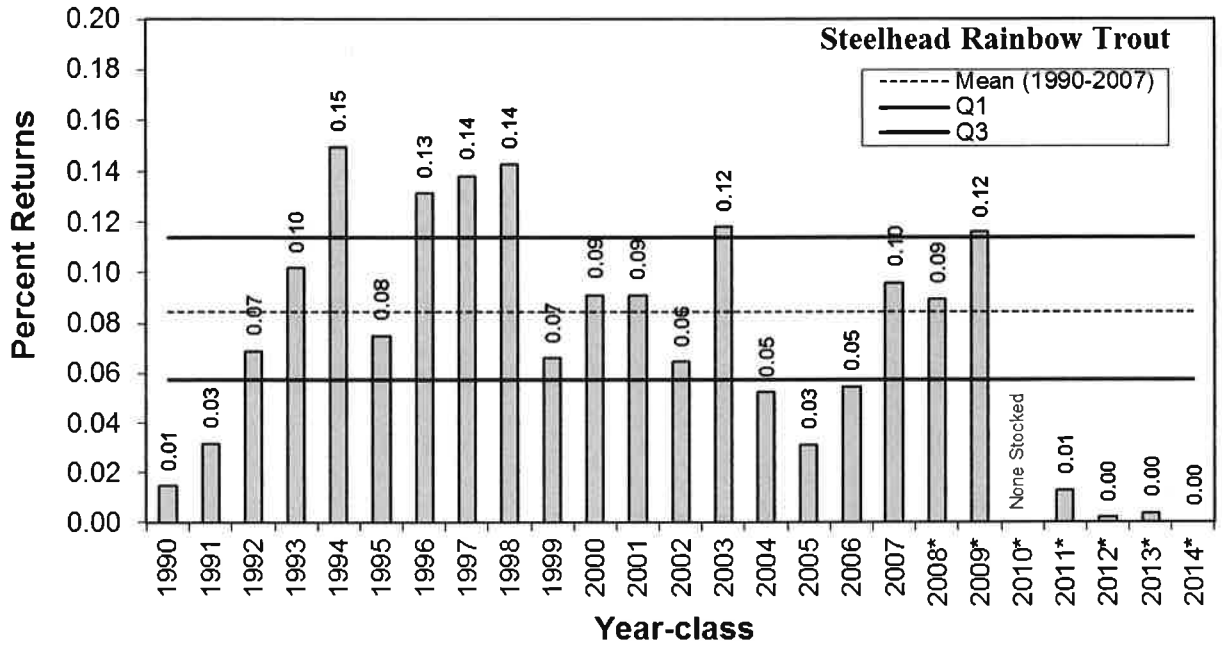

Figure 14. The percent of steelhead Rainbow Trout that returned to the French River by year-class. Incomplete year-classes are indicated by (*).

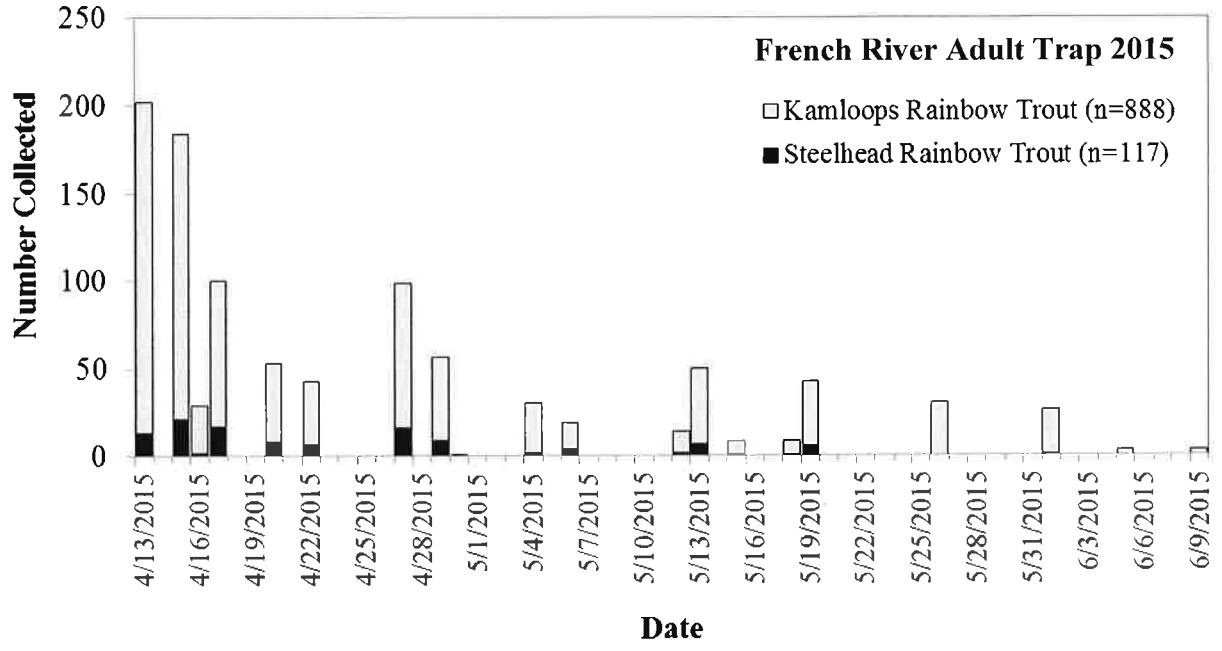

Figure 15. Number of Kamloops Rainbow Trout and steelhead Rainbow Trout collected by date during French River adult trap operations in 2015.

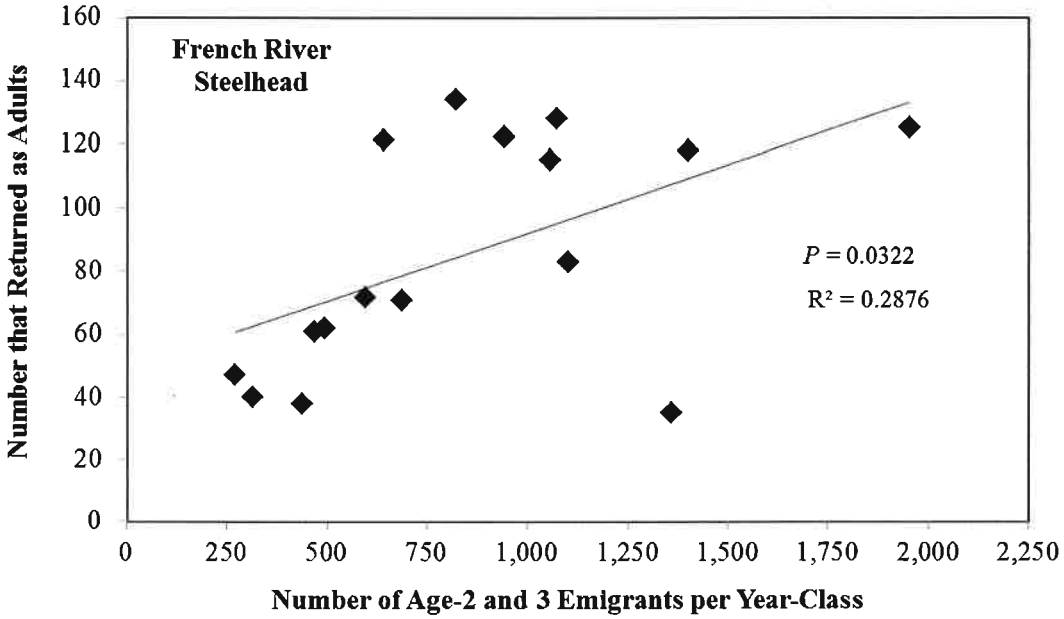

Figure 16. The number of age-2 and age-3 juvenile steelhead emigrants per year-class collected at the French River juvenile trap by the number that returned as adults to the French River adult trap (smolt/adult relationship).

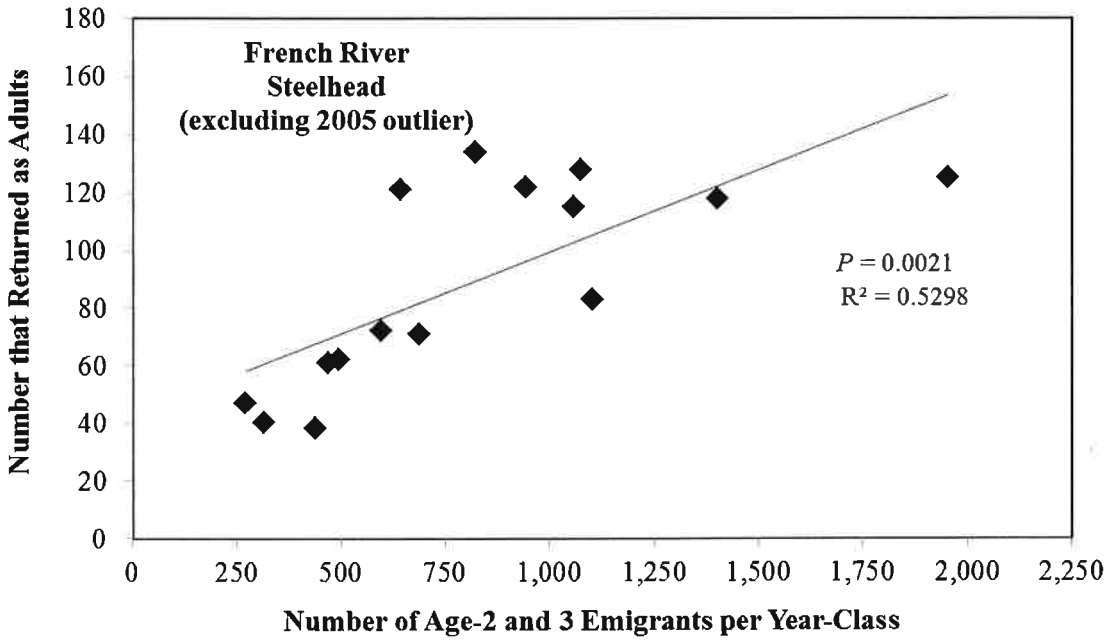

Figure 17. The number of age-2 and age-3 juvenile steelhead emigrants per year-class collected at the French River juvenile trap by the number that returned as adults to the French River adult trap (smolt/adult relationship - excluding 2005 outlier).