Enumeration of the Bull Trout Spawning Run and Juvenile Abundance Estimates in Lynx Creek, a Tributary to the Kakwa River

by:

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Executive Summary

The bull trout (*Salvelinus confluentus*) spawning run in Lynx Creek, Alberta (540^{0} N, 119^{0} W) was monitored annually from 1995 to 2001. Adults were intercepted with an enumeration fence, a permanent sampling site located upstream of the enumeration fence for juvenile population monitoring was established. Variations in run magnitude ranged from a high of 134 in 1999 to a low of 21 in 1997, and juvenile abundance ranged from a low of 15 in 2001 to a high of 82 in 1996. Time series data collected have provided insight into the spawning and recruitment dynamics of the Kakwa River Bull Trout in a relatively undisturbed environment. In future years, intensifying monitoring to detect impacts due to development will be crucial in assuring viability of this population in the future.

Acknowledgements

This study was made possible by the Alberta Conservation Association (ACA) funded by the anglers and hunters of Alberta. This ongoing study was initiated by Paul J. Hvenegaard in 1995 and will continue into the future. Special recognition goes to the ACA staff involved with key components of this project.

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1.0 Introduction

The bull trout (*Salvelinus confluentus*) is native to the Eastern slopes of Alberta (Nelson and Paetz 1992). Decreased abundance and distribution of bull trout (Carl 1985; Berry 1994) prompted fisheries managers to react by imposing zero harvest regulations in 1995 to promote the recovery of this sensitive species throughout Alberta. A fundamental component of future management and recovery of the bull trout is an understanding of its spawning biology, in an environment which is relatively unaffected by anthropogenic disturbance (Hvenegaard and Thera 2000; Hvenegaard and Fairless 1998).

The purpose of this ongoing study is to monitor the bull trout spawning run and juvenile abundance in the upper reaches of Lynx Creek.

2.0 Study Area

This study was conducted in the Kakwa River watershed as described by Hvenegaard and Fairless (1998). Lynx Creek is considered pristine with little access and no industrial activity as of yet.

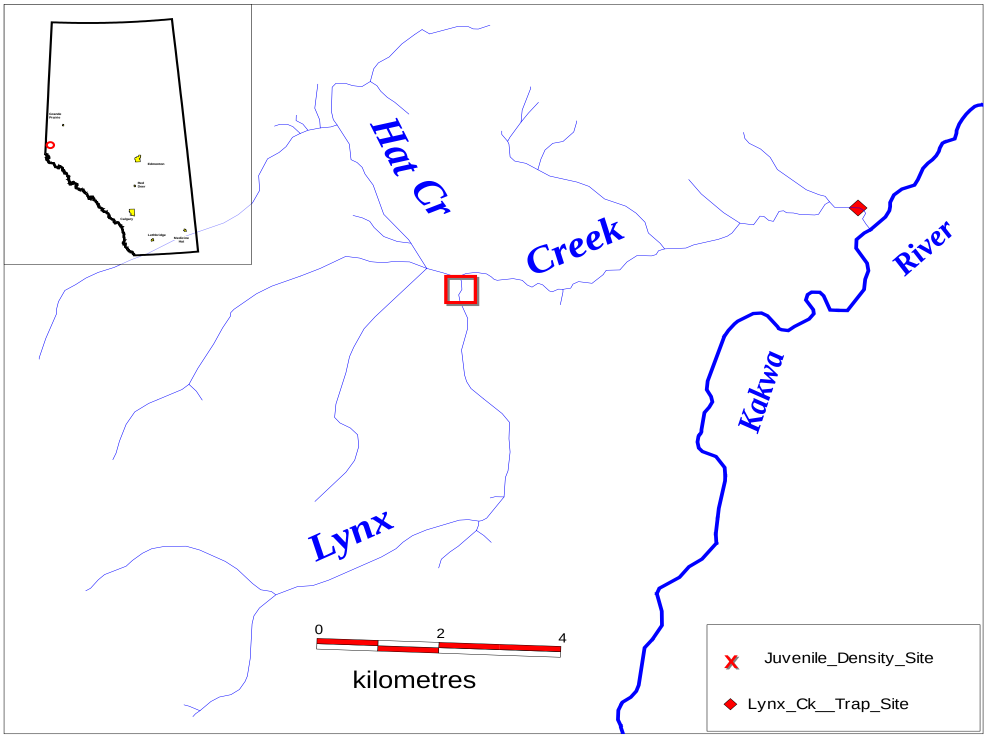

Figure 1. Map of Kakwa River Study Area.

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3.0 Methods

Fish Trapping

A fish trap and enumeration fence was operated from 1995 to 2001 during the late summer and fall to monitor dynamics of the bull trout (*Salvelinus confluentus*) spawning run. The fence was located 33 meters from the mouth of the Kakwa River in 1995, in all subsequent years the fence was located ~533 meters upstream of the confluence (Hvenegaard and Thera 2000). Trap / fence construction and operation were described by Hvenegaard and Thera (2000). All fish enumerated at the trap greater than 400 mm fork length were deemed adults.

Juvenile Population Estimates

A permanent sample site was located in upper Lynx Creek. Population estimates were conducted each year using three-pass depletion removal methods, described in Zippin (1956), Otis et al. (1978). Distances sampled ranged from 420 meters to 634 meters between years. Distance sampled was partially dependent on instream debris and channel morphology. The reach contained pool riffle and run habitat.

4.0 Results

Magnitude of the spawning run

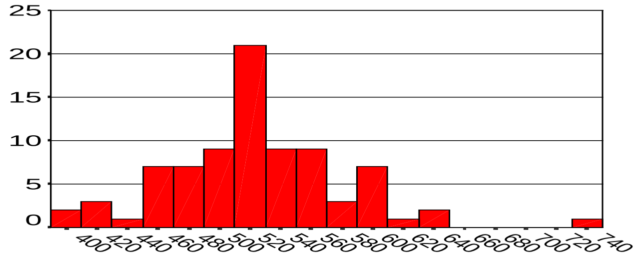
Adult bull trout enumerations varied from a high of 134 in 1999 to a low of 21 in 1997. In 2001 the Adult spawning run consisted of 65 bull trout greater than or equal to 400 mm fork length (Table 1.). It should be noted that the 1997 and 2000 enumerations were incomplete due to fence failure in high water conditions.

Table 1. Descriptive statistics of bull trout captured in or at the trap at Lynx Creek, 1995 – 2001.

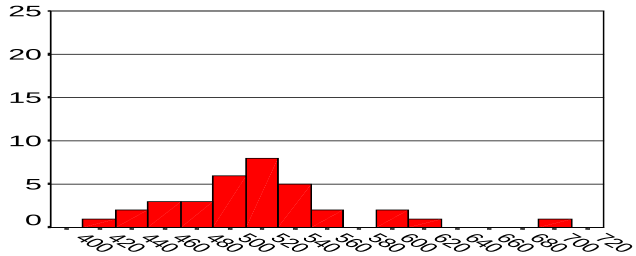
Year	Total Captured	FL Range	Mean FL	N < 400 mm	N > = 400 mm
1995	77	185 – 731	490	9 [12]	68 [88]
1996	36	154 – 691	488	4 [11]	32 [89]
1997	23	225 - 667	496	2 [09]	21 [91]
1998	72	160 – 658	376	35 [49]	37 [21]
1999	134	77 - 634	414	57 [42]	77 [51]
2000	25	311 – 675	498	5 [20]	20 [80]
2001	71	107 - 703	523	6 [8]	65 [92]

*Adapted from (Hvenegaard and Thera 2000).

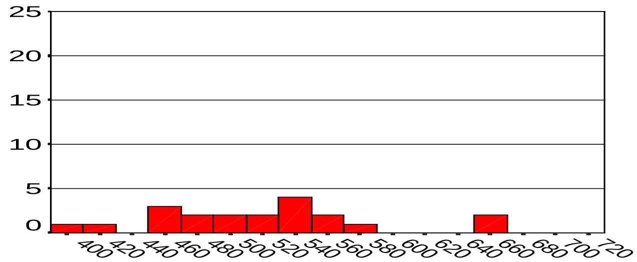
There were significant differences in the mean fork length of adult bull trout from yearly numerations (ANOVA: F = 3.309, df = 6, Sig. = 0.004), this result was confirmed by multiple means comparison Tukey HSD where mean difference was significant at the 0.05 level. Adult bull trout ranged in size from near the arbitrary 400 to 731 mm FL, see Figure 2. below.



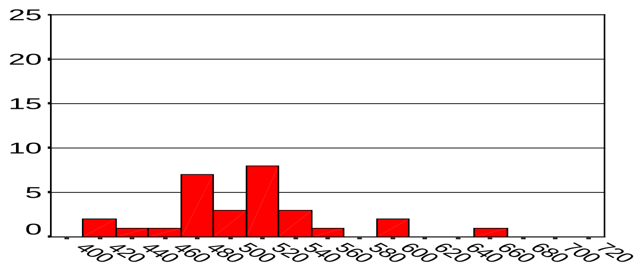
1995



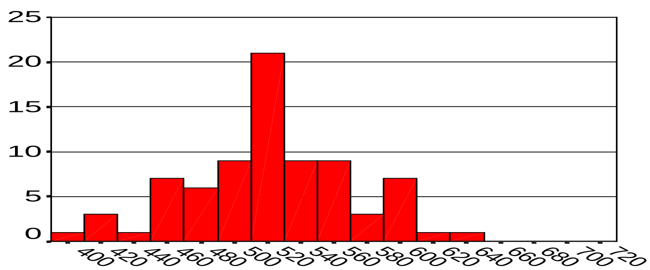
1996



1997



1998



1999

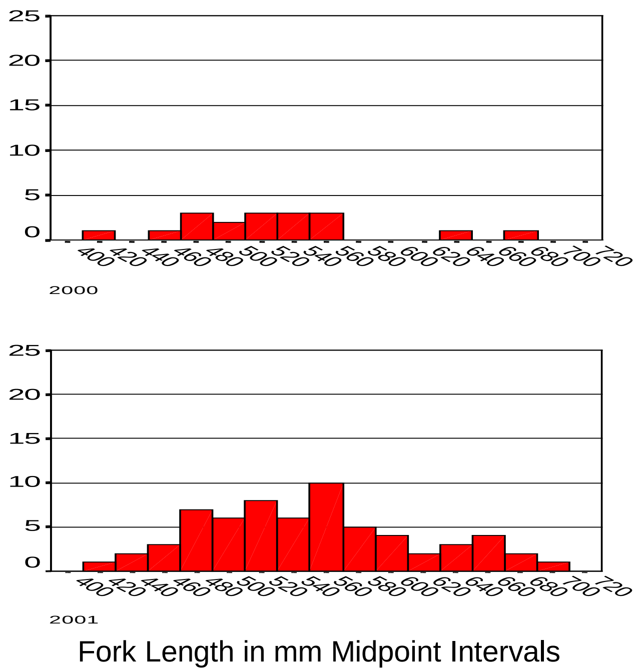


Figure 2. Length frequency distributions of adult bull trout (>400mm FL) captured in Lynx creek 1995 - 2001.

Juvenile Population Estimates

Juvenile bull trout population estimates were conducted from 1996 to 2001 on a single reach in upper Lynx Creek. Juvenile bull trout population estimates varied from a high of 82 in 1996 to a low of 15 in 2001 (Figure 3.), (Table 1.). There was a significant difference in mean fork lengths of juveniles sampled between years (ANOVA: $F = 8.072$, $df = 5$, Sig. = 0.000).

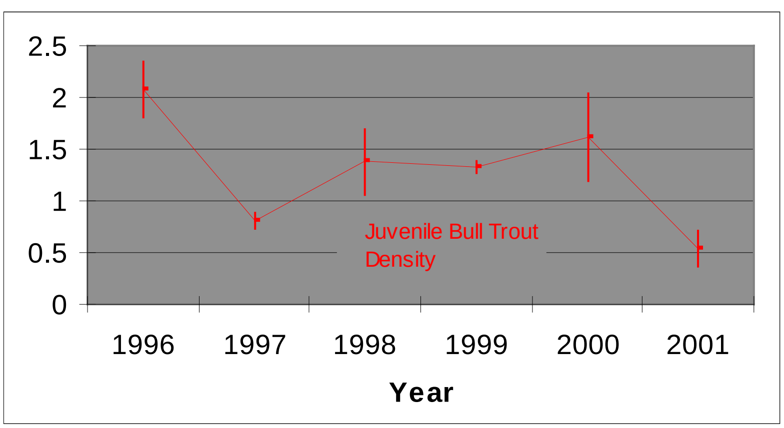


Figure 3. Density of Juvenile bull trout per 100 m^2.

Table 2. Population estimates with confidence intervals.

Year	Estimate	Lower interval	Higher interval	Density
1996	82	71.339	92.661	2.08273
1997	37	33.647	40.353	0.806072
1998	26	20.137	31.863	1.375661
1999	50	47.939	52.061	1.326964
2000	57	42.347	71.653	1.616686
2001	15	10.12246	19.878	0.53144

5.0 Discussion

The variance in run magnitude is consistent with the observation of Reiman and McIntrye (1993) in that small populations vary more than large ones. Spawning frequency and fidelity are probably factors related to the observed inter-year variation in spawning run magnitude. Hvenegaard and Thera (2000) reported a high degree of fidelity and a tendency toward alternate year spawning in Lynx Creek bull trout. These findings emulate the importance of this run as a source for recolonization of mainstem metapopulations with lynx creek propagules.

Variations in Juvenile abundance estimates are likely related to natural perturbations in both spawning run magnitude and rearing conditions. In mid July, discharges ~ 25 times greater than the annual mean were reported on the main stem 2 months prior to the 2001 estimate. This high water event caused: high bed load movements, influx of new woody debris and redistribution of old large woody debris, and extreme spatial changes in aquatic micro and macro-habitats. It is highly probable that the extreme flows dispersed juveniles from historic rearing habitats in upper Lynx Creek downstream. The significant difference in mean fork length of juveniles sampled between years can be attributed to highly variable population dynamics of the bull trout.

Long term monitoring of adult abundance and subsequent recruitment is required to detect changes attributable to anthropogenic disturbance. In order for monitoring to be sensitive enough to detect levels of population reduction in time to limit impacts of disturbance it must have the ability account for environmental and biological influences. Ham and Pearsons (2000) suggest that population abundance monitoring may not be sufficiently sensitive or rapid enough to prevent impacts from reaching unacceptable levels especially for rare or highly valued taxa. However, the collection of time series abundance data can provide insight into acceptable levels of inter-annual natural variation, and help in determining disturbance related impacts on this sensitive population.

Future industrial developments in the Kakwa River watershed warrant the necessity for increased monitoring. It is suggested that the number of sample sites for estimating juvenile abundance be increased to improve precision and lower the between year variance of total juvenile abundance in Lynx Creek. It may be necessary to monitor main-stem abundance and cohort strength of bull trout more intensively to ensure detection of impacts in time for fisheries managers to act.

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