

## WHITESWAN LAKE O&M - 2008



**British Columbia Ministry of Environment,  
Environmental Stewardship Division,  
Fish and Wildlife Section, Kootenay Region**



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## **EXECUTIVE SUMMARY**

Over a period from May 6 to June 21, 2008, a fisheries technician spent approximately 23 field days at Whiteswan Lake, in the East Kootenay Region of British Columbia. During this period, the technician conducted a creel survey, recorded fish lengths from harvested rainbow, conducted weekly rainbow spawner bank counts, installed a fish barrier fence, maintained and adjusted flow regime control structures, removed beaver dams and debris from spawning channel habitats, monitored conditions in 3 major spawning systems and ensured the protection of sensitive rainbow trout and spawning streams during the spawning period. In addition, the technician provided a fisheries presence for regulations advice and other educational information related to the Whiteswan Lake fishery and general fisheries management in the East Kootenay Region.

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## **1.0 INTRODUCTION**

Whiteswan Lake is the most heavily fished small lake in the Kootenay Region, supporting significant summer and winter fisheries. Significant fisheries resources have been dedicated to this lake system since 1964 and, over this period, extensive data has been collected by fisheries staff, continuing to present. Currently, Whiteswan Lake remains extremely popular among anglers from various demographics and groups and the target rainbow fishery is one of the most successful and impressive introduced, naturally reproducing rainbow populations in the province.

## **2.0 BACKGROUND**

Fisheries management at Whiteswan Lake has a long history, with records indicating that stocking with rainbow trout began as early as 1931 (Tepper, 2005). In 1959 and again in 1961, Whiteswan was “rehabilitated” with a treatment of toxaphene, a common management technique used up to 1980’s on many small lakes in British Columbia to eliminate “undesirable” native fish in order to create a monoculture system (Tepper, 2005; Westover, 1994). Alces Lake was also treated with toxaphene in 1959 for the same purpose (Tepper, 2008). Various reproductive strains of rainbow trout (mainly premier) were stocked at Whiteswan from approximately 1970 until 1985, when stocking shifted to a reproductive Gerrard strain of rainbow (Bell, Martin, 1985). In 2005, stocking was stopped, as several years of data from rainbow spawner ground counts and creel surveys indicated natural recruitment in the system was sufficient to maintain the population (Tepper, 2005).

In 1971, a water diversion structure and channel were constructed at the northwest end of Alces Lake to increase the flushing rate and improve the water quality of the lake. This diversion was replaced in 1999 with a larger diversion box and gate mechanism. In addition to the original purposes for this diversion, it also contributes to flushing of sediments and increased flows throughout the spawning channel.

In 1977 a spawning channel was constructed between Alces and Whiteswan Lakes. This channel created approximately .5 kilometer of spawning grounds for rainbow trout

moving upstream out of Whiteswan Lake. This channel was upgraded in 1979 (Bell, Martin, 1985). The spawning channel continues to be a significant source of natural recruitment for Whiteswan Lake and receives the second highest rainbow spawner use of the Whiteswan Lake spawning streams (Heidt, 2007). The channel also provides critical rearing habitat for juvenile rainbow trout prior to their out-migration to Whiteswan Lake.

In addition to improvements in spawning channel gravels, gravel/cobbles were also added in sections of Outlet Creek to improve spawning habitat in that system. Although specific details on this rehabilitation project are not available in Ministry files, it is suspected through anecdotal information and personal communication with retired fisheries staff, that the timing of this improvement would likely have coincided with the spawning channel upgrade in 1979.

Finally, in 1987, in an attempt to improve production in the spawning channel, a deep water outlet and dam structure was built at the outlet of Alces Lake (Tepper, 2005). This structure enables fisheries staff to control flows into the spawning channel, prevent upstream migration of Whiteswan RB into Alces Lake and draw cold water from Alces Lake into the channel to maintain critical water temperatures.

In addition to various infrastructure and spawning habitat improvement projects undertaken over years of fisheries management, angler creel surveys have been undertaken intermittently over spring/summer and winter fisheries since 1968 and annually over the spring fishery from 1987 to present (Westover, 1994; Heidt, 2001-2007).

### **3.0 STUDY AREA**

Whiteswan and Alces Lakes are located within Whiteswan Lake Provincial Park, approximately 30 kilometers east of Canal Flats, British Columbia. Whiteswan Lake has a surface area of 378 hectares, a maximum depth of 19.3 meters and a mean depth of 13 meters. It is located at an elevation of 1143 meters (Tepper, 2005). As mentioned in the background information, there are several important physical features and

tributary/spawning streams within the park relevant to fisheries management and population monitoring, including: Mutton Creek diversion, Alces Lake deep water outlet, the Spawning Channel, Inlet Creek and Outlet Creek (Figure 3).

#### **4.0 SPAWNING STREAMS & FISHERIES STRUCTURES**

##### **4.1 Whiteswan Lake Spawning Channel**

In order to maintain adequate flows, water temperatures and natural scarification of spawning gravels in the spawning channel, the Mutton Creek diversion (Figure 1) and Alces Lake deep water outlet (Figure 2) were monitored and adjusted as needed from the period of May 8 until the middle of June, 2008. This required daily inspection, adjustments and removal of debris. The deep water outlet at Alces Lake will continue to be monitored occasionally through the summer/fall season to ensure adequate flows and temperatures are maintained for rainbow trout egg/fry survival and for rainbow juveniles utilizing the channel as rearing habitat.

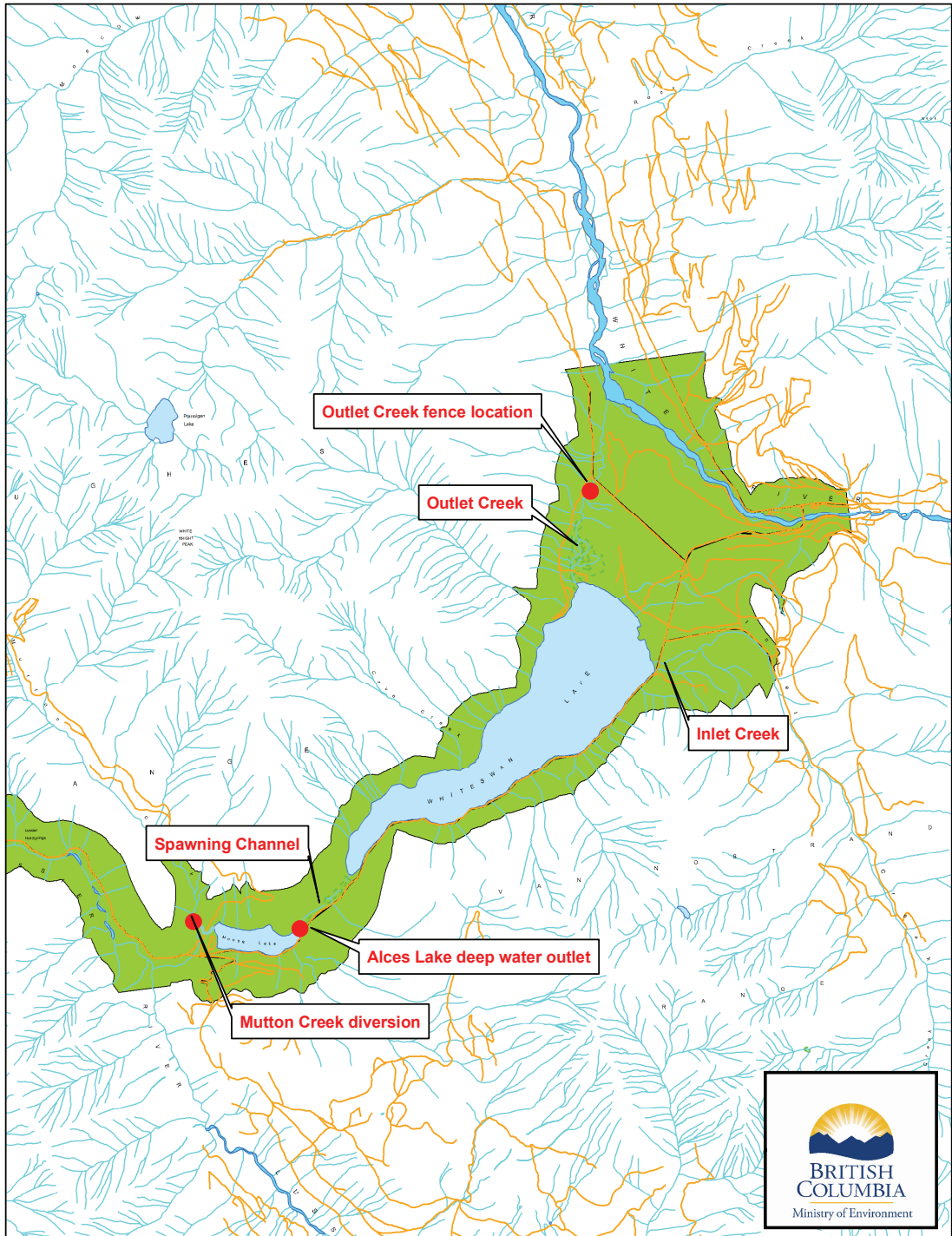


**Figure 1. Mutton Creek diversion**



**Figure 2. Alces Lake deep water outlet**

Beaver activity was noted in the spawning channel during the first week of May, 2008. Subsequently, two beavers were removed from the spawning channel just above Whiteswan Lake from the beginning through the end of May, 2008. Several days were required to remove the beaver dams and clean some of the debris from the channel in order for spring flows to adequately clean the gravels and fish passage to be facilitated.



**Figure 3. Whiteswan Lake overview map (fisheries structures and primary spawning streams)**

Removal of channel blocking debris to allow for natural flushing of sediments from the channel occurred just prior to the upstream spawning migration.

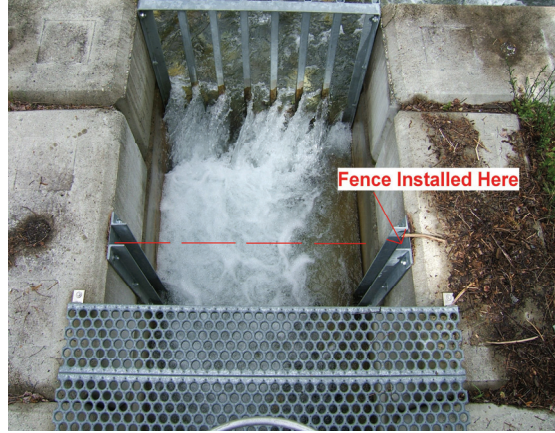
#### **4.2 Mutton Creek Diversion**

The original diversion structure at Mutton Creek was built in 1972 to increase the flushing rate of Alces Lake, improve water quality in the lake and increase discharge into the spawning channel (Bell, Martin, 1984). The original diversion structure prevented spawner escapement into the mainstem of Mutton Creek by use of an adjustable bottom-up gate system, which controlled flows and was an effective barrier to fish passage (Heidt, 2007). The second generation Mutton Creek Diversion was installed in 1999. In the new diversion box and gate mechanism, the gate can be adjusted top-down to control flows, but cannot be adjusted to limit upstream migration (Figure 4). From 1999 until 2007, this has resulted in many reproductive RB moving out of the Diversion channel and into the main Mutton Creek system to spawn. The timing of this escapement coincides with annual peak flows in Mutton Creek during spring freshet. As a result, many of the RB spawners that escaped into Mutton Creek during this period did not return to the Diversion channel and eventually moved or were carried down into the Lussier River and upper Kootenay River system.

On May 20, 2008, a barrier fence was installed inside the Diversion box to prevent upstream escapement of migrating rainbow spawners in an attempt to protect natural biodiversity values and hybridization issues pertaining to westslope cutthroat trout (WCT) (Figure 5). This fence was also installed in 2007. The small fence was constructed by attaching 1" square heavy gage galvanized wire fence to several metal t-bar and then inserted into existing ¼ inch aluminum u-brackets within the concrete Diversion box. As the fence was installed prior to RB reaching the Diversion (determined through prior visual inspection of the channel) and maintained throughout the spawning run, it is likely that the fence was successful in preventing any escapement during the spawning run. The fence was removed from the diversion on June 17, 2008, after visual inspection confirmed that rainbow spawners had returned to Alces Lake.



**Figure 4. Mutton diversion gate system**



**Figure 5. Mutton diversion fence location**

It is important to note that reproductive rainbow have not been stocked in Alces Lake since 2003. Stocking requests were modified in the spring of 2004 from reproductive rainbow strains to sterile AF3N Pennask. The purpose of this change was twofold: to mitigate future outmigration of reproductive rainbow trout and potentially foster a higher quality product for anglers fishing Alces Lake (Tepper, 2008).

### **4.3 Outlet Creek**

Rainbow escapement is also an issue at Outlet Creek, the primary spawning system at Whiteswan Lake. Spawning habitats in Outlet Creek begin approximately 50 metres downstream of Whiteswan Lake and occur intermittently throughout the system until just upstream of the Mutton Creek FSR bridge, at the junction of Home Basin Campground Rd. and Mutton Creek FSR. At this point, Outlet Creek becomes significantly more confined, there is an obvious gradient shift and the substrate changes from fines and gravels to larger cobble and boulder material. Several hundred metres downstream of the bridge, there is a significant falls on Outlet Creek (approximately 10 metres in height), which is a barrier to upstream fish passage from the White River system into upper Outlet Creek and Whiteswan Lake. During the spawning run, several Whiteswan rainbow populating Outlet Creek are carried over the falls (confirmed through visual inspections and angling surveys below the falls), and prevented from returning upstream to the lake. As spring flows in Outlet Creek recede and the water temperature increases these rainbow then move downstream into the White River and upper Kootenay River systems (Cope - 2004). This escapement is a concern to fisheries management due to biodiversity values

and the introduction of non-native species. In an attempt to mitigate future escapement and begin to address this issue, an experimental fish barrier fence was installed on Outlet Creek on May 10, 2007 (Figure 6); however, due to the substrate composition (mud/clay) and high water conditions, this fence was fully breached and unsuccessful (Figures 6&7). Given the demonstrated futility of this style of fence structure in soft substrate, the fence was not installed in 2008. Subsequent monitoring has occurred and discussion is ongoing to determine other possible fish barrier solutions to this annual problem.



Figure 6. Outlet Creek fence (May, 2007)



Figure 7. Final breach of Outlet fence

## 5.0 CREEL SURVEY

A creel survey was conducted at Whiteswan and Alces lakes over 15 days from May 20 to June 17, 2008. A total of 155 anglers were interviewed at Whiteswan Lake. They fished for 545 hours and caught 447 rainbow trout for a catch per unit effort (CPUE) of 0.82 fish per rod hour. Forty-two of the rainbow were harvested (9% of total catch), while 405 were released (Table 1). A total of 18 anglers were interviewed at Alces Lake. They fished 53 hours and caught 32 rainbow trout for a CPUE of 0.61 fish per rod hour. Only three of these RB were harvested, while 29 were released (Table 2).

**Table 1. Whiteswan Lake creel survey data from May 20 to June 17, 2008.**

<b>Number of Anglers</b>	<b>Rod Hours</b>	<b>Rainbow</b>		<b>CPUE (fish per rod hr)</b>
		<b>Harvested</b>	<b>Released</b>	
155	545	42	405	0.82

**Table 2. Alces Lake creel survey data from May 20 to June 17, 2008.**

<b>Number of Anglers</b>	<b>Rod Hours</b>	<b>Rainbow</b>		<b>CPUE (fish per rod hr)</b>
		<b>Harvested</b>	<b>Released</b>	
18	53	3	29	0.61

Comparisons in creel data from both systems demonstrate relatively similar fluctuating trends in spring CPUE over the past six years (2003-2008). Results from 2008 data indicate that the Whiteswan CPUE remains relatively consistent with the six year average, and remains at an acceptable level. The Alces Lake results for 2008 indicate the second lowest CPUE in six years; however, the number of anglers interviewed were limited (n=18), which may have influenced the results. In fact, caution should be used when interpreting the Alces Lake CPUE results over the past 4 years, as interview numbers were consistently low and could significantly influence results (Figures 8 and 9).

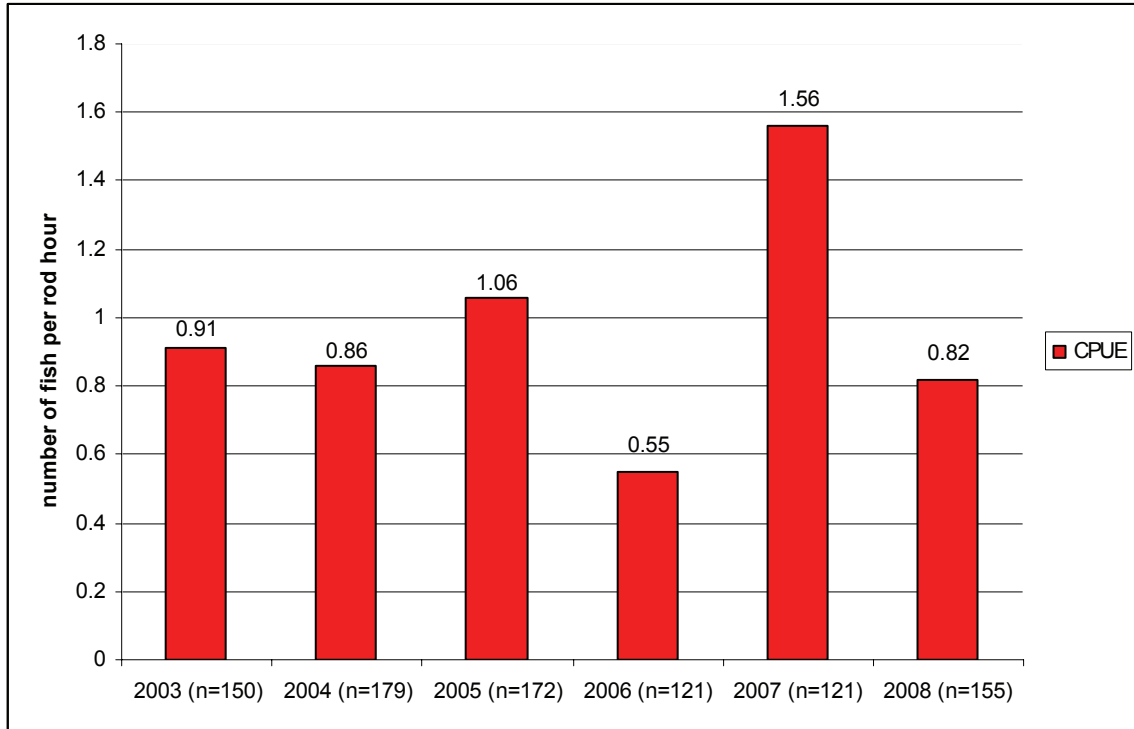


Figure 8. CPUE comparison on Whiteswan Lake (spring 2003-2008)

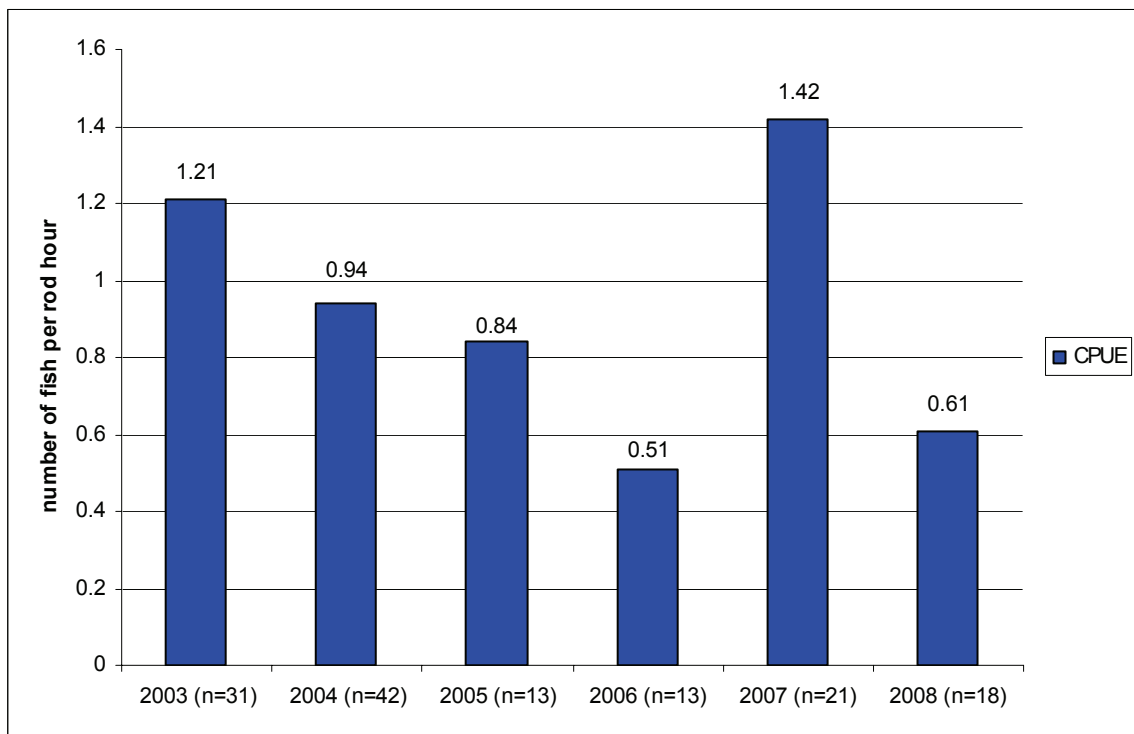


Figure 9. CPUE comparison on Alces Lake (spring 2003-2008)

## **5.1 Fish lengths**

During the period of this study (May 20 - end of June/2008), 133 fish lengths were taken from rainbow trout caught at Whiteswan Lake. Of these, 42 were taken from harvested rainbow measured during the creel survey, and 89 were taken by a selected angler asked to keep track of rainbow lengths during an angling trip at Whiteswan Lake. From June 3-June 26, this angler fished for 21 days and landed 104 rainbow, from which 89 lengths were recorded. It should be noted when interpreting these results, that the majority of this latter effort was limited to the south end of the lake (packrat point), potentially influencing average size results overall. Of the total rainbow measured (131), these fish ranged from 200 mm to 510 mm, with an average overall length of 410 millimetres (Appendix I). It should be noted that there were no fish lengths taken from Alces Lake due to the small sample size of anglers interviewed.

## **6.0 GROUND COUNTS**

Ground counts of spawning rainbow trout were conducted at the Spawning Channel, Inlet Creek and Outlet Creek (Table 3). The total number of fish counted peaked on June 6, when 3,916 spawners were enumerated (381 in the Spawning Channel, 249 in Inlet Creek and 3,286 in Outlet Creek). Timing for peak spawner counts were not consistent between streams, with high counts occurring on May 30, June 13 and June 6 on the three systems (Channel, Inlet and Outlet, respectively). It should be noted that Inlet Creek experiences extreme fluctuations in both flow regimes and turbidity during spring counts and, even during good conditions, ground counts are subject to a significant degree of error. Average ground counts taken from 1989 to 2008 indicate that Inlet Creek has accounted for approximately 18% of the spawning population (similar to the Spawning Channel) over that time frame. Looking at just the past 3 years (2006-2008), this statistic has dropped to 4% of the overall spawner count (peak counts of 21, 184 and 285, respectively). Analysis of the historical count data indicates that these low count anomalies have also occurred in previous study years (1999 and 2002 peak counts were 0 and 28, respectively). As indicated by these numbers, there is an extreme amount of variability in Inlet Creek counts and they should be interpreted with caution. Overall

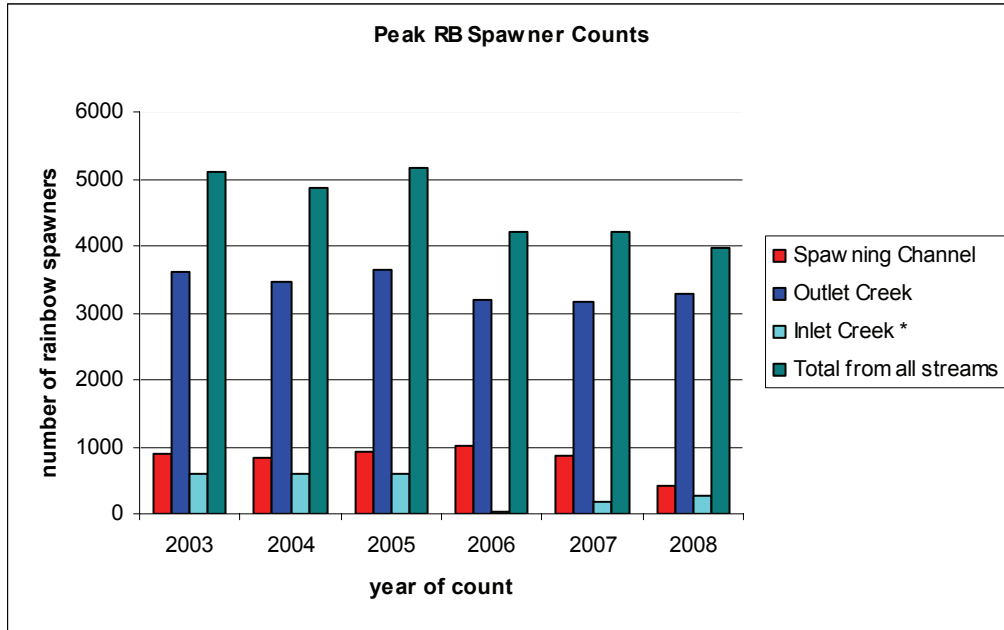
spawner numbers in this system likely remain relatively consistent with the historical trend. Continued long term monitoring will provide a more conclusive analysis.

**Table 3. Ground counts of rainbow trout in Outlet Creek, Inlet Creek and the spawning channel, 2007.**

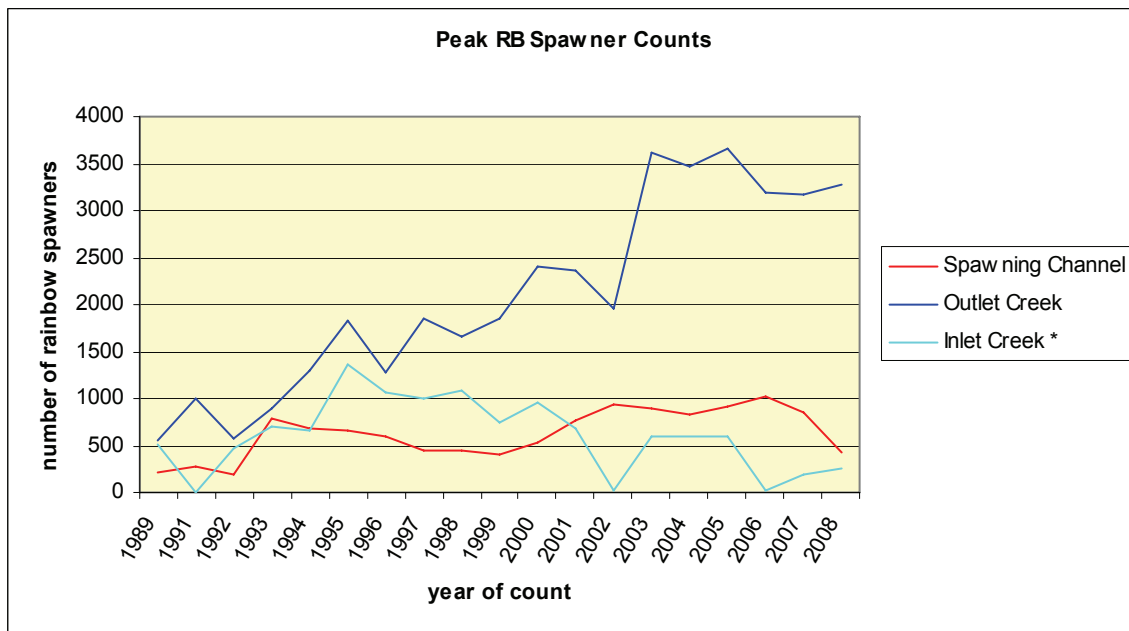
<b>Date</b>	<b>Channel</b>	<b>Inlet</b>	<b>Outlet</b>	<b>Total</b>
May 23	185	5*	1,610*	1,800
30	416	53*	2,796	3,265
June 6	381	249	3,286	3,916
13	108	265	1,782	2,155
20	8	111	730	849

\*High/turbid water – Poor visibility prevented counts.

Analysis of trend data from spawner counts over the past 6 years (2003-2008) indicates a slight overall lowering trend from 2006 to 2008. However, these counts were adversely affected by the limited visibility and resulting low counts encountered in Inlet Creek. In addition, the peak count in the Spawning Channel in 2008 was significantly lower than average. This may have partially been due to beaver activity at the outlet of the channel in early May, resulting in a large beaver dam and debris, which blocked the channel until its removal in early June. The count in Outlet Creek was slightly higher than the previous two years and, overall, spawner count numbers appear to indicate a healthy spawning population and good natural recruitment potential, as peak spawner counts remain around 4,000 (Figures 10, 11 & 12). Given an average fecundity of approximately 1,000 eggs per female at Whiteswan (Martin, 1986) and assuming an egg to adult survival of approximately 1% (Westover, 1994), a 4,000 spawner count average would contribute approximately 40,000 adult fish into the system each year. Given that spawning also occurs in several shoal areas within Whiteswan and in other small tributaries, natural recruitment appears to remain a viable source for populating this lake.



**Figure 10. Peak counts of spawning rainbow in 3 streams at Whiteswan Lake (2003-2008)**  
 \*Counts in Inlet Creek during 2006 -2008 were significantly effected by turbidity



**Figure 11. Peak counts of spawning rainbow in 3 streams at Whiteswan Lake (1989-2008)**

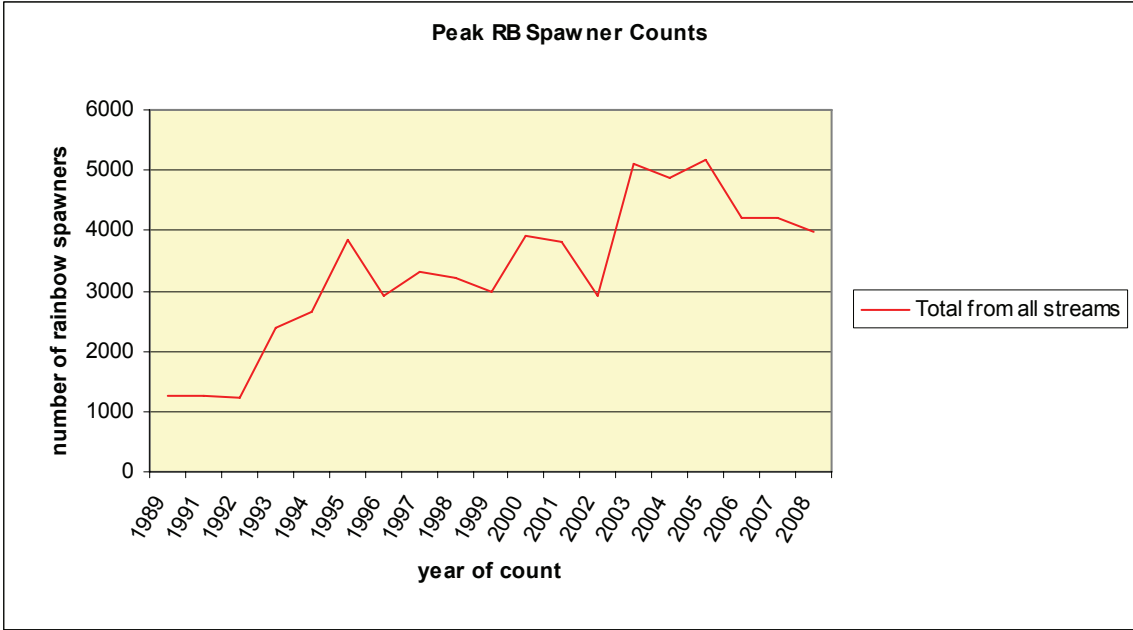


Figure 12. Total peak counts of spawning rainbow at Whiteswan Lake (1989-2008)

## 7.0 DISCUSSION & RECOMMENDATIONS

Whiteswan Lake is a very unique small lake fishery, with both a long and storied history of fisheries management and a unique naturalized reproductive rainbow population. The lake provides a consistent quality angling experience and continues to be the most heavily fished small lake in the Kootenay Region, averaging approximately 10,700 angler days annually over the past 13 years (Slim Count data)(Figure 13). This data includes only the spring, summer and fall fishery and does not take into account the popular ice fishery on this lake during winter months. The average extrapolated angler effort taken from winter creel data at Whiteswan Lake from 1970 to 1995 was 3,730 angler days (Westover, 1995), bringing total average angler days on this lake to approximately 14,400 per year.

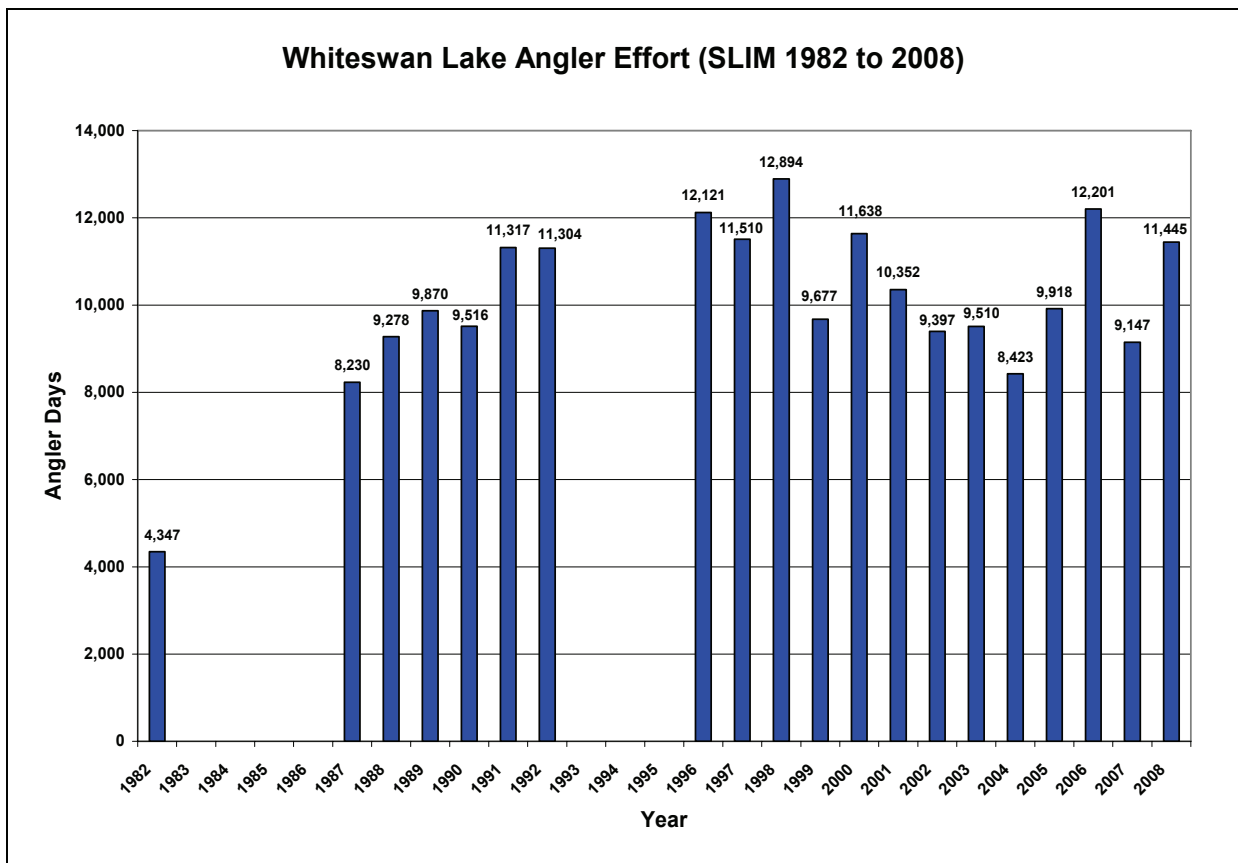


Figure 13. Slim boat count data for Whiteswan Lake (angler days per year)

Several ongoing issues are of concern regarding the effective management of the Whiteswan Lake fishery. These concerns fall primarily into two categories: Firstly, conflict in interagency management strategies as a result of proactive fisheries

management of the rainbow population; specifically, activities which actively protect spawning habitats within the provincial park by controlling beaver populations. Secondly, concerns pertaining to biodiversity values in the upper Kootenay River watershed directly affected by outmigrating reproductive Whiteswan Lake rainbow.

Anecdotal information indicates that activities to control beaver populations at Whiteswan Lake have been ongoing since active fisheries management began there; however, conflict with fisheries management in this regard began specifically in 1991. Although Whiteswan Lake was established as a Provincial Park in 1978 (1,977 hectare area including Whiteswan and Alces Lakes), a registered trapline was maintained at Whiteswan until 1991. During this period, beaver were actively trapped throughout the park and populations were controlled. In 1991, B.C. Parks bought out the registered trap line within the park. This, in conjunction with depressed prices for beaver pelts in the early 1990's, led to established beaver populations throughout the park and surrounding areas, resulting in impacts on rainbow spawning habitats (Westover, 1994). Beginning in the early 1990's, a trapper was hired by fisheries to remove beaver from the Spawning Channel and Outlet Creek, and from 1990 until 1997 gravels were actively scarified and cleaned following beaver dam removal. Both of these activities occurred in April and early May, just prior to rainbow spawning migrations out of Whiteswan Lake. The practice of hiring a trapper for beaver removal has continued to present, with annual removal of beaver from both Outlet Creek and the Spawning Channel. Beaver activity reduces and alters flow regimes, creates large silt impoundments, floods both spawning and rearing habitats and blocks fish passage (Westover, 1994). An analysis by the regional fisheries biologist in 1994 concluded that "an uncontrolled beaver population has the potential to...virtually eliminate the natural recruitment of rainbow trout to Whiteswan Lake" and that "an annual beaver trapping and dam removal program is essential to ensure rainbow trout spawners have access to [suitable] spawning areas and resulting fry can migrate back to Whiteswan Lake (Westover, 1994). It should be added that because beaver activity appears to shift to and impact different areas of the lake, sometimes moving from the Spawning Channel to Outlet Creek within one year,

maintaining a diversity of healthy spawning habitats is critical to ensuring long term survival and viability within this population.

Within the past 3 years, issues have come to the forefront regarding a potential conflict in policies between B.C. Parks and Fisheries staff. Specifically, concerns have been raised by B.C. Parks indicating that measures to control beaver within a provincial park contradict Parks policies of biodiversity values and public safety. Current procedures require Fisheries staff (or the trapper) to apply for a park use permit in order to enable the trapper to trap beaver within Whiteswan Park; however, due to the aforementioned concerns, Park staff have been reluctant to sign off a permit over the past two seasons. In addition, Fisheries staff have been requesting a more permanent solution to this issue, as the process of applying for permits each year requires time and limits their ability to deal quickly with this annual problem. Due to the conflict between policies and concerns of both the Fisheries Section and B.C. Parks, a headquarters driven structured decision making process was put in place in 2007. Staff from both divisions of the Ministry of Environment prepared background information and evidence to support their arguments, and this information was then reviewed by a panel to weight different factors in order to reach a decision on future policy. During the period of this process, 2 permits were issued to deal with beaver activity at Whiteswan Lake (spring and fall of 2007 and spring of 2008). As of this report, Fisheries and B.C. Parks staff in the East Kootenay Region are still not aware of any policy decision or conclusion to this process. Given this result, it is assumed that the issue will continue to be dealt with on a season by season, issue by issue basis. Increased cooperation needs to occur between Fisheries and B.C. Parks staff in Region 4 in order to mitigate concerns of both parties and responsibly manage fisheries resources within Whiteswan Provincial Park for the benefit of both agencies and the public.

A second issue of concern at Whiteswan Lake is the potential effect of reproductive rainbow trout escapement from Outlet Creek into the Upper Kootenay River system. Given that Westslope Cutthroat Trout are blue listed as a vulnerable species and that hybridization within the Kootenay River drainage is already an issue of importance, this

escapement is a real concern to fisheries management from a biodiversity value standpoint. This issue has been ongoing at Outlet Creek for many years, but has only received attention by fisheries staff over the past 4 seasons, with active attempts to both evaluate and measure impacts (2005 to 2008) and prevent escapement (2007). Because there are several critical unknown parameters regarding this situation, including; the number of rainbow escaping upper Outlet Creek, spawning activity in the lower creek, the use of lower Outlet Creek as a WCT spawning and rearing stream, fry and juvenile rainbow survival and movements in lower Outlet Creek, the number of reproductive adult rainbow entering the White River and Upper Kootenay systems and the survival rates of these fish upon entering a river system, given their genetic development and life cycle history as a lake species, it is recommended that fisheries step up efforts to monitor this situation more closely. This should involve evaluating the extent of escapement during the spawning run and a post spawning evaluation of spawner use within lower Outlet Creek (below the falls). This could include visual observations and counts throughout Outlet Creek (below the falls) to its confluence with the White River, and post-spawning electroshocking throughout this section of Outlet Creek, to determine rainbow fry population and spawner use evaluation in this system. It is also recommended that techniques be considered, evaluated and employed to directly address this escapement. These techniques could involve feasibility studies and use of possible fence structures (including acoustic fish barriers), employing focused angler harvest for rainbow below the falls during the spawning period and use of netting techniques below the falls in Outlet Creek.

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**Appendix I. Rainbow lengths taken at Whiteswan Lake (May 20 - June 26, 2008).**

Fish Length (mm)	Fish Length (mm)	Fish Length (mm)	Fish Length (mm)
470	410	430	410
460	280	510	380
420	460	460	390
420	380	410	370
450	510	410	390
480	300	430	380
430	410	430	410
480	460	430	430
450	360	410	380
500	410	410	440
480	430	460	390
420	410	470	390
460	390	430	390
480	430	430	390
460	460	420	380
460	300	380	410
440	470	370	460
420	430	390	380
500	410	370	410
420	440	390	410
480	510	390	360
480	500	430	380
380	380	280	430
500	300	390	410
390	300	430	500
430	430	360	410
440	430	360	360
490	410	380	390
420	430	390	390
390	480	380	250
200	420	390	230
430	380	200	510
410	360	280	
Average Length.	441	408	397
<b>Total Average Length (mm)</b>	<b>410</b>		