

Butterfly Lake

Recreational Fishery Stock Assessment

2004 Final Report

Project Tracking Number

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EXECUTIVE SUMMARY

A stocking assessment was completed on Butterfly Lake in Eskers Provincial Park in 2003. The objectives of this assessment were to 1) document the status of this fishery, including changes in fish growth-at-age through time, as well as 2) to confirm and investigate the level of naturalized recruitment from the descendants of eastern brook trout stocked before 1997. A third objective was to compare the relative growth and performance of stocked versus naturalized eastern brook trout in Butterfly and Bow lakes. Standard BC Resource Inventory and Standards Committee methods were used to complete the survey. Naturalized brook trout recruits (2N), mature brook trout and evidence of redd digging were observed during the course of the survey. A cohort of marked all female triploid (AF3N) eastern brook trout that were requested for stocking into Butterfly Lake in 2001 was not captured in 2003. It was determined through the course of another stock assessment survey on Kinglet Lake (Williamson 2004a, Williamson 2004 c) that these fish were in fact mis-stocked into Kinglet Lake. As a result of this error, a comparative study investigating the relative growth and success of hatchery (AF3N) versus wild naturalized (2N) EB in Butterfly and Bow Lakes was delayed. Catch per unit of net effort for diploid (2N) eastern brook trout was greater in 2003 than it was for surveys completed in 1999 and 1991. In contrast growth rates and lengths-at-age of naturalized brook trout in Butterfly Lake were found to be less than for other Omineca lakes and have declined since 1991. Growth, catch per effort and the spawning survey results are indicative of a growing population in Butterfly Lake where recruitment is not likely limited by spawning habitat. Based upon the results of this survey it is recommended that 1) Butterfly Lake should be re-assessed in 2004 to complete the Bow-Butterfly Lake paired lakes study and; 2) Butterfly Lake should continue to be assessed through opportunistic creel surveys and periodic stock assessments in an effort to monitor its growing EB population; and 3) an increase to the bag-limit for wild/naturalized EB in Butterfly Lake should be considered to help reduce this size of this population and maintain the quality of this fishery.

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INTRODUCTION 1.0

This report presents the results of a recreational fishery stock assessment of Butterfly Lake in 2003 with a comparison to work completed in 1999 (Zimmerman, 1999a) and 1991 (VanSchubert, 1991). This assessment was completed on October 1, 2003 by the Ministry of Water Land and Air Protection (M.W.L.A.P.) with funding obtained through the Small Lakes Management and Conservation Initiative (SLMCI). Analysis and reporting of the field results were conducted by the author. Peer review of this report was completed by regional fisheries staff. Inquiries pertaining to this report should be directed to the M.W.L.A.P. in Prince George.

Butterfly Lake is a closed drainage system (Table 1, Figure 1) located 32 km northwest of Prince George in Eskers Provincial Park. The lake was initially surveyed in 1985 and was determined to be barren of fish based on gill net and minnow trap surveys (Phillip, 1985a). Butterfly Lake was first stocked with eastern brook trout (*Salvelinus fontinalis*) in 1988 (Appendix 2 Table 1). The original fishery management objective for Butterfly Lake was to provide a moderate yield fishery for eastern brook trout (M.W.L.A.P. Lakes Files). Stocking was suspended at the request of the Parks Branch after 1989 as the result of concerns by Parks staff regarding uncontrolled angler access to the lakes in Eskers Park, which was occurring in response to the stocking program but in advance of the completion of adequate trail infrastructure to support the increased angler use.

After the stocking program ceased, unconfirmed reports were submitted to Fisheries and Parks staff that some of the lakes were continuing to produce brook trout, presumably through natural recruitment. Reports were also received that indicated that fish may have been transferred between lakes, a situation which, if true, would have a direct bearing on the management objectives for each of the lakes initially stocked. In 1996, Parks Branch requested that the stocking program be re-invoked, as it was felt that angler use could now be controlled given the state of the park's infrastructure. Stocking of EB was reinitiated in Butterfly Lake 1997 on an alternate year basis at a rate of 462 fingerlings/ha (Appendix 2. Table 1). In 2003 the stocking rate was changed to 231 fingerlings/ha annually.

Butterfly Lake was assigned status as a high priority lake for stock assessment in 1999 as it had only been assessed once, two years after it had been initially stocked. As part of ongoing management activities a third assessment was completed in October 2003 to 1) visually assess the extent of spawning by eastern brook trout and 2) to compare the relative abundance and growth of 2N and adipose marked, AF3N EB in Bow and Butterfly lakes as part of the Bow/Butterfly paired lakes study (Zimmerman, 1999a, 1999b).

BACKGROUND 2.0

Butterfly Lake is one of five stocked lakes that are managed within Eskers Provincial Park, located 32 km northwest of Prince George. Access to all of the lakes in Eskers Park is by foot or by canoe portage through a developed trail system. Fish stocking in Eskers Park coincided with initial park development in 1987 and was meant to provide a variety of angling opportunities utilizing “put and take” fisheries (BC Parks 1990). Currently within Eskers Park, there are five lakes that are intentionally stocked with sterile, all female triploid (AF3N) eastern brook trout and two that are stocked with all female (AF) rainbow trout (*Oncorhynchus mykiss*). These lakes include Bow, Butterfly, Byers, Camp and Kathie. The stocking of reproductively capable eastern brook trout prior to 1998 has resulted in several populations of brook trout that successfully shore-spawn within lakes in Esker Park.

Eskers Provincial Park currently supports a regionally important recreational fishery during both summer and winter months and Butterfly Lake supports an important component of that fishery. However, the presence and the illegal transfer of reproductively capable brook trout between the lakes in Eskers Park have compromised future recreational fishing quality and opportunities, as well as conservation of biodiversity objectives in adjacent unstocked lakes in the Park.

METHODS 3.0

A 91.4 m long, 2.4 m deep floating monofilament gill net with experimental mesh sizes was set in Butterfly Lake (Figure 2) on September 30, 2003, according to the methods specified in the Resource Inventory Committee document Fish Collection Methods and Standards (RIC 1997). The net was set at 15:20 and retrieved on October 1 at 13:05 hrs for a total soak time of 21.75 hrs hours. The net was extended north along the surface from the south shore along the east side of the shoal dividing the two basins in the lake (Figure 2). All trout collected were sampled for fork length (mm), weight (g), sex, and maturity. Weights were measured to the nearest 10 g and lengths were measured to the nearest 1 mm. Otoliths were collected for subsequent age structure analyses by Birkenhead Scale Analyses (Lone Butte, BC). A qualitative visual assessment of potential spawning habitat was also completed during this survey.

RESULTS 4.0

Catch summary 4.1

Brook trout were captured in 2003 (n=130, Table 2, Figure 3) and the raw assessment data for all sample years can be found in Appendix 3. As part of the Bow and Butterfly lakes study it was expected that a cohort of three-year-old, all female triploid (AF3N) EB marked with an adipose fin clip would be captured in 2003. These fish were not caught in Butterfly Lake and it was later determined that they were accidentally stocked into Kinglet Lake as the result of an incorrectly marked map (Grant Gale, FFSBC, pers. comm.). Comparisons between these two lakes based on stocked AF3N EB were therefore not possible for 2003. The 2003 catch was about five times that of 1999 catch

(Table 2, Zimmerman 1999a) and was more than ten times that of the 1991 catch (Table 2, Van Schubert, 1991) even though set times were similar in length (20-24 hours, Table 2).

In 2003 the sex ratio for EB in Butterfly Lake was biased towards males, where only 27 percent of the sample was female. The 1999 catch was slightly biased towards males with 40% females and 60% males. Both the 1999 and 2003 2N catches contained brook trout in a variety of maturity states. At the time of sampling in 2003, 52 % of the fish were in a late maturity state near or past spawning with only 41% of the fish being immature (Figure 4). Only one percent of the 2003 2N EB sample was spent, indicating the survey occurred prior to the main period of spawning (Figure 4). In 2003 greater than 60% of each year class two years of age or older was mature (Figure 5). The mature 2+ sample from Butterfly Lake was 79% male and 21% female.

Length Frequency, Condition and Growth 4.2

Diploid (2N) EB in 2003 ranged from 98 mm up to 340 mm in length (Table 3, Figure 3). The mean body condition of three-year-old EB in 2003 was 1.14. Condition-at-age was comparable for ages two and three for EB in 2003 (Table 4). One age-four fish was captured in 2003 and it was in relatively poor body condition. For the 1999 and 2003 sample years EB weight increased as power of length according to the following equations (Figure 6):

$$\begin{aligned} 2003 \ W &= .0002L^{2.4693} \ (\mathbf{R^2=0.99}) \\ 1999 \ W &= .000002L^{2.9477} \ (\mathbf{R^2=0.78}) \end{aligned}$$

The exponent value in the growth equation can be used as a relative measure of fish growth and condition. A value of three indicates isometric growth (growth without change in body shape). Values less than three indicate a drop in mass relative to length as the fish grows (negative allometric growth). Caution must be used in interpreting the length-at-age and growth of the 1999 sample as the weights were highly variable and scales were used as an aging structure. Scale samples from char species are typically small and difficult to interpret, and the ages presented for the 1999 sample are only a best guess of the true age of these fish. Ages for the catch in 1991 were inferred from the size of the fish and the stocking history. It is also likely that the precision of the weigh-scale used in that survey was low, or was inaccurate (Zimmerman 1999a), resulting in poor weight estimates.

Visual Spawner and Spawning Habitat Survey 4.3

The 2003 stocking assessment was completed in early October during the time period when EB spawning activity would likely have been at its highest intensity. Extensive schools of mature EB exhibiting spawning colour and morphology were observed cruising the littoral zone of the Lake, frequently in less than one meter of water. In one case a large school of EB, estimated at 100-200 fish was observed at the north end of the lake. Redd locations as well as sites where digging had occurred were also observed in

the near shore areas throughout the lake, however, activity was most prominent around the north side and eastern end of the lake.

DISCUSSION 5.0

The stocking of reproductively viable brook trout (EB) in the late 1980's and in 1997 has resulted in a wild naturalized EB population in Butterfly Lake. At present population levels, Butterfly Lake has the potential to provide a high yield brook trout fishery, however, the population appears to be increasing and fish are growing relatively poorly with corresponding declines in maximum lengths (Figure 3) as well as declines in length at age (Figure 7) and declines in fish condition (Table 3, Table 4).

The net catch in 2003 was relatively high ($n=130$ CPUE=5.98) compared with previous years and was an order of magnitude higher than the 1991 catch (Table 2) despite the fact that the sample times were similar in duration. Only diploid (2N) brook trout were caught in the 2003 survey. A three-year-old cohort of adipose marked all female triploid EB that was expected to be present was absent from the catch. The marked fish were supposed to be stocked in 2001 and were meant to facilitate a comparison of the relative growth and performance of hatchery and naturalized stock in Bow and Butterfly lakes (Williamson 2004a, Zimmerman 1999a, 1999b). Unfortunately, these fish were found nearby during a similar stock assessment in Kinglet Lake (Williamson 2004c) and this comparison was therefore not possible.

Discussion with staff from the Freshwater Fisheries Society of BC (FFSBC- formerly the Fish Culture section of BCFisheries) has revealed that a paper map error was a contributor to the mis-stocking of Kinglet Lake (Grant Gale, pers comm.). All of the lakes stocked in Eskers Park are stocked by helicopter and 1:50,000 scale NTS paper maps have been previously used as a guide for stocking. Apparently Kinglet Lake was hand-marked as "Butterball" on the map used for stocking in 2001 and the fish intended for Butterfly Lake were placed into Kinglet Lake in error. At present Kinglet Lake does not have a gazetted name and therefore official maps show this lake as an unnamed body of water. It is likely the map used for the 2001 stocking was also used during previous stocking events and it is probable that the presence of naturalized EB in Kinglet Lake is in part the result of previous stocking errors (Williamson 2004c).

Consistent with observations expected for a population that is expanding, length-at age, maximum length and fish condition have declined in Butterfly Lake over time. A comparison of three-year-old fish between sample years has shown that there has been a decline in mean fish size from 315 mm to 263 mm since 1991 (Figure 7). Considering that 1999 and 2003 sampling events have taken place near the end of the growth season, this decline is even more prominent. It is not surprising that mean length has declined since the 1991 sampling event, as declines in growth rates are typically observed a few years after a fishless lake is first stocked, however declines after 1999 are more concerning because the 2003 assessment was completed more than 15 years after the lake was first stocked.

Maximum lengths and the average size in the catch for Butterfly EB were also smaller in 2003 compared with the 1999 sample (Figure 3). In 1999 almost 75 percent of the catch

was larger than 250 mm whereas in 2003 ninety percent of the catch was less than 280 mm (Figure 3). In addition, the largest proportion of the 2003 catch was comprised of three-year-old fish with a mean length of 263 mm; within this cohort, 20% of the sample was smaller than a “cacheable” size of 250 mm. Two-year-old fish with a mean length of 203 mm were on average smaller than a “cacheable” size of 250 mm.

Fish condition has also been declining in Butterfly Lake. For the 2003 catch, the growth exponent (b) for weight-length relationship was 2.5 and has declined since 1999 when it was 2.9 (Figure 6), indicating that larger fish are having more difficulty obtaining food resources to sustain isometric growth. Butterfly Lake fish from 2003 were also in poorer condition than EB from other Omineca Lakes. For comparison, samples of EB from Shere and Ferguson lakes from two stock assessments in 1998-99, exhibited near isometric growth with length-weight exponent values of 3.128 and 3.097 respectively (Zimmerman 1999c, 1999d). Well conditioned fish that exhibit isometric growth are indicative of populations that are not constrained by food resources or habitat. Decreases in length and growth of Butterfly Lake brook trout are likely related to naturalized recruitment that is causing high levels of intraspecific competition for food resources.

Based on the visual surveys for spawning habitat, it is likely that recruitment in Butterfly Lake is not spawning habitat limited. The shoreline in Butterfly Lake is composed of a loose mixture of gravels and sands overlain with a thin layer of organic material (Photo 5). In Eskers Park, there are few areas of overland drainage and Butterfly Lake does not have any inlet or outlet streams. The drainage of precipitation from Butterfly Lake is therefore subsurface which, in combination with the porous shoreline substrate provides for extensive shore-spawning habitat. Despite apparently high levels of habitat availability, it is however unclear how much of this shore habitat would allow for successful egg and larval incubation.

Assuming that recruitment is not limited by spawning habitat, as Butterfly Lake nears carrying capacity, it can be expected that delayed maturity until age three or four, particularly for females, will become more prevalent. In Butterfly Lake most mature or spawning EB were three years of age or older (n=55), however 15 mature two-year-olds were captured. At the time of sampling in 2003, 52 % of the fish were in a late maturity state near or past spawning and 41% of the fish were immature. Within the 2003 catch, greater than 60% of each year class two years of age or older was mature (Figure 5). Similarly, in Bow Lake (Williamson, 2004a) more than 80% of two-year-old fish were mature. In contrast less than 20% of the two-year-olds from the 2003 Kathie Lake sample were mature (Williamson, 2004b). In Bow and Kathie lakes the mature/spawning component of the two-year-old catch was 100% male; however the mature 2+ sample from Butterfly Lake was 79% male and 21% female (Appendix 3 Table 1).

Declining growth rates, condition, maximum sizes and lengths-at-age of EB in Butterfly Lake are likely the result of competition due to population increases. Based on the catch composition and the visual surveys for spawners, it is apparent that the fish in Butterfly Lake are capable of successful reproduction. A high net catch of mature EB and decrease in growth rates of EB between survey years further suggests that EB recruitment is not

presently spawning habitat limited. Growth rates of EB in Butterfly Lake have declined since 1991 (Van Schubert, 1991) despite the fact that sampling events have taken place later in the growth season. Higher net yields, declines in the growth rates and declines in mean length-at-age are indicators that EB population in Butterfly Lake is continuing to increase, however it is unclear when Butterfly Lake will reach carrying capacity.

The presence of a growing naturalized brook trout population in Butterfly Lake presents hazards in terms of conservation of biodiversity and sport fishing quality in the presence of illegal fish transfer between lakes within the Park. Butterfly Lake is located immediately adjacent to Kathie and Kinglet Lake and is relatively close to three other lakes (Bow, Byers and Redstart) (Figure 1). Kathie Lake contains a wild naturalized EB population (Williamson, 2004b) that appears to be increasing; however it is unlikely that anglers would move EB from Butterfly to Kathie Lake, because Kathie Lake already contains EB. Similarly, the probability of illegal fish transfer to Bow and Byers lakes is low given the distance a person would be required to move fish; however the ease of transfer from Butterfly to Kinglet Lake is much higher due to the developed trail system and close proximity of the two lakes. Furthermore, Kinglet Lake contains a relatively small number of EB (Williamson, 2004c) and there would therefore be more incentive for people to move fish there. Overall, the hazards to fishing quality in Bow and Byers as well as risks to the conservation of biodiversity in Redstart and Kinglet (both un-stocked lakes) and other un-stocked lakes in Eskers Park are substantial and worth considering. For example, Bow and Byers lakes support populations of EB however, the wild naturalized component in Bow Lake is lower and may be absent in Byers Lake; both lakes are capable of supporting higher quality brook trout fisheries (Williamson, 2004a). Therefore, the transfer of reproductive EB from Butterfly Lake to these other lakes could jeopardize fishing quality.

Options to reduce the hazards to biodiversity and fishing quality in the Park could include:

- 1) Increases in brook trout quotas to reduce wild naturalized population sizes.
- 2) Eradication through the use of gillnets or trapnets in the smaller lakes (ex Butterfly, Redstart and Kinglet).
- 3) Park signage explaining the risks and hazards.

At a minimum a communication plan including signage should be established to inform anglers in the park of the hazards of fish transfer to biodiversity and sport fishing quality as well as the legal consequences of transferring fish.

In summary, Butterfly Lake presently supports a high yield fishery for small eastern brook trout. However, it is uncertain whether this fishery will continue to provide an opportunity that is attractive to anglers in the future. With a growing population, and a declining average fish size that is approaching 250 mm, fishing effort may be diverted to other higher quality lakes within Eskers Park or to lakes outside of the park. Monitoring of this fishery will be required to explain patterns of angling effort so that fisheries and parks staff can adequately plan for and manage park use and angling effort.

RECOMMENDATIONS FOR FUTURE MANAGEMENT 6.0

1. Implement quality assurance procedures to eliminate fish stocking errors such as the one observed for Butterfly and Kinglet lakes.
2. Continue monitoring the EB fishery and population levels through annual opportunistic creel surveys and stocking assessments at a three-year interval. The next stocking assessment should be completed in 2004 to compare the relative growth and success of stocked AF3N EB and 2N EB in Bow and Butterfly lakes and to complete the Bow and Butterfly paired lakes study.
3. Complete an updated angling management and stocking plan for all Eskers lakes that reflects the presence of naturalized brook trout in Eskers Park and balances the need for conservation while providing for quality recreational opportunities.
4. Establish a communication plan to reduce the incidence of fish transfer in the Park.
5. If populations of naturalized EB continue to grow in Butterfly Lake, management options such as: 1) changes to EB quotas, 2) eradication methods (ex. removal by gill nets or trapnets) could be considered to protect biodiversity and fishery values.

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TABLES 8.0

Table 1. Attributes of Butterfly Lake.

Attributes	
UTM Coordinates	10.488236.5991765
Nearest Center	32 km NW of Prince George
Waterbody identifier	01252STUR
Watershed Code	182-209700-94700
Water surface area	6.5 ha.
Littoral area (above 6 m contour)	3.8 ha.
Shoreline perimeter	1220 m
Maximum depth	17 m
Volume	371,000 m ³
Mean depth	5.7 m
Elevation	760 m
T.D.S.	112 mg/L
Morphoedaphic index	20

*from Philip (1985)

Table 2. Catch Summary for the years 1991-2003; CPUE- Catch per unit effort.

Year	Brook Trout		Set Time	Set Date
	Catch	Net CPUE	(Hours)	
2003	130	5.98	21.75	30-Sep-03
1999	31	1.32	23.5	24-Aug-99
1991	12	0.58	20.75	23-May-91

Table 3. Physical attributes of brook trout sampled in Butterfly Lake in 1991, 1999 and 2003.

Brook Trout		Length (mm)				Weight (g)				Condition (k)				
Sample Year	Sample Size	Mean	Min	Max	StdDev	Mean	Min	Max	StdDev	Mean	Min	Max	StdDev	Var
2003	130	219	98	340	63.6	145	9	388	87.7	1.11	0.79	1.46	0.14	0.02
1999	31	305	202	400	50.7	273	75	1100	186.3	0.88	0.46	1.78	0.28	0.08
1991	12	315	290	325	9.6	440	310	490	49.0	1.41	1.27	1.54	0.08	0.01

Table 4. Physical attributes of brook trout sampled in Butterfly Lake 1999 and 2003 listed by age class.

Brook Trout		Length (mm)				Weight (g)				Condition (k)					
Sample Year	Age	Sample Size	Mean	Min	Max	StdDev	Mean	Min	Max	StdDev	Mean	Min	Max	StdDev	Var
2003	1	11	120	98	148	16.2	18	12	30.9	6.0	1.02	0.83	1.27	0.1	0.02
2003	2	23	213	180	257	18.6	113	66	207	30.4	1.16	0.80	1.46	0.2	0.03
1999	2	1	202				85				1.03				
2003	3	71	263	210	320	18.5	207	110	323	37.6	1.14	0.79	1.41	0.1	0.01
1999	3	11	277	220	344	49.0	190	75	300	92.9	0.9	0.5	1.8	0.3	0.12
1991	3	12	315	290	325	9.6	440	310	490	49.0	1.4	1.3	1.5	0.1	0.01
1999	4	15	325	258	369	26.3	285	100	400	81.7	0.8	0.5	1.2	0.2	0.03
2003	4	1	340				388				0.99				
1999	5	2	363	325	400	53.0	700	300	1100	565.7	1.3	0.9	1.7	0.6	0.36
1999	6	1	372				475				0.9				

FIGURES 9.0

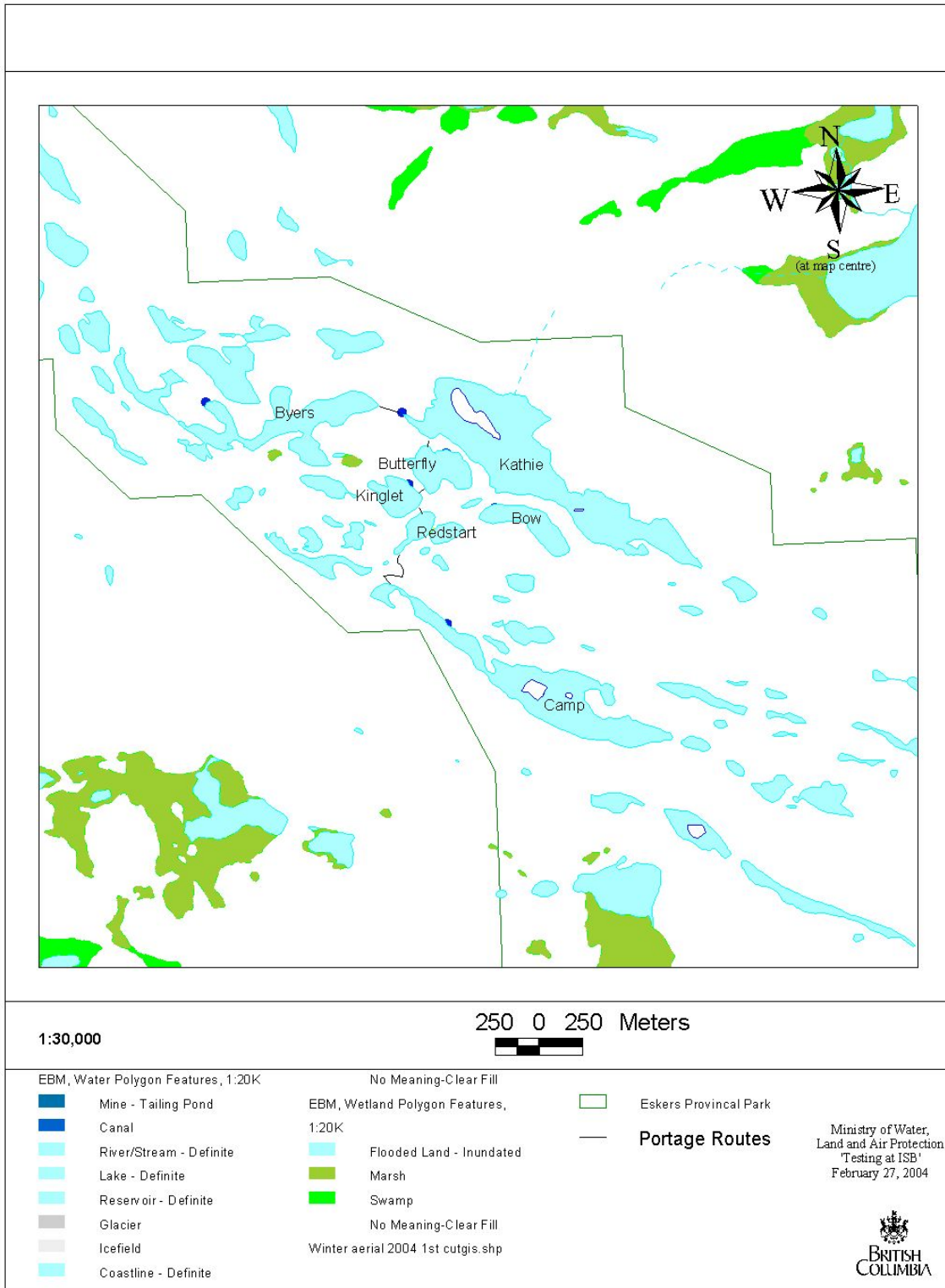


Figure 1. Map of Eskers Provincial Park showing lakes that were included in the 2003 survey (Note Byers Lake was not assessed in 2003).

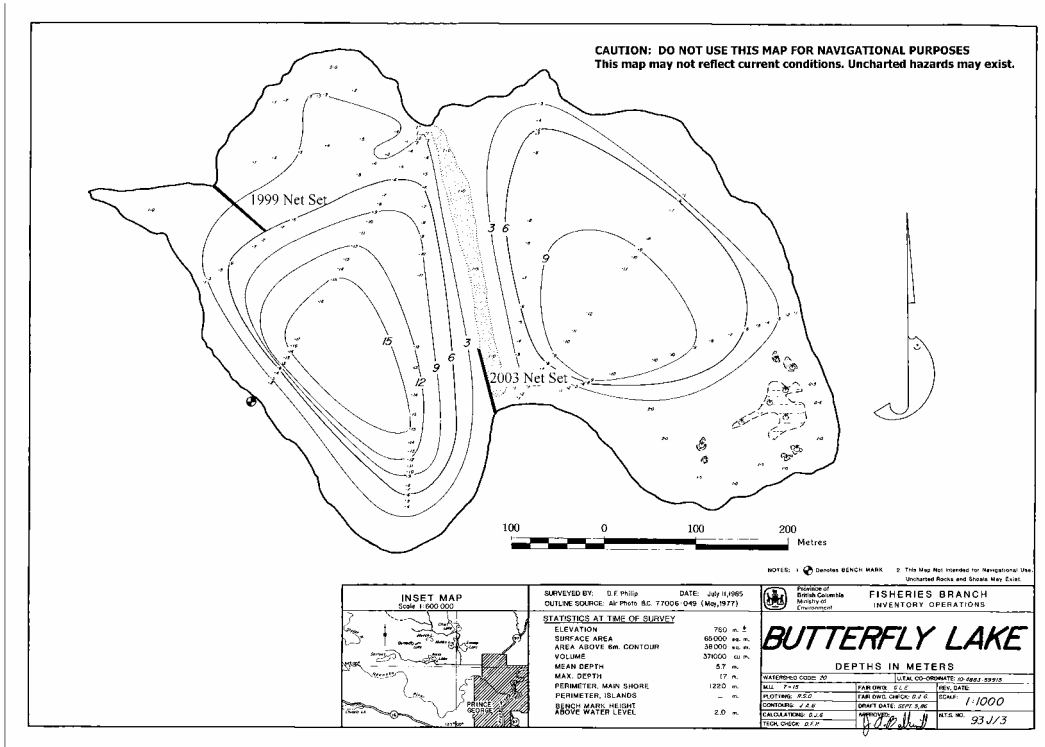


Figure 2. Bathymetric map of Butterfly Lake showing gill net sets in August, 1999 and October 2003. (see Appendix 1 Figure 1 for full size image).

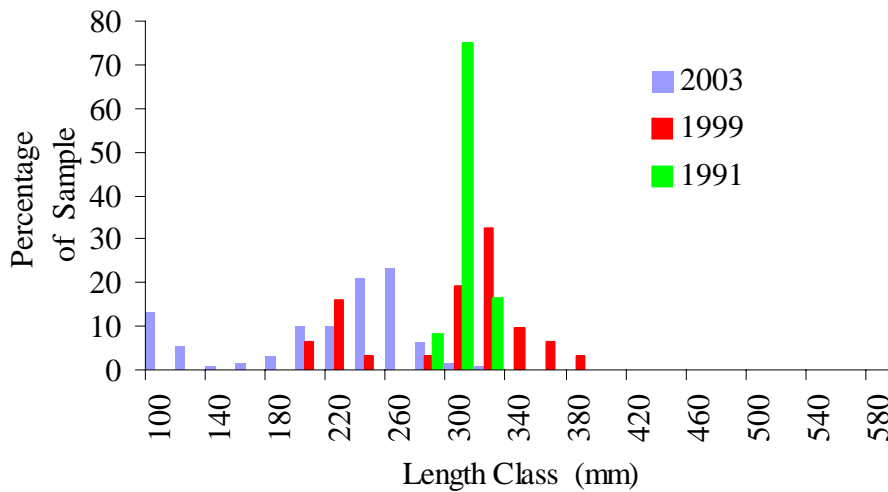


Figure 3. Length frequency distribution for the 2003 (n=130), 1999 (n=31) and 1991 (n=12) gill net samples for Butterfly Lake.

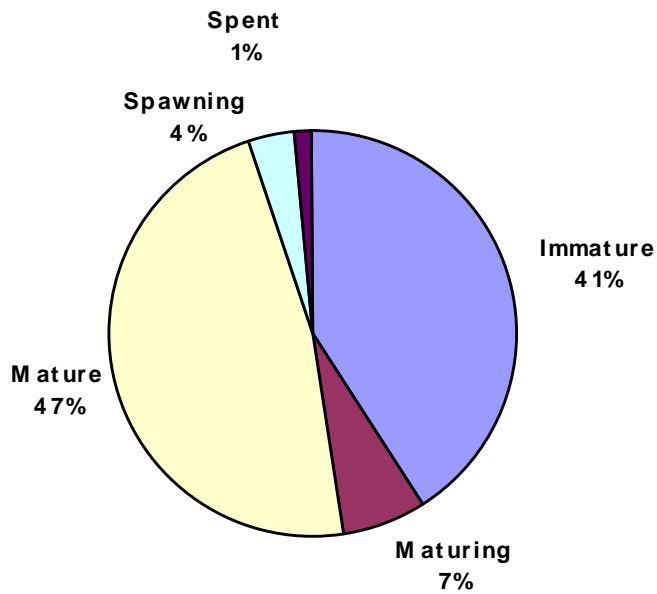


Figure 4. Maturity states of 2N EB captured in 2003 Butterfly Lake assessment listed by percent.

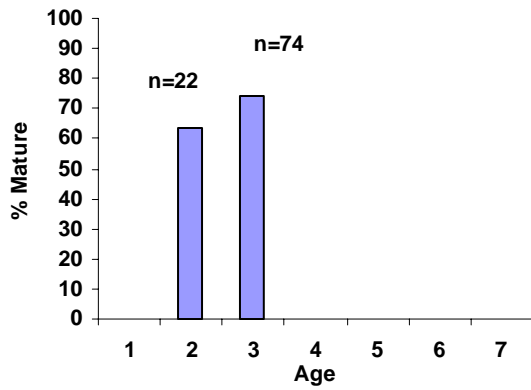


Figure 5. Percentage of mature EB in each age class for 2003 Butterfly Lake assessment with sample size for each class.

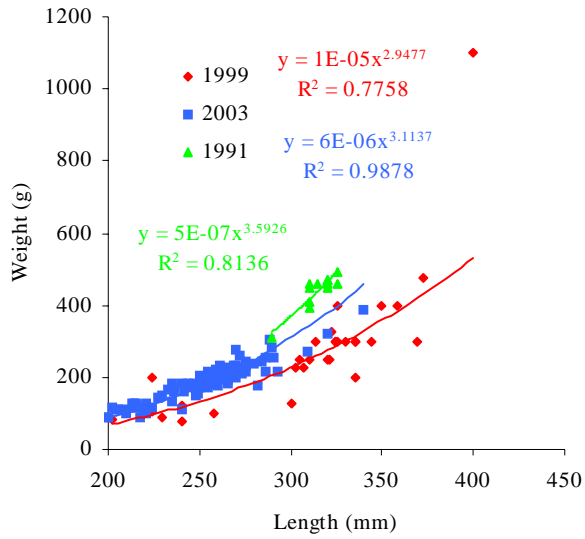


Figure 6. Length weight relationship for Butterfly Lake brook trout in 1991, 1999 and 2003.

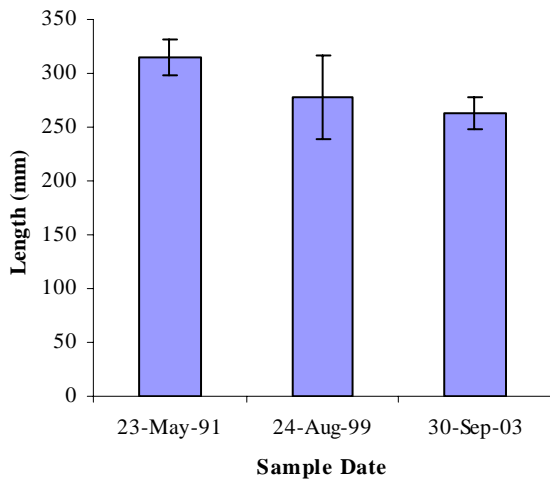


Figure 7. Mean length at age-three for all sample years with 95% confidence limits.

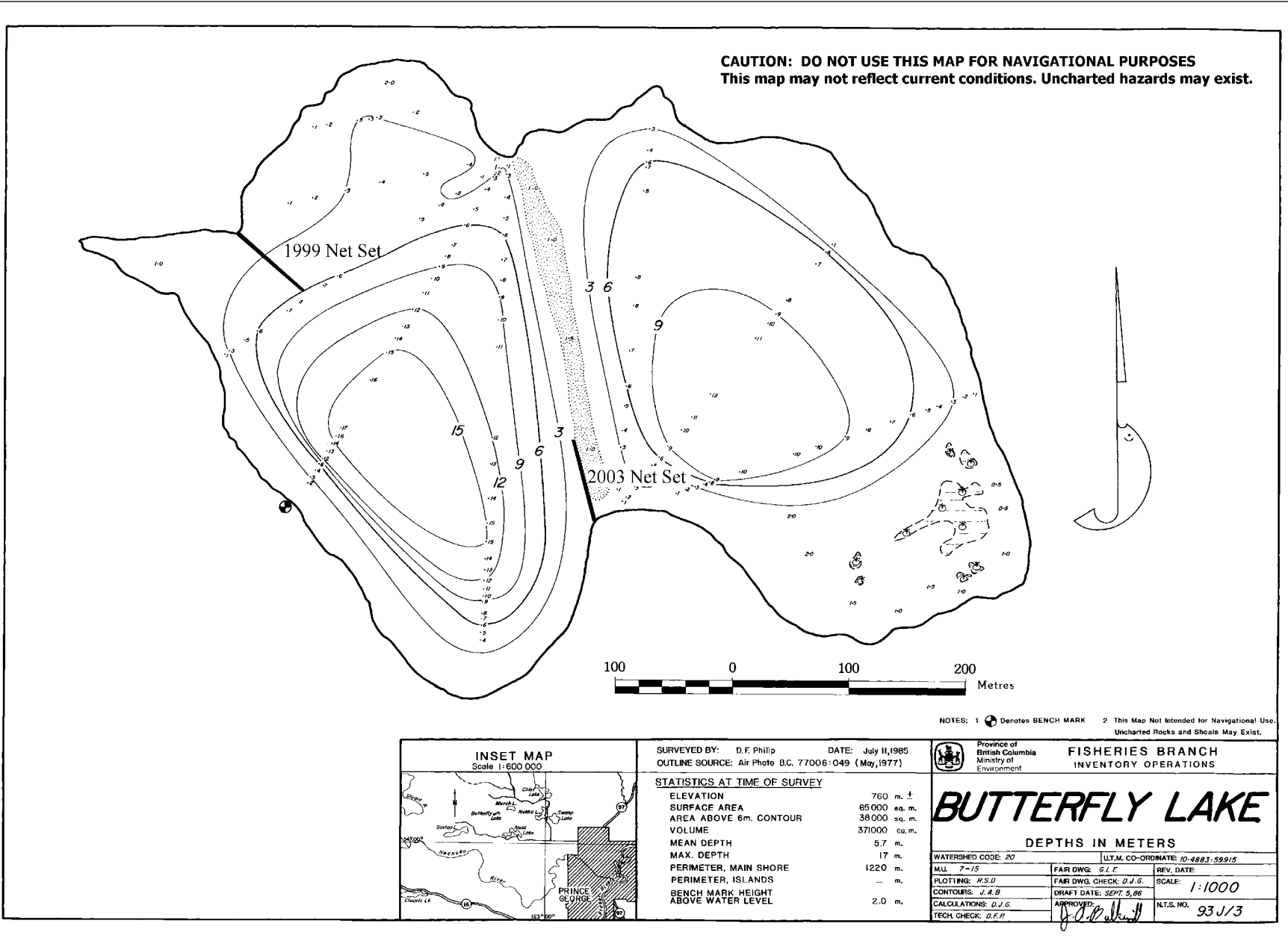
PHOTOS 10.0



Photo 1. Typical porous gravel shoreline of lakes in Eskers Park (photo from Bow Lake, Phillip, 1985b).

APPENDICES 11.0

Appendix 1 Figure 1. Bathymetric map of Butterfly Lake showing the location of the 1999 and 2003 gill net sets.



Appendix 2 Table 1. Stocking history and recent brood requests for Butterfly Lake.

Release Date	Gazetted Name	Alias	Region	Species Name	Fish Count	Stocking Density (fish/Ha)	Stock	Mark	Average Size (g)	Life Cycle Stage	Watershed Code	Waterbody Identifier
Requested								Adipose, Right				
2005	BUTTERFLY LAKE		7A	Brook Trout	1500	231	AYLMER AF3N	Maxillary		FINGERLING	182-209700-94700	01252STUR
Requested								Adipose, Left				
2004	BUTTERFLY LAKE		7A	Brook Trout	1500	231	AYLMER AF3N	Maxillary		FINGERLING	182-209700-94700	01252STUR
11-Jun-03	BUTTERFLY LAKE		7A	Brook Trout	1500	231	AYLMER AF3N	Adipose	7.13	FINGERLING	182-209700-94700	01252STUR
4-Jun-01	BUTTERFLY LAKE		7A	Brook Trout	3000	462	AYLMER AF3N	Adipose	7.4	FINGERLING	182-209700-94700	01252STUR
5-Jun-99	BUTTERFLY LAKE		7A	Brook Trout	3000	462	AYLMER AF3N		5.9	FINGERLING	182-209700-94700	01252STUR
17-Jun-97	BUTTERFLY LAKE		7A	Brook Trout	3000	462	AYLMER		3.01	FINGERLING	182-209700-94700	01252STUR
1-Jun-89	BUTTERFLY LAKE		7A	Brook Trout	5000	769	AYLMER		2.5	FRY	182-209700-94700	01252STUR
1-Jun-88	BUTTERFLY LAKE		7A	Brook Trout	10000	1538	AYLMER		2.7	UNKNOWN	182-209700-94700	01252STUR

Appendix 3 Table 1. Stock assessment data for Butterfly Lake eastern brook trout in 2003.

Lake	Sample#	Set #	Species Caught	Age	Length (mm)	Weight (grams)	Condition (k)	Scale Age	Structure	Cond. Code	Clip	Sex	Maturity	Ageing Comments	Comments	Date
Butterfly	142	GN1	EB	1	105	13	1.1	1+	ot	2	n	Unk	im	broken; age estimate		30-Sep-03
Butterfly	146	GN1	EB	1	118	14	0.9	1+	ot	1	n	Unk	im			30-Sep-03
Butterfly	147	GN1	EB	1				1+	ot	1	n	Unk	im		length weight errors	30-Sep-03
Butterfly	148	GN1	EB	1	98	12	1.3	1+	ot	1	n	Unk	im			30-Sep-03
Butterfly	150	GN1	EB	1	103	11.7	1.1	1+	ot	1	n	Unk	im			30-Sep-03
Butterfly	151	GN1	EB	1	112	17.6	1.3	1+	ot	1	n	Unk	im			30-Sep-03
Butterfly	152	GN1	EB	1	131	19.5	0.9	1+	ot	1	n	Unk	im			30-Sep-03
Butterfly	153	GN1	EB	1	111	14.2	1.0	1+	ot	1	n	Unk	im			30-Sep-03
Butterfly	154	GN1	EB	1	148	30.9	1.0	1+	ot	1	n	Unk	im			30-Sep-03
Butterfly	155	GN1	EB	1	125	19.4	1.0	1+	ot	1	n	Unk	im			30-Sep-03
Butterfly	156	GN1	EB	1	140	22.8	0.8	1+	ot	1	n	Unk	im			30-Sep-03
Butterfly	157	GN1	EB	1	132	23.4	1.0	1+	ot	1	n	Unk	im			30-Sep-03
Butterfly	117	GN1	EB	2	257	207	1.2	2+	ot	1	n	M	M	large plus growth		30-Sep-03
Butterfly	121	GN1	EB	2	213	128	1.3	2+	ot	1	n	m	m			30-Sep-03
Butterfly	125	GN1	EB	2	202	114	1.4	2+	ot	1	n	Unk	im			30-Sep-03
Butterfly	135	GN1	EB	2	204	110	1.3	2+	ot	1	n	m	m			30-Sep-03
Butterfly	140	GN1	EB	2	236	169	1.3	2+	ot	1	n	m	m	definite		30-Sep-03
Butterfly	180	GN1	EB	2	180	70	1.2	2+	ot	1	n	m	m			30-Sep-03
Butterfly	183	GN1	EB	2	224	118	1.0	2+	ot	1	n	Unk	im			30-Sep-03
Butterfly	184	GN1	EB	2	214	118	1.2	2+	ot	1	n	f	mt			30-Sep-03
Butterfly	185	GN1	EB	2	218	91	0.9	2+	ot	1	n	f	m			30-Sep-03
Butterfly	193	GN1	EB	2	190	100	1.5	2+	ot	2	n	m	m			30-Sep-03
Butterfly	207	GN1	EB	2	190	73	1.1	2+	ot	1	n	f	m			30-Sep-03
Butterfly	208	GN1	EB	2	215	115	1.2	2+	ot	1	n	m	m			30-Sep-03
Butterfly	211	GN1	EB	2	214	115.6	1.2	2+	ot	1	n	Unk	im			30-Sep-03
Butterfly	224	GN1	EB	2	210	101	1.1	2+	ot	1	n	Unk	im			30-Sep-03
Butterfly	230	GN1	EB	2	215	127.23	1.3	2+	ot	1	n	m	m			30-Sep-03
Butterfly	232	GN1	EB	2	240	110.17	0.8	2+	ot	1	n	m	m			30-Sep-03
Butterfly	233	GN1	EB	2	235	134.41	1.0	2+	ot	1	n	Unk	im	definite		30-Sep-03
Butterfly	241	GN1	EB	2	205	108	1.3	2+	ot	1	n	f	m			30-Sep-03
Butterfly	243	GN1	EB	2	220	111	1.0	2+	ot	1	n	m	m			30-Sep-03
Butterfly	247	GN1	EB	2	221	102	0.9	2+	ot	1	n	unk	im			30-Sep-03
Butterfly	248	GN1	EB	2	200	89	1.1	2+	ot	1	n	m	m	definite		30-Sep-03
Butterfly	249	GN1	EB	2	180	66	1.1	2+	ot	1	n	m	m			30-Sep-03
Butterfly	244a	GN1	EB	2	214	126	1.3	2+	ot	1	n	M	im			30-Sep-03
Butterfly	120	GN1	EB	3	291	257	1.0	3+	ot	1	n	m	st			30-Sep-03
Butterfly	122	GN1	EB	3	258	189	1.1	3+	ot	1	n	m	sp			30-Sep-03
Butterfly	123	GN1	EB	3	270	227	1.2	3+	ot	1	n	f	im			30-Sep-03
Butterfly	126	GN1	EB	3	229	151	1.3	3+	ot	1	n	f	m			30-Sep-03
Butterfly	127	GN1	EB	3	259	187	1.1	3+	ot	1	n	m	m			30-Sep-03
Butterfly	128	GN1	EB	3	244	185	1.3	3+	ot	1	n	m	m			30-Sep-03
Butterfly	129	GN1	EB	3	286	254	1.1	3+	ot	1	n	f	m			30-Sep-03
Butterfly	130	GN1	EB	3	270	230	1.2	3+	ot	1	n	m	m			30-Sep-03
Butterfly	131	GN1	EB	3	263	221	1.2	3+	ot	1	n	Unk	im			30-Sep-03
Butterfly	132	GN1	EB	3	260	208	1.2	3+	ot	1	n	f	m			30-Sep-03
Butterfly	133	GN1	EB	3	250	202	1.3	3+	ot	1	n	m	m			30-Sep-03
Butterfly	134	GN1	EB	3	259	194	1.1	3+	ot	1	n	m	m			30-Sep-03
Butterfly	136	GN1	EB	3	257	184	1.1	3+	ot	1	n	m	m			30-Sep-03
Butterfly	137	GN1	EB	3	265	209	1.1	3+	ot	1	n	m	m			30-Sep-03
Butterfly	138	GN1	EB	3	264	226	1.2	3+	ot	1	n	f	m			30-Sep-03
Butterfly	139	GN1	EB	3	265	208	1.1	3+	ot	1	n	m	m			30-Sep-03
Butterfly	141	GN1	EB	3	275	233	1.1	3+	ot	1	n	m	st			30-Sep-03
Butterfly	143	GN1	EB	3	293	217	0.9	3+	ot	1	n	f	m			30-Sep-03
Butterfly	144	GN1	EB	3	259	206	1.2	3+	ot	1	n	f	m			30-Sep-03
Butterfly	145	GN1	EB	3	261	230	1.3	3+	ot	1	n	m	sp			30-Sep-03
Butterfly	173	GN1	EB	3	320	323	1.0	3+	ot	1	n	m	m			30-Sep-03
Butterfly	174	GN1	EB	3	269	204	1.0	3+	ot	1	n	m	m			30-Sep-03
Butterfly	175	GN1	EB	3	262	214	1.2	3+	ot	1	n	m	m			30-Sep-03
Butterfly	176	GN1	EB	3	242	160	1.1	3+	ot	2	n	m	m			30-Sep-03
Butterfly	177	GN1	EB	3	284	242	1.1	3+	ot	1	n	m	im			30-Sep-03
Butterfly	178	GN1	EB	3	264	209	1.1	3+	ot	1	n	m	m			30-Sep-03
Butterfly	179	GN1	EB	3	251	195	1.2	3+	ot	1	n	m	m			30-Sep-03
Butterfly	181	GN1	EB	3	271	224	1.1	3+	ot	1	n	f	m			30-Sep-03
Butterfly	182	GN1	EB	3	272	258	1.3	3+	ot	1	n	m	m			30-Sep-03
Butterfly	186	GN1	EB	3	255	216	1.3	3+	ot	1	n	m	mt			30-Sep-03
Butterfly	187	GN1	EB	3	282	178	0.8	3+	ot	1	n	f	m			30-Sep-03
Butterfly	188	GN1	EB	3	288	304	1.3	3+	ot	1	n	m	m			30-Sep-03
Butterfly	189	GN1	EB	3	255	203	1.2	3+	ot	1	n	m	m			30-Sep-03
Butterfly	190	GN1	EB	3					ot	1	n	m	m		length weight errors	30-Sep-03
Butterfly	191	GN1	EB	3	275	217	1.0	3+	ot	1	n	m	m			30-Sep-03

Appendix 3 Table 1 cont. Stock assessment data for Butterfly Lake eastern brook trout in 2000.

Lake	Sample#	Set #	Species Caught	Age	Length (mm)	Weight (grams)	Condition (k)	Scale Age	Structure	Cond. Code	Clip	Sex	Maturity	Ageing Comments	Comments	Date
Butterfly	191	GN1	EB	3	275	217	1.0	3+	ot	1	n	m	m			30-Sep-03
Butterfly	192	GN1	EB	3	280	238	1.1	3+	ot	1	n	m	m			30-Sep-03
Butterfly	194	GN1	EB	3	270	228	1.2	3+	ot	1	n	Unk	im			30-Sep-03
Butterfly	195	GN1	EB	3	275	231	1.1	3+	ot	1	n	m	m			30-Sep-03
Butterfly	196	GN1	EB	3	255	173	1.0	3+	ot	1	n	m	m			30-Sep-03
Butterfly	198	GN1	EB	3	265	206	1.1	3+	ot	1	n	m	m			30-Sep-03
Butterfly	199	GN1	EB	3	258	180	1.0	3+	ot	1	n	unk	im			30-Sep-03
Butterfly	200	GN1	EB	3	270	222	1.1	3+	ot	1	n	m	m			30-Sep-03
Butterfly	201	GN1	EB	3	247	184	1.2	3+	ot	1	n	m	m			30-Sep-03
Butterfly	202	GN1	EB	3				3+	ot	1	n	f	m		length weight errors	30-Sep-03
Butterfly	203	GN1	EB	3	259	223	1.3	3+	ot	1	n	m	m			30-Sep-03
Butterfly	205	GN1	EB	3				3+	ot	1	n	f	m		length weight errors	30-Sep-03
Butterfly	206	GN1	EB	3	260	176.92	1.0	3+	ot	1	n	m	m			30-Sep-03
Butterfly	209	GN1	EB	3	233	167	1.3	3+	ot	1	n	f	m			30-Sep-03
Butterfly	210	GN1	EB	3	227	144.27	1.2	3+	ot	1	n	m	mt			30-Sep-03
Butterfly	212	GN1	EB	3	269	230	1.2	3+	ot	1	n	f	sp			30-Sep-03
Butterfly	213	GN1	EB	3	235	182	1.4	3+	ot	1	n					30-Sep-03
Butterfly	214	GN1	EB	3	286	216	0.9	3+	ot	1	n	f	sp			30-Sep-03
Butterfly	215	GN1	EB	3	250	172	1.1	3+	ot	1	n	f	m			30-Sep-03
Butterfly	216	GN1	EB	3	270	277	1.4	3+	ot	1	n	m	m	large growth in 3rd year		30-Sep-03
Butterfly	217	GN1	EB	3	245	171	1.2	3+	ot	1	n	m	m			30-Sep-03
Butterfly	218	GN1	EB	3	264	197	1.1	3+	ot	1	n	m	m			30-Sep-03
Butterfly	219	GN1	EB	3	255	181	1.1	3+	ot	1	n	M	MT			30-Sep-03
Butterfly	221	GN1	EB	3	270	201	1.0	3+	ot	1	n	M	MT			30-Sep-03
Butterfly	222	GN1	EB	3	309	270	0.9	3+	ot	1	n	m	m			30-Sep-03
Butterfly	223	GN1	EB	3	270	225	1.1	3+	ot	1	n	m	mt			30-Sep-03
Butterfly	225	GN1	EB	3	265	192	1.0	3+	ot	1	n	Unk	im			30-Sep-03
Butterfly	226	GN1	EB	3	210	110	1.2	3+	ot	2	n	m	m	broken but definite		30-Sep-03
Butterfly	228	GN1	EB	3	290	284	1.2	3+	ot	1	n	m	mt			30-Sep-03
Butterfly	229	GN1	EB	3	265	221	1.2	3+	ot	1	n	m	m			30-Sep-03
Butterfly	231	GN1	EB	3	249	155.66	1.0	3+	ot	1	n	m	mt			30-Sep-03
Butterfly	235	GN1	EB	3	221	126	1.2	3+	ot	1	n	unk	im	definite		30-Sep-03
Butterfly	236	GN1	EB	3	260	191	1.1	3+	ot	1	n	m	im			30-Sep-03
Butterfly	237	GN1	EB	3	236	159	1.2	3+	ot	1	n	m	m			30-Sep-03
Butterfly	238	GN1	EB	3	263	228	1.3	3+	ot	1	n	m	m			30-Sep-03
Butterfly	239	GN1	EB	3	273	212	1.0	3+	ot	1	n	m	m			30-Sep-03
Butterfly	240	GN1	EB	3	275	241.6	1.2	3+	ot	1	n	f	m			30-Sep-03
Butterfly	242	GN1	EB	3	265	184.3	1.0	3+	ot	1	n	Unk	im			30-Sep-03
Butterfly	245	GN1	EB	3	251	179	1.1	3+	ot	1	n	m	im			30-Sep-03
Butterfly	246	GN1	EB	3	253	182	1.1	3+	ot	1	n	M	IM			30-Sep-03
Butterfly	204	GN1	EB	4	340	387.6	1.0	4+	ot	1	n	f	mt			30-Sep-03
Butterfly	124	GN1	EB		255	193	1.2	n/a		7	n	Unk	im	broken; estimate 3+		30-Sep-03
Butterfly	149	GN1	EB		114	13.5	0.9	n/a		8	n	Unk	im			30-Sep-03
Butterfly	158	GN1	EB		101	11.2	1.1	n/a		8	n	Unk	im	No otolith envelope		30-Sep-03
Butterfly	159	GN1	EB		102	11.8	1.1	n/a		8	n	Unk	im	No otolith envelope		30-Sep-03
Butterfly	160	GN1	EB		120	20	1.2	n/a		8	n	Unk	im	No otolith envelope		30-Sep-03
Butterfly	161	GN1	EB		102	11.5	1.1	n/a		8	n	Unk	im	No otolith envelope		30-Sep-03
Butterfly	162	GN1	EB		104	11.5	1.0	n/a		8	n	Unk	im	No otolith envelope		30-Sep-03
Butterfly	163	GN1	EB		105	9.9	0.9	n/a		8	n	Unk	im	No otolith envelope		30-Sep-03
Butterfly	164	GN1	EB		114	12.9	0.9	n/a		8	n	Unk	im	No otolith envelope		30-Sep-03
Butterfly	165	GN1	EB		118	16.6	1.0	n/a		8	n	Unk	im	No otolith envelope		30-Sep-03
Butterfly	166	GN1	EB		98	10.6	1.1	n/a		8	n	Unk	im	No otolith envelope		30-Sep-03
Butterfly	167	GN1	EB		112	11.4	0.8	n/a		8	n	Unk	im	No otolith envelope		30-Sep-03
Butterfly	168	GN1	EB					n/a		8	n	Unk	im	No otolith envelope	length weight errors	30-Sep-03
Butterfly	169	GN1	EB					n/a		8	n	Unk	im	No otolith envelope	headless, ~100 mm	30-Sep-03
Butterfly	170	GN1	EB					n/a		8	n	Unk	im	No otolith envelope	headless, ~100 mm	30-Sep-03
Butterfly	171	GN1	EB		99	9.1	0.9	n/a		8	n	Unk	im	No otolith envelope		30-Sep-03
Butterfly	172	GN1	EB		112	14.6	1.0	n/a		8	n	Unk	im	No otolith envelope		30-Sep-03
Butterfly	220	GN1	EB		240	180.32	1.3	n/a		7	n	f	sp			30-Sep-03
Butterfly	234	GN1	EB		248	149	1.0	n/a		8	n	f	m			30-Sep-03
Butterfly	244	GN1	EB		200	89	1.1	n/a		8	n	f	im	No otolith envelope		30-Sep-03
Butterfly	250	GN1	EB		129	23	1.1	n/a		8	n	unk	im			30-Sep-03
Butterfly	251	GN1	EB		110	13	1.0	n/a		8	n	unk	im			30-Sep-03
Butterfly	252	GN1	EB		110	13	1.0	n/a		8	n	unk	im			30-Sep-03
Butterfly	253	GN1	EB		124	15	0.8	n/a		8	n	unk	im			30-Sep-03
Butterfly	254	GN1	EB		126	19	0.9	n/a		8	n	unk	im			30-Sep-03
Butterfly	255	GN1	EB		103	10	0.9	n/a		8	n	unk	im			30-Sep-03
Butterfly	256	GN1	EB		221	123	1.1	n/a		8	n	unk	im			30-Sep-03
Butterfly	197	GN1	EB							7	n	m	m		length weight errors	30-Sep-03
Butterfly	227	GN1	EB	3				3+	ot	1	n	m	im		length weight errors	30-Sep-03

Appendix 3 Table 2. Stock assessment data for Butterfly Lake eastern brook trout in 1999.

Lake	Sample#	Set #	Species Caught	Age	Length (mm)	Weight (grams)	Condition (k)	Scale Age	Structure	Cond. Code	Clip	Sex	Maturity	Ageing Comments	Comments	Date
Butterfly	25	GN1	EB	2	202	85	1.03	2	FR			M	m			Aug.25/99
Butterfly	1	GN1	EB	3	320	250	0.76	3+	FR			na	na			Aug.25/99
Butterfly	4	GN1	EB	3	324	300	0.88	3+	FR			F	m	4?		Aug.25/99
Butterfly	11	GN1	EB	3	310	250	0.84	3+	FR			M	m	4?		Aug.25/99
Butterfly	14	GN1	EB	3	344	300	0.74	3+	FR			M	m			Aug.25/99
Butterfly	18	GN1	EB	3	314	300	0.97	3+	FR			F	m	4?		Aug.25/99
Butterfly	23	GN1	EB	3	224	105	0.93	3	FR			F	im			Aug.25/99
Butterfly	24	GN1	EB	3	240	75	0.54	3	FR			F	im			Aug.25/99
Butterfly	26	GN1	EB	3	220	100	0.94	3	FR			F	m			Aug.25/99
Butterfly	27	GN1	EB	3	300	125	0.46	3+	FR			F	m	4?		Aug.25/99
Butterfly	29	GN1	EB	3	224	200	1.78	3+	FR			F	m			Aug.25/99
Butterfly	30	GN1	EB	3	230	90	0.74	3+	FR			F	m	4?		Aug.25/99
Butterfly	2	GN1	EB	4	307	225	0.78	4+	FR			M	m			Aug.25/99
Butterfly	3	GN1	EB	4	303	225	0.81	4+	FR			M	m			Aug.25/99
Butterfly	5	GN1	EB	4	326	400	1.15	4+	FR			M	unk			Aug.25/99
Butterfly	6	GN1	EB	4	369	300	0.60	4	FR			M	m			Aug.25/99
Butterfly	8	GN1	EB	4	305	250	0.88	4	FR			M	m			Aug.25/99
Butterfly	10	GN1	EB	4	330	300	0.83	4	FR			F	m			Aug.25/99
Butterfly	12	GN1	EB	4	335	300	0.80	4+	FR			F	m			Aug.25/99
Butterfly	13	GN1	EB	4	322	325	0.97	4+	FR			M	m			Aug.25/99
Butterfly	16	GN1	EB	4	335	300	0.80	4	FR			M	m			Aug.25/99
Butterfly	17	GN1	EB	4	335	200	0.53	4+	FR			M	m			Aug.25/99
Butterfly	19	GN1	EB	4	350	400	0.93	4	FR			M	m	3?		Aug.25/99
Butterfly	20	GN1	EB	4	358	400	0.87	4+	FR			M	m			Aug.25/99
Butterfly	21	GN1	EB	4	324	300	0.88	4	FR			M	im			Aug.25/99
Butterfly	22	GN1	EB	4	258	100	0.58	4	FR			F	m	3?		Aug.25/99
Butterfly	31	GN1	EB	4	321	250	0.76	4	FR			M	m	3?		Aug.25/99
Butterfly	7	GN1	EB	5	325	300	0.87	5	FR			M	m			Aug.25/99
Butterfly	9	GN1	EB	5	400	1100	1.72	5	FR			M	m			Aug.25/99
Butterfly	15	GN1	EB	6	372	475	0.92	6	FR			F	m			Aug.25/99
Butterfly	28	GN1	EB		240	120	0.87	2or3?	FR			M	m	PoorXS		Aug.25/99

Appendix 3 Table 3. Stock assessment data for Butterfly Lake eastern brook trout in 1991.

Lake	Sample#	Set #	Species Caught	Age	Length (mm)	Weight (grams)	Condition (k)	Scale Age	Structure	Cond. Code	Clip	Sex	Maturity	Ageing Comments	Comments	Date
Butterfly	4	GN1	EB	3	290	310	1.27					F	MG			23-May-91
Butterfly	8	GN1	EB	3	310	450	1.51					M	MG			23-May-91
Butterfly	10	GN1	EB	3	310	410	1.38					F	MG			23-May-91
Butterfly	11	GN1	EB	3	310	390	1.31					F	MG	age of 3 assigned to all fish	gammarus	23-May-91
Butterfly	12	GN1	EB	3	310	460	1.54					F	MG	given stocking history/ growth	gammarus	23-May-91
Butterfly	2	GN1	EB	3	315	460	1.47					F	MG	condition and comparative size	Chironomids	23-May-91
Butterfly	1	GN1	EB	3	320	450	1.37					M	IM	at age from other lakes/ assessments	Chironomids	23-May-91
Butterfly	6	GN1	EB	3	320	460	1.40					F	MG			23-May-91
Butterfly	7	GN1	EB	3	320	470	1.43					F	IM		dragonfly nymph	23-May-91
Butterfly	9	GN1	EB	3	320	470	1.43					F	MG			23-May-91
Butterfly	3	GN1	EB	3	325	460	1.34					M	MG		Chironomids	23-May-91
Butterfly	5	GN1	EB	3	325	490	1.43					F	MG			23-May-91

PROJECT EVALUATION 12.0

Project Budget Summary:

Budget allocated: 5000

Budget spent: 5000

Cost savings: 0

The project was:

on budget

over budget Why? _____

under budget Why? _____

Was the project completed as planned?

Yes.

No. If not, describe problems that arose and changes made to address problems. We were unable to complete the Bow/ Butterfly Lake paired lake study as the result of a fish stocking error. A follow-up survey is planned for 2004.

Would the proponent recommend changes to similar projects in the future?

No.

Yes (Please provide details). _____

Contractor performance:

Not applicable. No contractor employed.

Acceptable. Would employ again.

Acceptable. But some concerns (please provide details): _____

Unacceptable. Would not recommend for future projects (please provide reasons): _____