Bow Lake

Recreational Fishery Stock Assessment

2003 Final Report

Project Tracking Number:

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EXECUTIVE SUMMARY

A stocking assessment was completed on Bow 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 of the study was to compare the relative growth and performance of stocked versus naturalized eastern brook trout in Bow and Butterfly lakes. Standard BC, Resource Inventory and Standards Committee methods were used to complete the surveys. Naturalized brook trout recruits (2N), mature brook trout and evidence of redd digging were observed during the course of the survey. A comparison with Butterfly Lake was not possible in 2003 due the mis-stocking of the marked brook trout intended for Butterfly Lake into another lake in Eskers Park. In Bow Lake catch per unit of net effort was less for naturalized brook trout (2N) than it was for all female triploids (AF3N) indicating that the wild component of this fishery is likely smaller than the stocked portion. Growth rates and lengths-at-age of 2N EB were found to be less than for other Omineca lakes. Likewise, AF3N EB stocked in 2001 into Bow Lake were found to be growing more slowly than other Omineca lakes; however AF3N EB in Bow Lake were growing better at age three than naturalized three-year-olds. Differences in growth between 2N and the AF3N stock are likely a function of the advanced maturity of the three-year-old naturalized fish; eighty percent of the naturalized EB were found to be mature. A third stock assessment should be completed in 2004 to ascertain the relative growth potential of stocked (AF3N) versus naturalized 2N EB in Bow Lake as well as to compare the relative growth rates of AF3N and 2N EB in Bow and Butterfly lakes. This information will be used to evaluate future stocking of Bow Lake as well as other lakes in Eskers Provincial Park.

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INTRODUCTION 1.0

This report presents the results of a recent stock assessment of Bow Lake with a comparison to work completed in 1999 (Zimmerman, 1999a). The assessment was completed on October 3, 2003 by the M.W.L.A.P. Funding was provided in part by the Freshwater Fisheries Society of British Columbia, Small Lake Management and Conservation Initiative. Peer review of this report was completed by regional fisheries staff. Analysis and reporting of the field results were conducted by the author. Inquiries pertaining to this report should be directed to the email and address of the author.

Bow 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 (Phillips 1985). Bow Lake was first stocked eastern brook trout (*Salvelinus fontinalis*)(EB) in 1988 (Appendix 2 Table 1). The original fishery management objective for Bow Lake was to provide moderate to high yield fishery for eastern brook trout (MWLAP Lakes Files). Stocking was suspended at the request of the Parks Branch after 1988 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 1997 on an alternate year basis at a rate of 500 fingerlings/ha (Appendix 2), although the stocking of Bow Lake was suspended after 2001 as part of the Bow Lake/ Butterfly Lake study which was designed to compare the relative success and growth of wild (diploid) and marked hatchery, sterile, all female triploid (AF3N) EB in these two lakes (Zimmerman, 1999a, 1999b).

Bow Lake was assigned status as a high priority lake for stock assessment in 1999 as it had not been formally assessed since the inception of stocking. As part of ongoing management activities, a second 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 diploid 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

Bow 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 the 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 the park.

Eskers Provincial Park currently supports a regionally important recreational fishery during both summer and winter months and Bow Lake supports an important component of that fishery. However, stocking errors and possible 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 un-stocked 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 Bow Lake on October 2, 2003, according to the methods specified in the Resource Inventory Committee document Fish Collection Methods and Standards (RIC 1997). The net was set at 15:30 hrs and retrieved on October 3 at 11:10 hrs for a total soak time of 23.2 hours. The net was extended west on the surface from the shore of the island in a west orientation into approximately 4 meters of water (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 from all brook trout for 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

Both AF3N and 2N brook trout were captured in 2003 (Table 2, Figure 3) and the raw assessment data can be found in Appendix 3. Approximately 78% of the catch was comprised of all female triploids (AF3N) and 22% were diploid (2N) naturalized stock. AF3N were differentiated from naturalized stock by an adipose fin clip.

The sex ratio for 2N EB in Bow Lake was biased towards males in 2003; only 24 percent of the sample was female. The 2N catch contained brook trout in a variety of maturity states. At the time of sampling greater than 80 % of the 2N fish were in a late maturity state near or past spawning with only 12% of the fish being immature (Figure 4). Only 4 percent of the 2N EB sample had already spawned. Greater than 80% of each year class including 2-year-olds were mature (Figure 4).

LENGTH FREQUENCY, CONDITION AND GROWTH 4.2

In the 2003 catch the 2001 stocked cohort of AF3N EB ranged in length from 263 mm to 329 mm ($\bar{x}$ = 302 mm) (Table 3, Figure 3). 2N EB ranged from 238 mm up to 327 mm ($\bar{x}$ = 289 mm).

The mean body condition of 2N EB (1.31) was much higher compared with the body condition for AF3N (1.15). Condition-at-age was comparable for ages 2 and 3 for 2N EB in 2003 (Table 3). Age four fish were on average less conditioned than were the two and threes (Table 2), although only two 4-year-old 2N EB were captured. AF3N, three-year-old EB were of lower body condition than 2N fish. The 2N sample was collected in early October when the gonad mass would be at a maximum just prior to spawning and this may have had a strong influence on the apparently high body condition. For the 1999 and 2003 sample years EB weight increased as power of length according to the following equations (Figure 5):

$$\text{2003 2N } W = .0017L^{2.189} \quad \mathbf{(R^2=0.88)}$$
$$\text{2003 AF3N } W = .0001L^{2.217} \quad \mathbf{(R^2=0.66)}$$
$$\text{1999 2N } W = 2\,\text{E-}10\,L^{4.812} \quad \mathbf{(R^2=0.85)}$$

The exponent value in the length-weight relationship can be used as a relative measure of fish 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 collected were highly variable and scales were used as an ageing structure. It is likely that the precision of the weigh-scale used in that survey was low, or was inaccurate (Zimmerman 1999a). Furthermore, 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. The 2003 2N catch had good representation of two to four-year-old fish however, one-year-old EB were not sampled in the gill nets. During the course of the spawning surveys, small (<200 mm) fish were observed in several locations along the eastern shore of Bow Lake and it is assumed that these fish represented the missing one 1+ year-class. Due to the steep shoreline and abundant riparian cover at Bow Lake the smallest mesh panel of the gillnet was set approximately two meters from shore which may have enabled the smallest size class of fish to swim around the end of the net.

Visual Spawner and Spawning Habitat Survey 4.2.3

This 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. Redd locations as well as sites where digging had occurred were also observed in the near-shore areas throughout 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 Bow Lake. However, only 22 percent of the catch in the 2003 survey was comprised of diploid (2N) fish suggesting the total population of reproducing EB is likely much less than the adult all female triploid (AF3N) EB originating from the 2001 stocking event. Assuming equal survival to age three and assuming equal vulnerability to the gill net of 2N and AF3N, a rough population estimate (Peterson estimate) for Bow Lake 2N brook trout fingerlings in 2001 was 545 fish or approximately 90 fingerlings/ha compared with 491 stocked AF3N EB fingerlings/ha. Although approximate, this estimate can be used as a reference point for relative population size in future stock assessments.

The combined catch per net-hour of both 2N and AF3N EB was about 20% higher in 2003 compared with 1999 (Table 2), however the catch per effort of 2N EB was less than it was in 1999. A greater range of fish lengths (170-460) mm was also obtained in the 1999 sample (Table 3, Figure 3) even though the 1999 catch was sub-sampled (Zimmerman 1999a) at the time of the survey.

The mean length-at-age of Bow Lake three-year-old EB appears to be relatively similar between 1999 and 2003 (Table 3) and lengths-at-age of 2N three-year-old EB in Bow Lake from the 2003 sample are similar ($\bar{x}$ =289 mm) to those observed in Kathie Lake ($\bar{x}$ =297). Kathie Lake is not stocked and is showing signs of reduced growth rates which may be the result of higher levels intraspecific competition (Williamson, 2004a). Likewise, Bow Lake 2N brook trout appear to be exhibiting declining body condition as they age compared to other populations of brook trout in the region. For example EB samples from Shere and Ferguson lake EB, from two stock assessments in 1998-99, exhibited near isometric growth with growth exponent values of 3.128 and 3.097 respectively (Zimmerman 1999c, 1991d). Given the relatively low population size of naturalized EB in Bow Lake, reduced condition and growth is more likely a function of the higher stocking rate. In 2001, Bow Lake was stocked with 3000 EB, which equates to a stocking rate of 491 fish/ha. Reducing this rate to the range of 150-250 fish/ha may result in higher growth rates similar to those observed in Byers Lake, which is also located in Eskers Provincial Park (Figure 1). Bow and Byers Lakes have similar water chemistry; total dissolved solids (TDS) measurements collected by Phillips in 1985 were 138 and 140 ppm respectively. Presently, the stocking rate on Byers Lake has been set at 175 fish/ha in odd years. At this rate, three-year-old EB in Byers Lake have been

reaching lengths in excess of 450 mm (M.W.L.A.P. unpublished data). It is therefore recommended that a stock assessment be completed in 2004 in Bow Lake to compare the growth rates of the 2001 stocked cohort against the naturalized cohort that spawned in fall 2003 in an effort determine the efficacy of stocking Bow Lake in 2005 at a reduced rate.

Based on the catch composition and the visual surveys for spawners, it is apparent that 2N EB in Bow Lake are capable of successful reproduction. The shoreline in Bow Lake is composed of a loose mixture of gravels and sands overlain with a thin layer of organic material (Photo 1). In Eskers Park, there are few areas of overland drainage and Bow Lake does not have any inlet or outlet streams. The drainage of precipitation from Bow 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. Furthermore, as the result of the apparently lower relative abundance of 2N EB in Bow Lake compared to Kathie or Butterfly Lake it is also unclear whether EB recruitment is spawning habitat limited or whether populations of these fish are still expanding. Based on the observation of juvenile EB as well as the capture of EB of multiple age classes it is however clear, that some unknown level of successful spawning and recruitment is taking place.

The presence of naturalized brook trout populations in Bow Lake also presents hazards in terms of conservation of biodiversity and sport fishing quality if illegal fish transfer between lakes within the Park continues. At present the risk from Bow Lake is low as the two lakes in the Park immediately adjacent (within 200 m) of Bow Lake presently contain stocked brook trout. Two of these lakes (Kathie and Butterfly) are known to contain naturalized brook trout. Given that the lakes adjacent to Bow already contain brook trout the incentive for anglers to move fish is low and it is more likely that fish would be moved from the lakes adjacent to Bow Lake rather than Bow Lake itself. At a minimum a communication plan should be established to inform anglers in the park the hazards of fish transfer to biodiversity and to sport fishing quality as well as the legal consequences of transferring fish.

In summary, Bow Lake has the potential to provide a high yield brook trout fishery at present EB population levels with the possibility of a trophy brook trout fishery if stocking rates are reduced and if the naturalized population does not expand. Continued monitoring of this fishery will be required to understand trends in naturalized EB population levels as well as 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. Continue monitoring the EB fishery and population levels through annual opportunistic creel surveys and stocking assessments at five-year interval. The next stocking assessment should be completed in fall 2004 to assess the

contribution of the 2001 stocked cohort to fishing quality and to compare this data with Butterfly Lake.

2. Consider restocking Bow Lake in 2005 at a reduced rate of 175-250 fish/ha.
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 a variety of recreational opportunities.
4. Establish a communication plan to reduce the incidence of fish transfer in the Park.
5. If populations of naturalized EB increase in Bow Lake, management options such as: 1) changes to EB bag limits or 2) eradication methods (removal by gill or trap-nets) could be considered to protect biodiversity and fishery values.

REFERENCES 7.0

BC Parks 1990. Master Plan for Eskers Provincial Park: March 1990. 36 pp

Ministry of Water Land and Air Protection. Lakes Files. 4051 18th Ave. Prince George, BC.

Gale, Grant. Personal Communication. Freshwater Fisheries Society of British Columbia. Clearwater Trout Hatchery, Clearwater, BC.

Philip, D.F. 1985. A Reconnaissance Survey of Bow Lake. Report prepared for the Fisheries Branch, Ministry of Environment. Prince George.

Resources Inventory Committee. 1997. Fish Collection Methods and Standards. Version 4.0. 58 p. Victoria BC.

Williamson, C. 2004a. Kathie Lake Recreational Fishery Stock Assessment 2003 Final Report. Ministry of Water Land and Air Protection. Prince George, BC 23p.

Williamson, C. 2004b. Butterfly Lake Recreational Fishery Stock Assessment 2003 Final Report. Ministry of Water Land and Air Protection. Prince George, BC 22p.

Zimmerman, J.T. 1999a. Bow Lake Recreational Fishery Stock Assessment 1999 Final Report. http://wlapwww.gov.bc.ca/nor/fish/stocking/bow/index.html

Zimmerman, J.T. 1999b. Butterfly Lake Recreational Fishery Stock Assessment 1999 Final Report. http://wlapwww.gov.bc.ca/nor/fish/stocking/butterfly/index.html

Zimmerman, J.T. 1999c. Shere Lake Recreational Fishery Stock Assessment 1999 Final Report. http://wlapwww.gov.bc.ca/nor/fish/stocking/shere/index.html

Zimmerman, J.T. 1999d. Ferguson Lake Recreational Fishery Stock Assessment 1999 Final Report. http://wlapwww.gov.bc.ca/nor/fish/stocking/ferguson/index.html

TABLES 8.0

Table 1. Attributes of Bow Lake.*

Attributes	
UTM Coordinates	10.488498.5991446
Nearest Center	32 Km NW of Prince George
Waterbody identifier	01262STUR
Wateshed Code	182-209700-95100
Water surface area	6 ha.
Littoral area (above 6 m contour)	3.9 ha.
Shoreline perimeter	1360 m
Maximum depth	9 m
Volume	269,000 m3
Mean depth	4.5 m
Elevation	760 m
T.D.S.	138 mg/L
Morphoedaphic index	31

*from Philip (1985)

Table 2. Catch Summary for the years 1999-2003; CPUE- Catch per unit effort; AF3N- all female triploid.

Year	Brook Trout Catch	Net CPUE	Set Time (Hours)	Set Date
2003 2N	25	1.27	19.7	3-Oct-03
2003 AF3N	88	4.47	19.7	3-Oct-03
1999	80	3.96	20.2	12-Aug-99

Table 3. Physical attributes of brook trout sampled in Bow Lake 1999 and 2003 broken down by age class; AF3N- all female triploid, 2N- diploid.

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
1999	1	1	170				27				0.54				
1999	2	5	281	258	305	19.2	94	40	210	67.3	0.40	0.23	0.74	0.2	0.04
2003 2N	2	6	260	238	285	15.7	227	210	250	18.6	1.31	1.08	1.56	0.2	0.03
2003 2N	3	16	289	267	310	12.1	307	270	360	31.0	1.27	1.16	1.42	0.1	0.00
2003 AF3N	3	88	302	263	329	12.0	316	210	410	33.3	1.15	0.96	1.54	0.1	0.01
1999	3	15	301	250	345	24.1	166	40	390	88.2	0.58	0.19	0.95	0.2	0.05
2003 2N	4	2	327	326	327	0.7	355	350	360	7.1	1.02	1.01	1.03	0.0	0.00
1999	4	13	394	345	455	28.5	710	440	1190	195.1	1.14	0.89	1.42	0.1	0.02
1999	5	1	460				900				0.9				

FIGURES 9.0

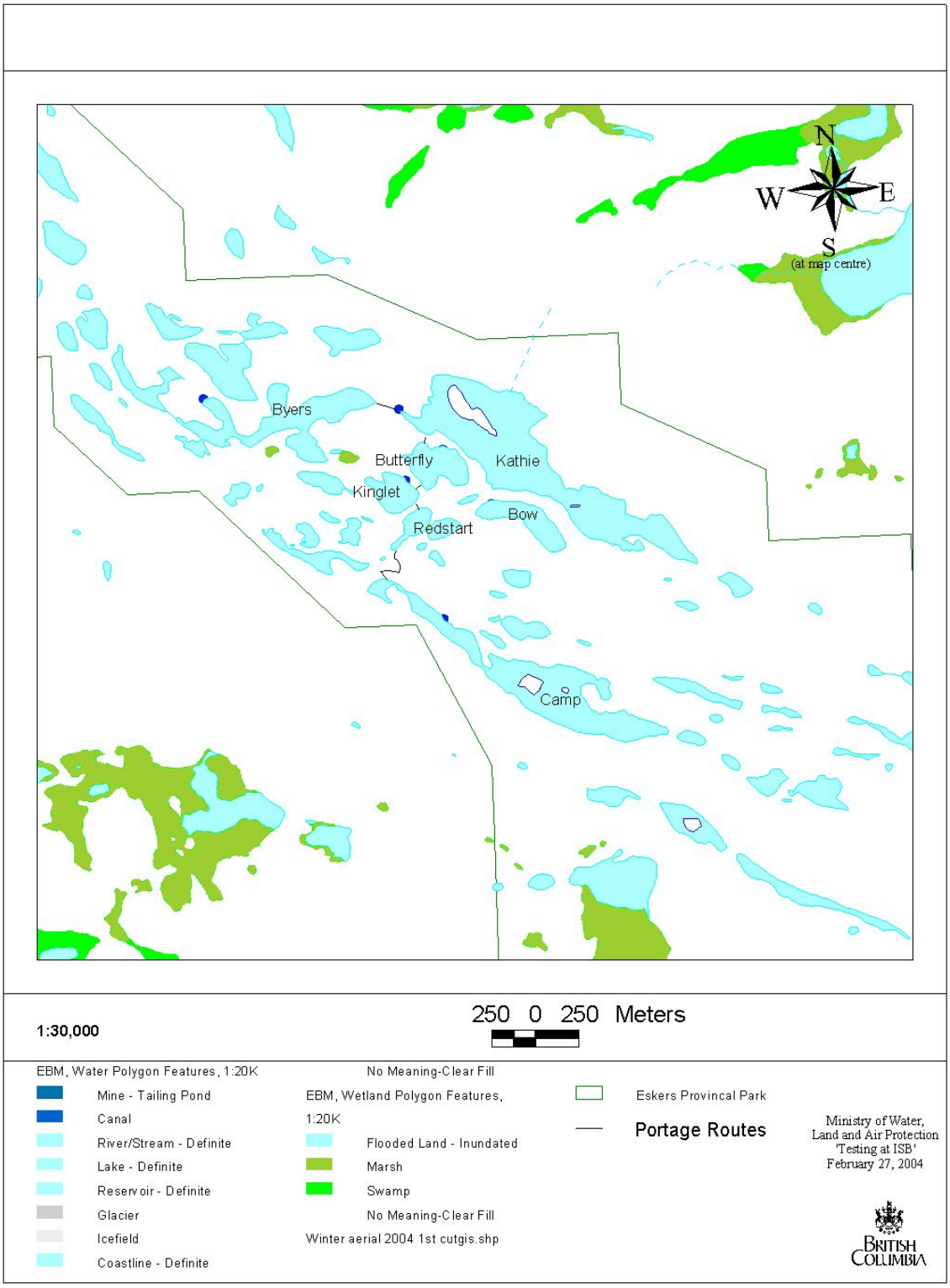


Figure 1. Map of Eskers Provincial Park showing Lakes that were included in the 2003 survey (Note Byers Lake was not assessed in 2003).

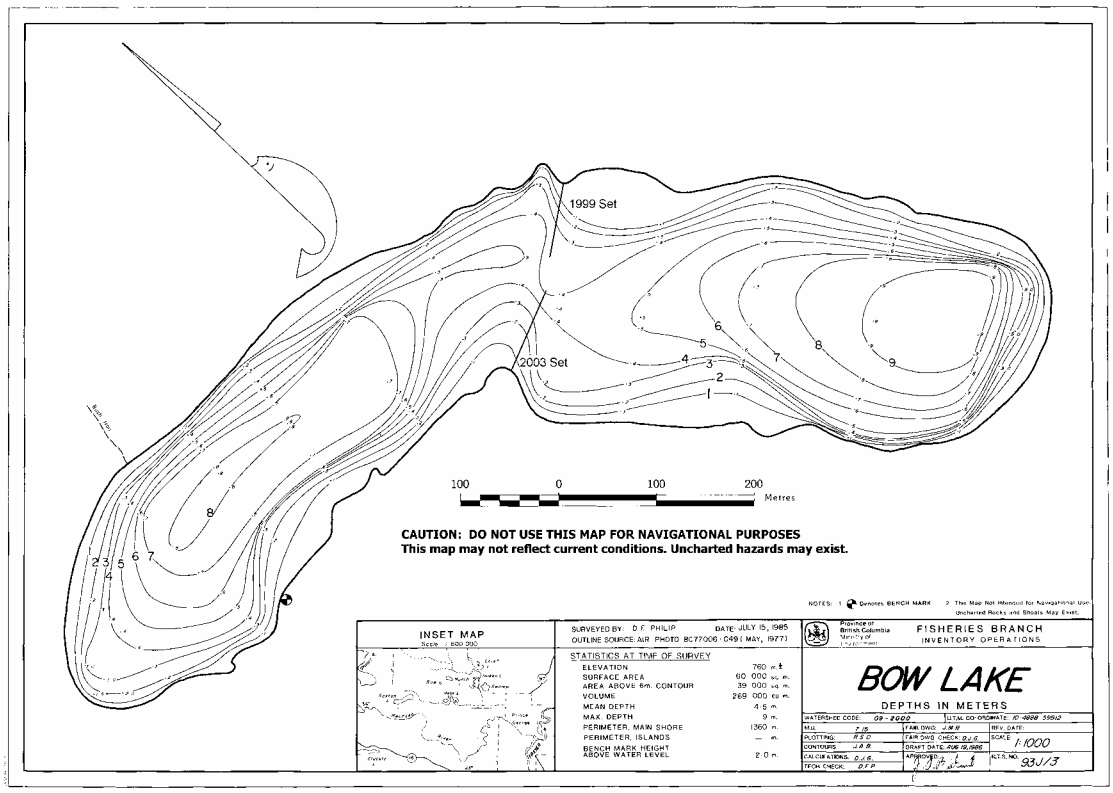


Figure 2. Bathymetric map of Bow Lake showing gill net sets in August, 1999 and October 2003. (see Appendix 1 Figure 1 for full size image).

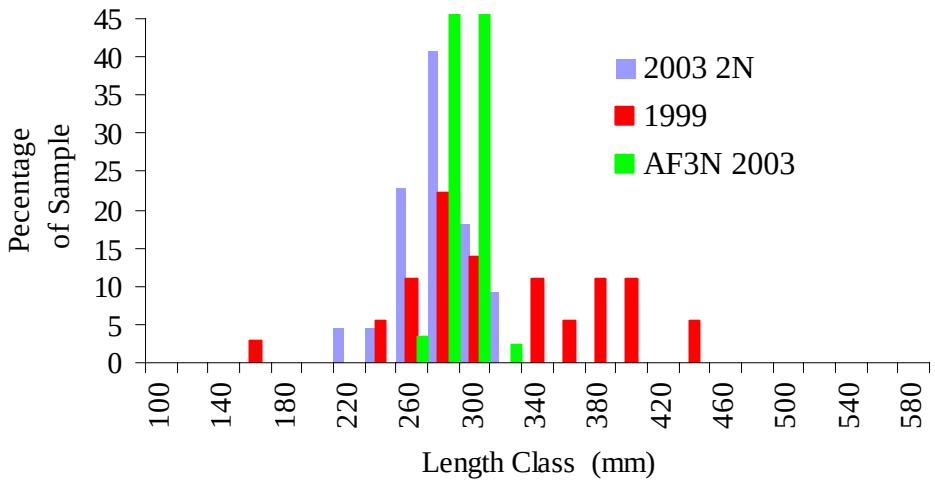


Figure 3. Length frequency distribution for the 2003 and 1999 gill net samples for Bow Lake. 2003 2n n=25; 2003 AF3N n=88; 1999 n=35.

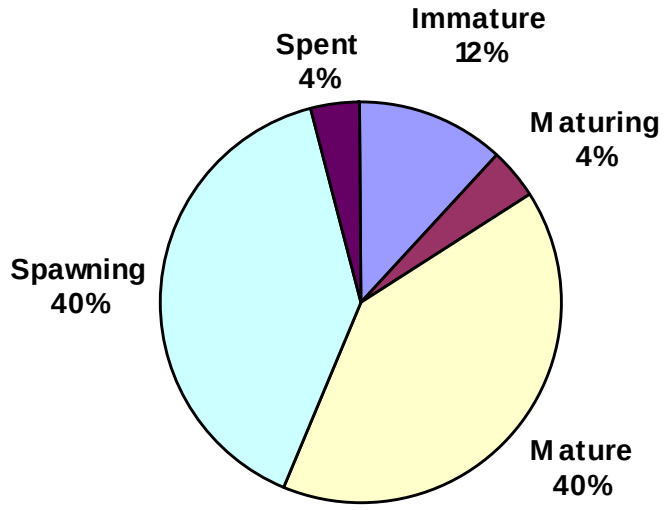


Figure 4. Maturity states of diploid (2N) EB captured in 2003 listed by percent.

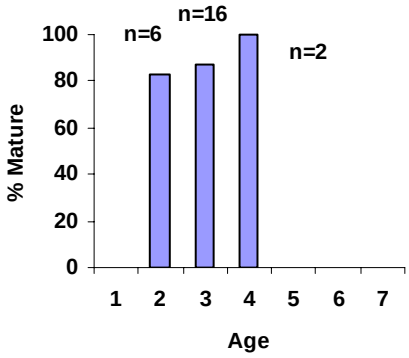


Figure 5. Percentage of mature EB in each age class for 2003.

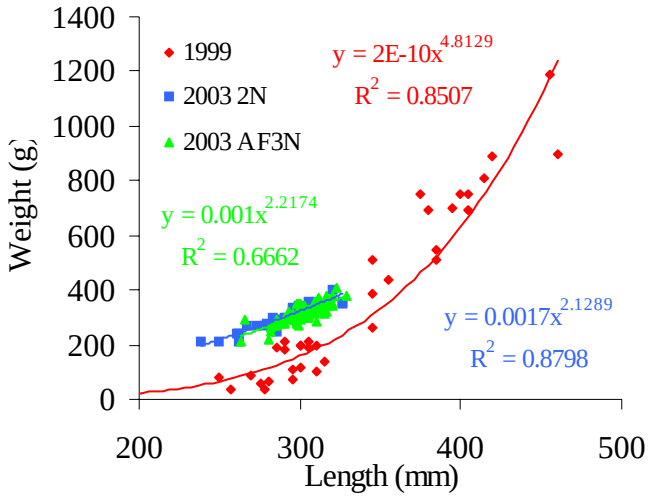


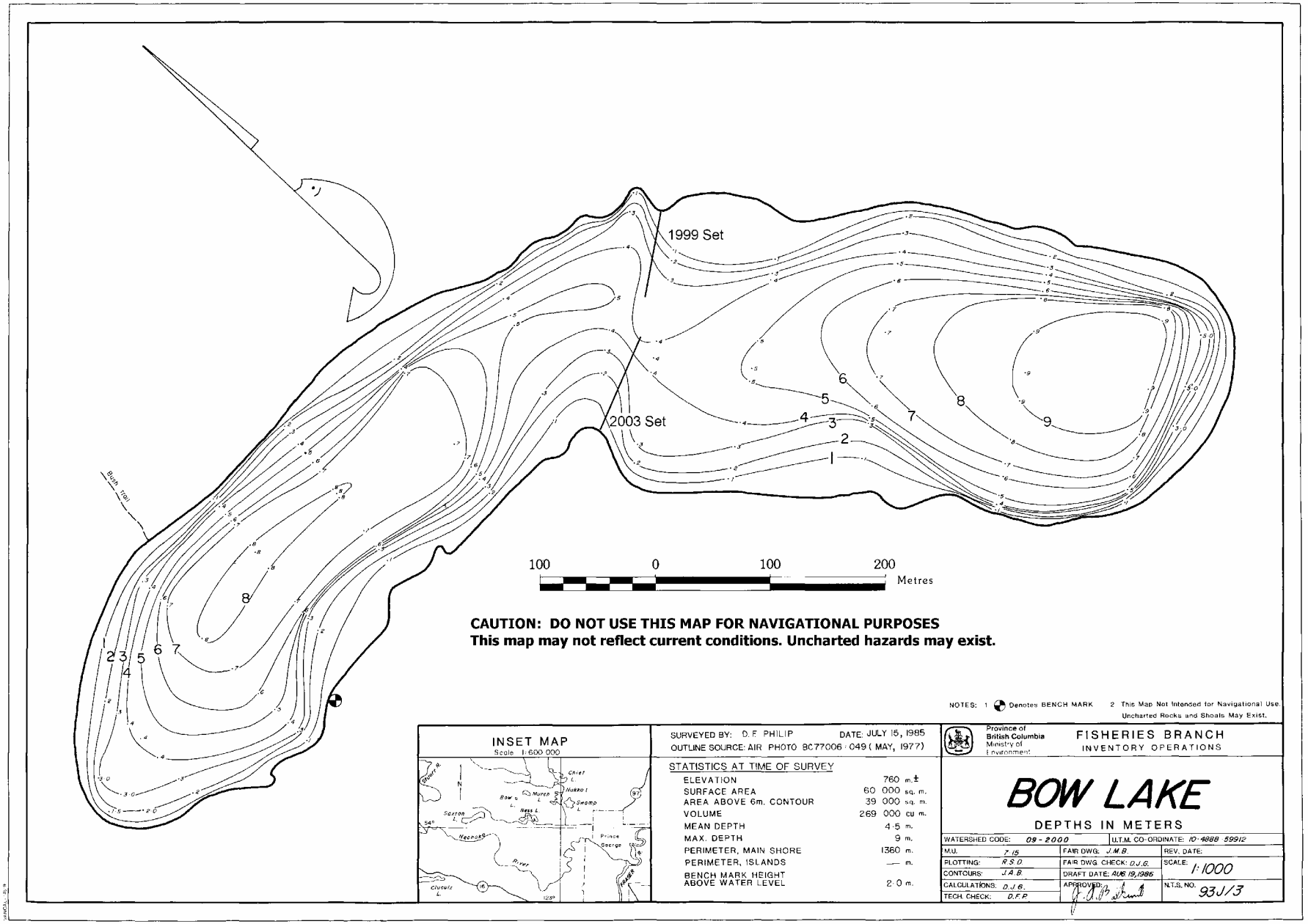
Figure 6. Length weight relationship for Bow Lake brook trout in 1999 and 2003.

PHOTOS 10.0

Photo 1. Example of typical shoreline in Bow (Philip, 1985).

APPENDICES 11.0

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



Appendix 2 Table 1. Stocking history Bow 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
Future Stocking on Hold Pending Research Outcomes												
4-Jun-01	BOW LAKE		7A	Brook Trout	3000	500	AYLMER AF3N	Adipose	7.4	FINGERLING	182-209700-95100	01262STUR
5-Jun-99	BOW LAKE		7A	Brook Trout	3000	500	AYLMER AF3N		5.9	FINGERLING	182-209700-95100	01262STUR
17-Jun-97	BOW LAKE		7A	Brook Trout	3000	500	AYLMER		3.01	FINGERLING	182-209700-95100	01262STUR
1-Jun-89	BOW LAKE		7A	Brook Trout	5000	833	AYLMER		2.5	FRY	182-209700-95100	01262STUR
1-Jun-88	BOW LAKE		7A	Brook Trout	10000	1667	AYLMER		2.7	UNKNOWN	182-209700-95100	01262STUR

Appendix 3 Table 1. Stock assessment data for Bow Lake diploid (2N) 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
Bow	91	GN1	eb	2	285	250	1.1	2+	Ot	1	n	m	sp			03-Oct-03
Bow	93	GN1	eb	2	262	240	1.3	2+	Ot	1	n	m	sp			03-Oct-03
Bow	95	GN1	eb	2	262	210	1.2	2+	Ot	1	n	m	im			03-Oct-03
Bow	96	GN1	eb	2	238	210	1.6	2+	Ot	1	n	m	m			03-Oct-03
Bow	97	GN1	eb	2	261	240	1.3	2+	Ot	1	n	m	sp			03-Oct-03
Bow	98	GN1	eb	2	249	210	1.4	2+	Ot	2	n	m	m	broken		03-Oct-03
Bow	89	GN1	eb	3	292	300	1.2	3+	Ot	1	n	f	m			03-Oct-03
Bow	90	GN1	eb	3	295	330	1.3	3+	Ot	2	n	m	m	broken		03-Oct-03
Bow	94	GN1	eb	3	273	270	1.3	3+	Ot	1	n	m	sp			03-Oct-03
Bow	100	GN1	eb	3	284	290	1.3	3+	Ot	1	n	f	m			03-Oct-03
Bow	101	GN1	eb	3	278	270	1.3	3+	Ot	1	n	m	m			03-Oct-03
Bow	102	GN1	eb	3	305	330	1.2	3+	Ot	1	n	m	mt			03-Oct-03
Bow	103	GN1	eb	3	299	340	1.3	3+	Ot	1	n	m	sp			03-Oct-03
Bow	105	GN1	eb	3	286	290	1.2	3+	Ot	1	n	f	m			03-Oct-03
Bow	106	GN1	eb	3	267	270	1.4	3+	Ot	1	n	m	sp			03-Oct-03
Bow	107	GN1	eb	3	284	290	1.3	3+	Ot	1	n	f	m			03-Oct-03
Bow	108	GN1	eb	3	305	360	1.3	3+	Ot	1	n	f	m			03-Oct-03
Bow	109	GN1	eb	3	296	335	1.3	3+	Ot	1	n	m	sp			03-Oct-03
Bow	110	GN1	eb	3	283	300	1.3	3+	Ot	1	n	m	sp			03-Oct-03
Bow	111	GN1	eb	3	310	360	1.2	3+	Ot	1	n	m	im			03-Oct-03
Bow	112	GN1	eb	3	279	280	1.3	3+	Ot	1	n	m	sp			03-Oct-03
Bow	113	GN1	eb	3	290	300	1.2	3+	Ot	1	n	f	m			03-Oct-03
Bow	99	GN1	eb	4	327	360	1.0	4+	Ot	1	n	m	sp			03-Oct-03
Bow	104	GN1	eb	4	326	350	1.0	4+	Ot	1	n	m	st			03-Oct-03
Bow	92	GN1	eb		320	400	1.2	n/a	Ot	8	n	m	im	no otolith envelope		03-Oct-03

Appendix 3 Table 2. Stock assessment data for triploid Bow 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
Bow	1	GN1	eb	3	299	330	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	2	GN1	eb	3	292	300	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	3	GN1	eb	3	315	320	1.0	3+	None		a	af3n	na	known age		03-Oct-03
Bow	4	GN1	eb	3	320	380	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	5	GN1	eb	3	293	310	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	6	GN1	eb	3	295	290	1.1	3+	None		a	af3n	na	known age		03-Oct-03
Bow	7	GN1	eb	3	294	290	1.1	3+	None		a	af3n	na	known age		03-Oct-03
Bow	8	GN1	eb	3	298	290	1.1	3+	None		a	af3n	na	known age		03-Oct-03
Bow	9	GN1	eb	3	311	350	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	10	GN1	eb	3	284	270	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	11	GN1	eb	3	309	330	1.1	3+	None		a	af3n	na	known age		03-Oct-03
Bow	12	GN1	eb	3	323	410	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	13	GN1	eb	3	300	320	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	14	GN1	eb	3	286	290	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	15	GN1	eb	3	312	330	1.1	3+	None		a	af3n	na	known age		03-Oct-03
Bow	16	GN1	eb	3	304	300	1.1	3+	None		a	af3n	na	known age		03-Oct-03
Bow	17	GN1	eb	3	315	335	1.1	3+	None		a	af3n	na	known age		03-Oct-03
Bow	18	GN1	eb	3	291	290	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	19	GN1	eb	3	305	330	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	20	GN1	eb	3	302	310	1.1	3+	None		a	af3n	na	known age		03-Oct-03
Bow	21	GN1	eb	3	263	210	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	22	GN1	eb	3	285	270	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	23	GN1	eb	3	302	320	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	24	GN1	eb	3	310	335	1.1	3+	None		a	af3n	na	known age		03-Oct-03
Bow	25	GN1	eb	3	286	280	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	26	GN1	eb	3	311	350	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	27	GN1	eb	3	302	300	1.1	3+	None		a	af3n	na	known age		03-Oct-03
Bow	28	GN1	eb	3	316	340	1.1	3+	None		a	af3n	na	known age		03-Oct-03
Bow	29	GN1	eb	3	317	320	1.0	3+	None		a	af3n	na	known age		03-Oct-03
Bow	30	GN1	eb	3	298	285	1.1	3+	None		a	af3n	na	known age		03-Oct-03
Bow	31	GN1	eb	3	309	360	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	32	GN1	eb	3	290	280	1.1	3+	None		a	af3n	na	known age		03-Oct-03
Bow	33	GN1	eb	3	301	300	1.1	3+	None		a	af3n	na	known age		03-Oct-03
Bow	34	GN1	eb	3	300	320	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	35	GN1	eb	3	308	320	1.1	3+	None		a	af3n	na	known age		03-Oct-03
Bow	36	GN1	eb	3	312	340	1.1	3+	None		a	af3n	na	known age		03-Oct-03
Bow	37	GN1	eb	3	301	320	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	38	GN1	eb	3	308	320	1.1	3+	None		a	af3n	na	known age		03-Oct-03
Bow	39	GN1	eb	3	308	335	1.1	3+	None		a	af3n	na	known age		03-Oct-03
Bow	40	GN1	eb	3	319	350	1.1	3+	None		a	af3n	na	known age		03-Oct-03
Bow	41	GN1	eb	3	300	320	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	42	GN1	eb	3	316	380	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	43	GN1	eb	3	305	300	1.1	3+	None		a	af3n	na	known age		03-Oct-03
Bow	44	GN1	eb	3	305	305	1.1	3+	None		a	af3n	na	known age		03-Oct-03
Bow	45	GN1	eb	3	309	320	1.1	3+	None		a	af3n	na	known age		03-Oct-03
Bow	46	GN1	eb	3	287	285	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	47	GN1	eb	3	291	300	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	48	GN1	eb	3	298	350	1.3	3+	None		a	af3n	im	known age	large for hatchery	03-Oct-03
Bow	49	GN1	eb	3	299	300	1.1	3+	None		a	af3n	na	known age		03-Oct-03
Bow	50	GN1	eb	3	299	320	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	51	GN1	eb	3	298	290	1.1	3+	None		a	af3n	na	known age		03-Oct-03
Bow	52	GN1	eb	3	295	300	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	53	GN1	eb	3	300	320	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	54	GN1	eb	3	310	285	1.0	3+	None		a	af3n	na	known age		03-Oct-03
Bow	55	GN1	eb	3	312	370	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	56	GN1	eb	3	303	340	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	57	GN1	eb	3	312	350	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	58	GN1	eb	3	293	320	1.3	3+	None		a	af3n	na	known age		03-Oct-03
Bow	59	GN1	eb	3	300	350	1.3	3+	None		a	af3n	na	known age		03-Oct-03
Bow	60	GN1	eb	3	285	285	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	61	GN1	eb	3	315	315	1.0	3+	None		a	af3n	na	known age		03-Oct-03
Bow	62	GN1	eb	3	282	260	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	63	GN1	eb	3	311	350	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	64	GN1	eb	3	314	350	1.1	3+	None		a	af3n	na	known age		03-Oct-03
Bow	65	GN1	eb	3	309	310	1.1	3+	None		a	af3n	na	known age		03-Oct-03
Bow	66	GN1	eb	3	300	290	1.1	3+	None		a	af3n	na	known age		03-Oct-03
Bow	67	GN1	eb	3	280	220	1.0	3+	None		a	af3n	na	known age		03-Oct-03
Bow	68	GN1	eb	3	295	310	1.2	3+	None		a	af3n	na	known age		03-Oct-03
Bow	69	GN1	eb	3	299	270	1.0	3+	None		a	af3n	na	known age		03-Oct-03
Bow	70	GN1	eb	3	308	330	1.1	3+	None		a	af3n	na	known age		03-Oct-03

Appendix 3 Table 3. Stock assessment data for Bow 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
Bow	1	GN1	EB	4	420	890	1.2	4+	sc			M	m			12-Aug-99
Bow	2	GN1	EB	3	315	140	0.4	3+	sc			F	im			12-Aug-99
Bow	3	GN1	EB	5	460	900	0.9	5.0	sc			M	m	4?		12-Aug-99
Bow	4	GN1	EB	3	310	100	0.3	3+	sc			M	m			12-Aug-99
Bow	5	GN1	EB	3	280	65	0.3	3+	sc			F	im			12-Aug-99
Bow	6	GN1	EB	4	395	700	1.1	4+	sc			M	im			12-Aug-99
Bow	7	GN1	EB	4	405	690	1.0	4+	sc			F	m			12-Aug-99
Bow	8	GN1	EB	2	295	70	0.3	2+	sc			F	im	3?		12-Aug-99
Bow	9	GN1	EB	3	300	120	0.4	3+	sc			M	im			12-Aug-99
Bow	10	GN1	EB	1	170	26.5	0.5	1+	sc			M	im			12-Aug-99
Bow	11	GN1	EB	2	257.5	40	0.2	2+	sc			M	im			12-Aug-99
Bow	12	GN1	EB	4	405	750	1.1	4+	sc			M	m			12-Aug-99
Bow	13	GN1	EB	2	270	90	0.5	2+	sc			M	im	3?		12-Aug-99
Bow	14	GN1	EB	4	400	750	1.2	4.0	sc			F	m			12-Aug-99
Bow	15	GN1	EB	3	345	390	0.9	3+	sc			F	im			12-Aug-99
Bow	16	GN1	EB	3	277.5	40	0.2	3+	sc			F	im			12-Aug-99
Bow	17	GN1	EB	3	295	110	0.4	3+	sc			F	im			12-Aug-99
Bow	18	GN1	EB	3	290	210	0.9	3+	sc			F	im			12-Aug-99
Bow	19	GN1	EB	2	275	60	0.3	2+	sc			M	im	3?		12-Aug-99
Bow	20	GN1	EB	3	345	260	0.6	3+	sc			M	m			12-Aug-99
Bow	21	GN1	EB	3	305	190	0.7	3+	sc			M	im			12-Aug-99
Bow	22	GN1	EB	4	455	1190	1.3	4+	sc			F	m	5?		12-Aug-99
Bow	23	GN1	EB	4	345	510	1.2	4+	sc			M	m	5?		12-Aug-99
Bow	24	GN1	EB	3	300	200	0.7	3+	sc			M	m			12-Aug-99
Bow	25	GN1	EB	4	380	690	1.3	4+	sc			M	m	5?		12-Aug-99
Bow	26	GN1	EB	4	415	810	1.1	4.0	sc			M	m	5?		12-Aug-99
Bow	27	GN1	EB	4	355	440	1.0	4+	sc			M	m			12-Aug-99
Bow	28	GN1	EB	4	385	510	0.9	4+	sc			F	st			12-Aug-99
Bow	29	GN1	EB	4	385	550	1.0	4.0	sc			F	im			12-Aug-99
Bow	30	GN1	EB	2	305	210	0.7	2+	sc			F	im	3?		12-Aug-99
Bow	31	GN1	EB	4	375	750	1.4	4+	sc			F	st			12-Aug-99
Bow	32	GN1	EB	3	310	200	0.7	3+	sc			M	m			12-Aug-99
Bow	33	GN1	EB	3	300	200	0.7	3+	sc			M	im			12-Aug-99
Bow	34	GN1	EB	3	290	180	0.7	3+	sc			F	im			12-Aug-99
Bow	35	GN1	EB	3	250	80	0.5	3+	sc			F	im			12-Aug-99
Bow	36	GN1	EB		285	190	0.8	NS	sc			NA	na			12-Aug-99

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): _____