MARBLE RIVER

Fish And Fish Habitat Inventory

(Watershed code: 930-8652)

Prepared for
MINISTRY OF ENVIRONMENT, LANDS AND PARKS
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ARL Report 238-8
October, 1998

Addendum to Marble River Fish and Fish Habitat Inventory, October 1998

Stream Card Database

Duplicate site numbers have been made unique for each stream surveyed. The following table shows the changes made to the database. The maps and reports have not been changed.

Stream Name	Local Name	Old Reach No.	New Reach No.	Site No.
Marble River	Lower Marble River	1	1	1
Marble River	Lower Marble River	2	2	2
Marble River	Lower Marble River	3	3	3
Marble River	Lower Marble River	4	4	4
Marble River	Lower Marble River	5	5	5
Marble River	Lower Marble River	6	6	6
Marble River	Link River	1	7	1
Marble River	Link River	2	8	2
Marble River	Link River	3	9	3
Marble River	Link River	3	9	4
Marble River	Link River	3	9	5
Marble River	Upper Marble River	1	10	1
Marble River	Upper Marble River	1	10	2
Marble River	Upper Marble River	2	11	3
Marble River	Upper Marble River	3	12	5

Watershed Codes

The following table illustrates the difference between the digital database and the reports/maps. The digital database did not allow for the new 45 digit watershed codes and did not have a place for Locational Points. The locational points in the following table are suggested to keep the streams uniquely identified.

Map Sheet	Labeled on maps/in reports	WSC (45 digit) if available	WSC # in database	LPs
92L.053	Tributary to unnamed lake 1	930-865200-10000-29900-3495	000-0000	00001
92L.053	Tributary to unnamed lake 4	930-865200-10000-94261	000-0000	00002
92L.034	Tributary 3 to Victoria Lake	NA	000-0000	00003
92L.034	Tributary to 930-8652-664	930-865200-66400-46878	000-0000	00004
92L.043	Tributary 11 to Alice Lake	NA	000-0000	00005
92L.043	Tributary 1 to Victoria Lake	NA	000-0000	00006
92L.043	Tributary 2 to Victoria Lake	NA	000-0000	00007
92L.044	Tributary to 930-8652-365	930-865200-36500-41764	000-0000	00008

After reviewing the 1:20,000 overlays (these were not available at the beginning of the project) and the reports, the following changes were made only on the maps.

92L.033

- Tributary 20 to Victoria Lake, wsc 930-8652-557 changed to wsc 930-8652-544.

92L.034

- Tributary 4 to Victoria Lake, wsc 930-8652-665 changed to wsc 930-8652-676.
- Tributary 7 to Victoria Lake, wsc 930-8652-729 changed to wsc 930-8652-731.
- Tributary 13 to Victoria Lake, wsc 930-8652-737 changed to wsc 930-8652-741.
- Tributary 14 to Victoria Lake, wsc 930-8652-731 changed to wsc 930-8652-737.
- Tributary 16 to Victoria Lake, wsc 930-8652-676 changed to wsc 930-8652-712.

92L.043

- Tributary 5 to Alice Lake, wsc: 930-8652-313-143 changed to wsc: 930-8652-306.
- Tributary 11 to Alice Lake was given an incorrect watershed code of 930-8652-385 in the report – no watershed code is available at this time.
- Tributary to Alice Lake, wsc 930-8652-372 changed to 930-8652-385 (not sampled).
- Tributary 21 to Victoria Lake, wsc 930-8652-544 changed to wsc 930-8652-522.

Digital Map Data
The digital map data will be included with this addendum in an Arc/Info .e00 file format.

Data Inconsistencies

- Tributary 3, reach3, site 4 – species symbol has been added to the map.
- Lake and marshes are identified as in the report.
- Reach numbers for Sorenson Creek (930-8652-385) and its tributary (930-8652-385-420) on map 92L.043 have been changed on the TRIM maps to reflect the stream network shown there. The reports and the database have not been changed from the field survey information. The field survey indicated that the mainstem channel followed Sorenson Creek until the falls on the third reach where the channel changed direction from the TRIM maps and flowed into its tributary until just west of site 5 and the returned to the mainstem for the remainder of its course. The following table shows the reach numbering on the maps vs. the reach numbering in the report and in the database.

Reach No. in report/database	Reach No. on map	Site No.
Sorenson Creek reach 1	Sorenson Creek reach 1	1
Sorenson Creek reach 2	Sorenson Creek reach 2	2
Sorenson Creek reach 3	According to field surveys, this reach doesn't exist as shown on the current map. The stream flows partially along the tributary's course – sites are located on tributary reaches 2 and 3	3, 4
Sorenson Creek reach 4	Sorenson Creek reach 4	5,6
Sorenson Creek reach 5	Sorenson Creek reach 5	7
Sorenson Creek reach 6	Sorenson Creek reach 6	
Sorenson Creek reach 7	Sorenson Creek reach 7	

- The report noted that the cascades on Yootook Creek were on Reach 2 this has been corrected on the map.
- Teihsum Creek reaches 3 and 4 were on the maps
- Upper Marble River – second reach break has been added
- Upper Marble River tributary 1 site symbol has been removed from the maps.

Other changes made to digital and hardcopy map data.

92L.043

- The cascade label on Marble River at the north end of Victoria Lake changed from 8C10 to 8C20.

92L.044

- Added two cascades to Howlal Creek to the map.
- 8 metre falls on reach 1 of stream (wsc 930-8652-365) was changed on the map to 9 metres to correspond to the information in the report
- 6 metre falls on reach 2 of Yootook Creek added to maps.

92L.053

- On the map, added a 1.2 metre falls on reach 1 of Marble River.
- On the map, added a 1.5 metre cascade on reach 4 of Marble River.

EXECUTIVE SUMMARY

The British Columbia Ministry of Environment, Lands and Parks contracted Aquatic Resources Limited, in 1996, to review information on the Marble River watershed and to conduct a reconnaissance survey of fish and fish habitat in the Marble River and some of its tributaries. The Marble River is located on northern Vancouver Island, a few kilometres east of Port Alice and 21 km south of Port Hardy. The river flows into Rupert Inlet on the west coast of Vancouver Island. The watershed covers an area of 518 km^2. Alice Lake and Victoria Lakes are large lakes located along the mainstem and the Benson River, the largest tributary, has three smaller lakes; Kathleen Lake, Benson Lake and Maynard Lake.

The tributaries surveyed were Lippy Creek, Sorenson Creek, Howlal Creek, Benson River, Malook Creek, Yootook Creek, Teihsum River, Jeune Creek, unnamed tributaries to Alice Lake, unnamed tributaries to Victoria Lake and unnamed tributaries to the lower Marble River.

Most of the watershed is Crown Land. The newly formed 1,512 ha Marble River Provincial Park is located in the lower part of the watershed. Land use activities in the watershed include logging, mining, trapping and recreation. The watershed lies within Tree Farm License 6 managed by Western Forest Products Ltd. and in Tree Farm License 39 managed by MacMillan Bloedel Ltd. The watershed has been heavily logged over the last 50 years. There have been five past producing copper and iron mines in the Benson Lake area. A limestone quarry, near Benson Lake, is the only active mine. The Marble River is used as a source of water (3.3 - 3.8 $m^{3 \cdot} sec^{-1}$) for the BHP copper mine on Rupert Inlet and for the Port Alice Pulpmill.

The Marble River contains stocks of summer steelhead, winter steelhead, sockeye, coho, chum, chinook, pink and sea run cutthroat trout. In addition to these anadromous stocks, there are resident stocks of Dolly Varden, cutthroat trout and rainbow trout. Chum and pink salmon are only found in the lower reach of the river up to Twin Falls located 2.8 km upstream. The distribution and size of the searun cutthroat stock is unknown. Coho are widely distributed and are found in many of the Alice Lake tributaries. A falls on the middle Marble River (Link River) prevents anadromous fish from entering Victoria Lake. The stocks of summer steelhead, winter steelhead and sockeye are small and are found in some Alice Lake tributaries. The Marble River has a large chinook stock, most of which spawn in the lower Marble River.

The stream surveys on the mainstem and tributaries of the Marble River were conducted between August and October, 1996 during a period of low flows. The mean annual

discharge for the lower Marble River is 44.2 $m^{3}\cdot sec^{-1}$. The discharge during the survey was measured at 2.1 $m^{3}\cdot sec^{-1}$. Stream temperatures ranged from 8 to 19°C. The lake fed streams had temperatures from 17 to 19°C, the groundwater fed streams had temperatures of 8 to 10°C and the creeks with surface flows over relatively long distances had temperatures of 11 to 14°C. pH ranged from 6.2 to 7.6, alkalinity ranged from 22 to 234 $mg\cdot L^{-1}$ and conductivity ranged from 22 - 234 $\mu S\cdot cm^{-1}$.

During the field program, the reaches of the various study streams were verified and a site within most of the reaches was surveyed. The majority of the tributaries to Victoria Lake are steep and have little fish habitat. The Teihsum River and the upper Marble River contain the majority of fish habitat in the Victoria Lake watershed. The tributaries to Alice Lake are generally lower in gradient and have greater fisheries potential.

Prickly sculpin, threespine stickleback, coho salmon, cutthroat trout, rainbow trout and Dolly Varden were the species of fish found in the study area. Coho juveniles were the most ubiquitous species in areas accessible to anadromous fish. Coho were found in lower Marble tributaries 2, 4 and 5, Lippy Creek, Sorenson Creek, Pinch Creek, Link River, Benson River, Malook Creek, Yootook Creek and Alice Lake tributaries 4, 5, 7, 11 and 12. Rainbow trout were found in Pinch Creek, Benson River, Howlal Creek, Link River, Jeune Creek and Yootook Creek. The rainbow trout in Jeune Creek were stream resident. Cutthroat trout were captured in lower Marble tributary 3, lower Marble tributary 5, Lippy Creek, Sorenson Creek, Victoria Lake tributary 6, Alice Lake tributary 7 and the upper Marble River. Stream resident cutthroat adults were only found in areas where there was no lake access. Dolly Varden were found in Yootook Creek, Lippy Creek, Malook Creek, Link River and Alice Lake tributary 7.

Fish densities were determined at eight sites in areas accessible to anadromous fish. Coho wer,e generally, the most numerous species of fish and were captured at all the sites. Lippy Creek had the highest fish densities and the Benson River had the lowest densities.

Size data were collected from 789 fish sampled from 11 tributaries and five species. Scales and otoliths were collected from a portion of the salmonids to determine age. Coho fork length averaged 65.1 mm (n = 527, stdev = 15.2 mm). Of 37 coho aged, all were age 0+ except one 1+. Rainbow trout sampled from five systems averaged 69.0 mm (n = 25, stdev = 27.2) of which 76% were age 0+ and 24% were age 1+. Dolly Varden sampled from five systems averaged 70.2 mm in length (n = 48, stdev = 30.7) and ranged in age from 0+ to 3+.

Maximum salmonid densities were calculated for 21 habitat units in eight tributaries to the Marble River. A comparison of actual fish densities to predicted maximum salmonid densities indicates that the habitat in the eight tributaries is under utilized by Dolly Varden and trout. Five tributaries had coho juvenile densities that were near or above capacity and three tributaries had coho juvenile densities well below expected levels.

Wildlife observed in the Marble River watershed during the study included marten, beaver, black bear, blacktail deer, red squirrel, Stellar's jay, widgeon, junco, band tail pigeon, scaup, ruffed grouse and belted king fisher.

Additional sampling recommendations include: a more intensive survey of fish densities to determine if trout and Dolly Varden densities were generally low throughout the watershed or if there were areas where they were more concentrated. A list of reaches and areas that were not surveyed is provided.

Of all the industrial activity in the watershed, logging has probably had the most impact on fish populations in the tributaries feeding the lakes. The valley bottoms throughout most of the watershed have been logged to the stream banks over the past 50 years. Logging has likely contributed to channel instability, increased channel widths, reduced large woody debris in the channel and a loss of habitat complexity in many reaches. The best opportunities for enhancement are the mitigation of the effects of logging on stream habitat.

ACKNOWLEDGEMENTS

Tom Henderson, Rick Fielden and Rob Fielden conducted the field survey. Stephanie Egan and Rob Fielden read the fish scales and otoliths. Tracy Cardinal did the mapping and GIS work. Tim Slaney was the project manager and Arlene Tompkins of Nanaimo MELP was the contract authority. Dan Gebhart, Bronwen Lewis and Arlene Tompkins reviewed and improved the report.

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1.0 INTRODUCTION

1.1 Background

The British Columbia Ministry of Environment, Lands and Parks (MELP) contracted Aquatic Resources Limited in 1996 to conduct a reconnaissance level survey of fish and fish habitat in the Marble River watershed which is situated on northern Vancouver Island. Funding for the project was provided by Forest Renewal British Columbia (FRBC) through the Resources Inventory Program. The mandate of FRBC includes restoring and protecting the environment for fish and wildlife. The Resources Inventory Program has been funding surveys to increase the quantity and improve the quality of resource inventory information. The survey followed procedures laid out in a series of Resources Inventory Program manuals (RIC 1995, RIC 1996a and RIC 1996b). Information that was required included; physical, chemical and biological characteristics of the system, fish distribution and the species that were present, quality and quantity of fish habitat, the identity of areas that could be sensitive to human activities, and identifying fish habitat improvement opportunities.

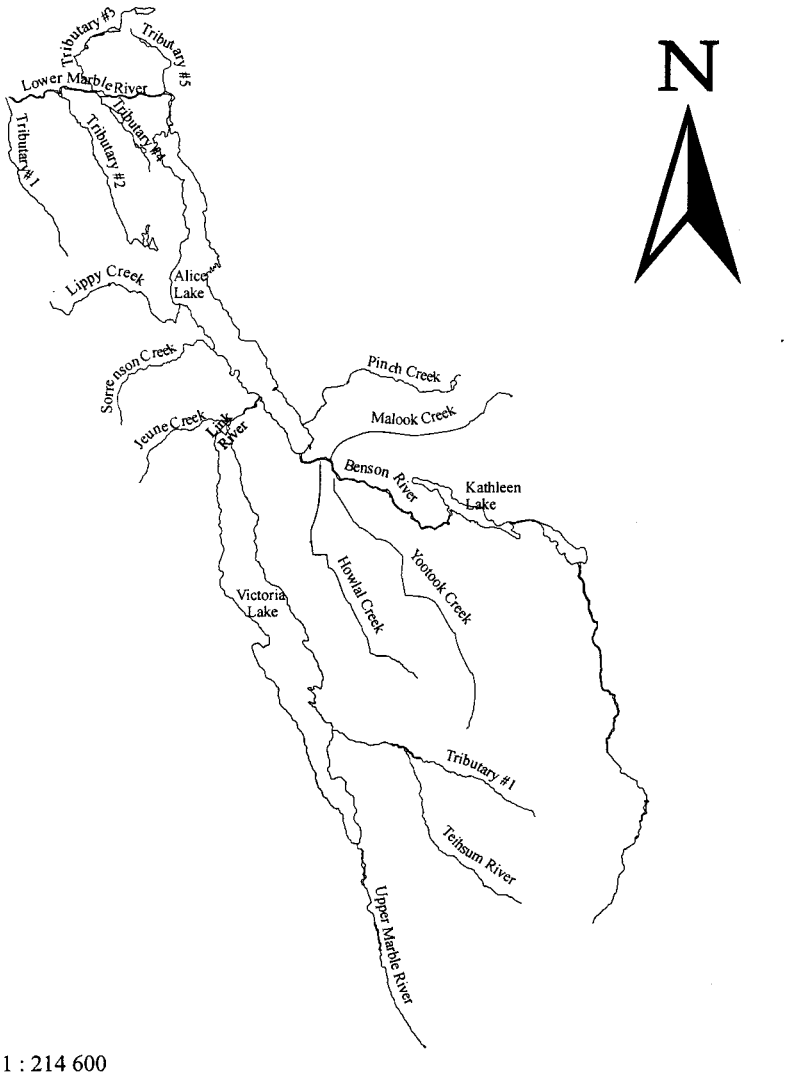
1.2 Objectives

The primary objective of the survey was to collect information on the Marble River to add to the current body of knowledge to aid government in protecting and managing the resources within the watershed. MELP fisheries biologists identified 82 km of stream habitat within the Marble River watershed that were to be targeted for study (Table 1, Figure 1).

Table 1. Study streams within the Marble River watershed.

Stream	Length to be inventoried (km)
Lower Marble River	5
Benson River	7
Lippy Creek	4
Sorenson Creek	3
Pinch Creek	5
Malook Creek	4
Howlal Creek	3
Yootook Creek	5
Teihsum River	8
Jeune Creek	2
Upper Marble River	8
Unnamed tributaries to Alice Lake	16
Unnamed tributaries to Victoria Lake	13

Figure 1
Marble River and Major Tributaries.



The Terms of Reference outlined information required by the Resources Inventory Program for each of the streams listed in Table 1:

1. Reach breaks were to be determined from maps and aerial photographs.
2. Reach breaks were to be verified in the field and habitat information following the Fish Information and Summary System was to be collected at one site in each reach.
3. Fish distributions was to be determined.
4. Fish densities were to be determined in sections of some of the streams that were accessible to anadromous fish.
5. Fish habitat capability estimates were to be made in areas where fish density estimates were made.
6. The study area was to be video taped from the air.
7. A report and maps were to be prepared to document the data collected.

2.0 STUDY AREA

2.1 Location

The Marble River is situated on northern Vancouver Island. It generally flows northwest to Rupert Inlet which is an arm of Quatsino Sound on the west coast of the island. The river lies 21 km west of Port Hardy and 5 km east of Port Alice. The watershed covers an area of 518 km^2 and has a mean annual discharge of 44.3 $m^3 \cdot sec^{-1}$ (WAC 1989). The mainstem length is 40.0 km (FHIIP 1991). The system contains two large lakes, Alice Lake and Victoria Lake. The Benson River, the primary tributary, has three smaller lakes; Kathleen Lake, Benson Lake and Maynard Lake.

Alice Lake is located 8.5 km upstream from the mouth of the river. Within the mainstem below Alice Lake there are three sets of falls. Twin Falls is 2.0 m high and is located 2.8 km upstream. This falls blocks chum and pink salmon from passing upstream. Bear Falls is a 3 m high barrier located 5.0 km upstream and finally the lake outlet falls which is 4 m high and located 8.3 km upstream. Sockeye, coho, chinook and steelhead can pass all three barriers. Falls on the Link River (middle Marble River) block anadromous fish from accessing Victoria Lake.

The 1,512 ha Marble River Provincial Park was created in early 1996 (Table 2). The park surrounds the estuary and extends along the river to within 300 m of Alice Lake.

Table 2. Geographical and morphological information for the Marble River.

Watershed name:	Marble River
Watershed code:	930-8652
Gazetted stream name:	Marble River
Local name:	Amazon River, Marble Creek
UTM units at the outlet:	09.606000.5598700
NTS map numbers:	92 L/3, 6, 11 and 12
BCGS map number:	OF 1994-14 (Hammack et al.) OF 1997-13 (Nixon et al.)
MINFILE map:	092L
TRIM maps:	92L.024, 033, 034, 043, 044 and 053
Biogeoclimatic zone:	CWHvm1
Regional district:	Mount Waddington
MOE region, district:	Vancouver Island, Port Hardy
MOF region, district:	Vancouver, Port McNeill
MOE management unit:	1-13
MOE fisheries planning unit:	West Coast
First Nation consultation area:	Kwakiutl- Quatsino
Land status:	Majority is Crown Land; Three Indian Reserves (Quattishe 1, Toh-quo-eugh 2, Maquazneecht); a lot at Link River is private and six lots near Benson Lake are private; 1,512 ha Marble River provincial park.
Aerial photo numbers:	BCB90048 11-40; BCB90022 210-212, 244-245, 271; BC80066 36-38, 122-129, 187-215, 295-309; BC80088 247-260, BC78076-2; BC77016-174; BC78075 32-39, 55; BC77035 76.

The park is approximately 500 m wide along the river. The formation of the park was recommended by the Commission on Resources and Environment (CORE 1994).

2.2 Access

The Marble River watershed has been heavily logged and as a result there is a network of gravel roads that provide two wheel drive access to most areas in the system. Roads lead into the watershed from Port Hardy, Port McNeill and Port Alice. The watershed is covered by tree farm licenses (TFL) managed by Western

Forest Products (WFP) and MacMillan Bloedel (MB). WFP has log dumps at Jeune Landing near Port Alice and at Port McNeill. MB has a log dump at Port McNeill. Timber that is logged west of Alice Lake from the WFP TFL is hauled to Jeune Landing along the Southeast Main which joins a network of roads in the middle of the watershed near the north end of Alice Lake. WFP timber that is logged east of Alice Lake is hauled to Port Hardy on the West Main and the Rupert Main. The West Main connects to roads near the south end of Alice Lake and the Rupert Main connects to roads at the south end of the watershed at Rupert Inlet. MB haul wood out of the watershed along the West Main and from the Benson Main which runs north from the Benson River.

A paved public road cuts through the watershed on the way to Port Alice. The highway branches off Highway 19 midway between Port McNeill and Port Hardy and crosses the Marble River just below Alice Lake, 15 km from Highway 19.

The only area that has poor access is the lower Marble River below Alice Lake. Some logging has taken place in the lower part of the watershed near the mouth of the river from Branch V510 of the Varney Main. The Varney Main runs along the south shore of Rupert Inlet and connects to roads leading to log dumps in Port McNeill and Jeune Landing. The area between the river mouth and the Port Alice Highway is unlogged so there are no roads near the mainstem. A trail runs down the south side of the river from a WFP campsite located on the river near the highway. The trail is 3.3 km long and comes to within 2 km of the mouth.

Although roads have at one time provided access to most of the system, some areas are no longer accessible as roads have been deactivated, washed out or have become overgrown.

Lippy Creek has good access. This creek flows east into Alice Lake. The lower reach is crossed about 750 m upstream from the mouth by Southeast Main 4 (SEM4) which has recently been upgraded. Two kilometres upstream Lippy Creek is crossed by the Port Alice Highway. Upstream of the Port Alice highway the Gibson Main parallels the creek for 1.5 km and crosses the creek 3.5 km upstream from the mouth.

Sorenson Creek is crossed by SEM4 approximately 1.2 km upstream from the mouth. There is no road access below SEM4 and access by foot is difficult due to heavy bush and a canyon below the road. Upstream of SEM4 the access is very good as the Southeast Main parallels the south side of the creek for 2 km and crosses the creek at the upper limit of fish habitat approximately 4 km upstream from the mouth of the creek.

Jeune Creek flows east into the Link River between Alice Lake and Victoria Lake. Access to the Jeune Creek watershed is poor. The creek is crossed by the West Main 200 m from the mouth of the creek. Roads into the upper part of the watershed are no longer accessible except on foot. There are no areas near the creek for a helicopter to land.

Pinch Creek flows west to the southern end of Alice Lake. This creek is crossed 250 m upstream by the Alice Lake Main and again by the Port Hardy Main 2 km upstream from the mouth. Both roads are accessible with a two wheel drive vehicle. The lower 2.5 km of Pinch Creek can be accessed by foot during low flows.

Malook Creek flows east into the lower reaches of the Benson River. The lower reach of the creek can be accessed by Branch 57 of the Alice Lake Main. This is an old road that used to cross the creek but is now only passable as far as the creek. There are a couple of old roads that remain passable in the watershed. Branch 41 runs up the watershed along the north side of the creek for 2 km and the Port Hardy Main crosses the creek 2.8 km from the mouth.

The lower Benson River flows for 7 km from Kathleen Lake to Alice Lake. The Alice Lake Main runs parallel to the river along the south side, 200 to 300 m away from the channel and up to 60 m above the river. Access to the river from the road is difficult in some areas as the river flows through a canyon and the second growth forest is thick. A rough trail leads down to the river in the vicinity of the Devil's Bath.

Howlal Creek flows north into the lower reaches of the Benson River. The creek is crossed by the Benson Main at the mouth and by the Southeast Main 800 m from the mouth. The Southeast Main runs up the Howlal Creek valley, but it has become overgrown and is only passable on foot.

Yootook Creek is located just east of Howlal Creek and flows north into the Benson River. It is crossed by the Benson Main, 150 m upstream from the mouth and provides the only vehicle access to the system. All the other roads in the watershed are old and have become overgrown.

The Teihsum River flows west into Victoria Lake. The Victoria Lake Main crosses the river 600 m from the mouth. The upper reaches of the Teihsum River and its main tributary have been extensively logged however roads in the system are now only passable 3.2 km up the valley. Roads beyond this point have become

washed out or have become overgrown. A gate is kept locked at the bottom of the road (VL300) running up the valley to protect a herd of elk in the watershed.

Upper Marble River flowing into the south end of Victoria Lake has good road access. PA 60 parallels the river right to the headwaters. The river is crossed by bridges approximately 400 m, 5 km and 8 km from the mouth. None of the roads along the tributaries are passable.

Alice Lake unnamed tributary 7 has good road access. The creek and its main tributary is crossed by the Port Hardy Main 3 km upstream from the mouth. Branch 25 is an old logging road that branches off the Port Hardy Main and crosses the creek about 400 m upstream from the mouth of the creek. Branch 25 continues on to the lake where there is a large campsite at the mouth of tributary 7.

Alice Lake and Victoria Lake have numerous unnamed tributaries of which the lower reaches were examined by boat. Alice Lake has two concrete boat launches. One is located near the WFP campsite at the northern end of the lake and the other is at the Link River campground maintained by the regional district. Boats can also be launched at the mouth of Pinch Creek and near the mouth of Alice Lake unnamed tributary 7. Victoria Lake has a concrete boat ramp located half way down the west side of the lake at the pulpmill intake.

Vancouver Island Helicopters are based at the Port Hardy Airport 18 km or six minutes flight time from the Marble River mouth. Canadian, Prism and West Coast helicopters are based in Port McNeill, which is 24 km or nine minutes flight time from Alice Lake.

2.3 Resource use

2.3.1 Forestry

The Marble River watershed is located in the Kingcome Timber Supply Area. The majority of the watershed is low in elevation and is in the sub montane very wet maritime coastal western hemlock biogeoclimatic zone (CWHvm1). The watershed is in Tree Farm License (TFL) 6 managed by Western Forest Products Ltd. and TFL 39 managed by MacMillan Bloedel Ltd. TFL 6 covers approximately 40% of the watershed and includes almost all of the Victoria Lake drainage area, most of the area to the west of Alice Lake and the watershed below Alice Lake. TFL 39 covers most of the Benson River watershed and most of the area to the east of Alice Lake. The TFL also covers two smaller parcels of land along the west side of Alice Lake and to the west of Victoria Lake.

The Alice Lake Logging Company started operations near Alice Lake in the 1940's in what is now part of TFL 39. Logs from this operation were hauled to Port Hardy. This company was acquired by the Powell River Company which eventually became part of MacMillan Bloedel Ltd.

A large portion of the Marble Watershed has been logged. The largest parcel of unlogged timber is located below Alice Lake. This area is forested primarily by 90 year old hemlock that grew up after timber was blown down by a storm in 1906.

2.3.2 Fisheries

The Marble River has significant stocks of salmon that make contributions to the sport and commercial fisheries on the BC coast. The mean annual escapements between 1983 and 1992 are; chinook - 1,711, chum - 1,400, coho - 1,433, pink - 40 and sockeye - 10 (DFO SEDS data). The estimated annual escapement for winter steelhead is 50 and for summer steelhead is 100 (C. Wightman, MELP, pers. comm.). Searun cutthroat are also reported to be in the system but the size and distribution of the population is unknown (P. Law, MELP, pers. comm.). In addition to the anadromous fish species, there are resident populations of cutthroat trout, Dolly Varden and rainbow trout in the system (Nanaimo MELP file data).

Hamilton (1980) provides the most detailed information on salmon spawning distribution in the system. Chum and pink salmon are restricted to the lower 2 km of the river below Twin Falls. Sockeye salmon spawn in lower reaches of some of the Alice Lake tributaries such as Sorenson Creek, unnamed Alice Lake tributary 8, Pinch Creek and the Link River. A 6 m high falls 1.5 km up the Link River blocks sockeye and other anadromous fish from ascending farther up the system to Victoria Lake. Sockeye spawn in the Benson River below Kathleen Lake, between Benson Lake and Kathleen Lake, and in the 1.5 km of the Benson River above Benson Lake. A falls on the lower Benson River, 3 km upstream of Alice Lake, is passable to salmon but it can hamper migration to upstream areas. Coho salmon are wide spread and spawn in many of the Alice Lake tributaries, the Link River and the Benson River. Coho have been found spawning in Alice Lake unnamed tributaries 4, 5, 7 and 8, Pinch Creek, Sorenson Creek, Howlal Creek and Yootook Creek. Coho spawn in the Benson River as far as 8 km above Benson Lake. The main chinook salmon spawning areas are in the lower Marble River below Alice Lake and the Benson River below Kathleen Lake. Chinook have also been found spawning in the Link River, Sorenson Creek, Lippy Creek, Alice Lake unnamed tributary 8, Pinch Creek and Yootook Creek.

Steelhead spawn in the lower Marble River below Alice Lake, the Link River and throughout the Benson River to the upper reaches (FHIIP 1991). No information was found on the spawning distribution of searun cutthroat trout. This species generally spawns in small tributaries with the juveniles rearing in off channel habitat with channel widths of less than 3 m in width (P. Law, MELP, pers. comm.). No information was found on whether this stock migrates past the three falls on the lower Marble River.

Chinook start migrating in the system as early as August 1, although, it usually starts in mid-September (FHIIP 1991). Spawning ends as late as late December. Chum generally start migrating into the system in mid-October and finish spawning by the end of November (FHIIP 1991). Sockeye migrate into the system as early as mid-July (Hamilton 1980). Spawning finishes mid to late October. The coho migration generally starts in mid-September with spawning finishing as late as mid-January (FHIIP 1991). The pink migration starts in mid-August with spawning finishing by late October (Hamilton 1980).

There have been several salmon enhancement projects on the Marble River (FHIIP 1991). Twin Falls is located 2.8 km upstream from the mouth. The upper falls drops 1.2 m and the lower falls drops 2.4 m. The lower falls blocks pink and chum salmon and was considered a serious obstruction to other species of salmon, especially at low flows (Hamilton 1980). The crest of the lower falls was lowered by 1.2 m along the left bank in 1928 (Hunt 1928).

Bear Falls, located 5.2 km upstream, has also been identified as a major obstruction to the upstream migration of salmon (Knewstubb 1926; Tait 1942 and Hamilton 1980). The crest of the falls on the left bank was blasted in 1928. Fish passage was improved but fish migration was reported to be difficult at very low flows. The right side of the falls was blasted in 1967. In 1986, a fishway was constructed around the falls.

The lake outlet falls is located just downstream of Alice Lake. This falls drops 3.6 m and would be impassable to fish if it was not for a natural channel around the falls along the left side. This channel can easily be negotiated by salmon in all but low flows (Hunt 1928). Pools were blasted in the channel in 1964 and 1965 to improve passage (Hamilton 1980) and some remedial work was conducted on the falls in 1987 (FHIIP 1991).

A Salmonid Enhancement Program Community Development Program hatchery has been in operation, at the north end of Alice Lake, since 1981. The hatchery has the capacity to raise up to 1,000,000 chinook, 250,000 coho and 25,000 steelhead

fry annually. The hatchery staff released coho into Sorenson Creek, Howlal Creek, Link River, Marble River, Sara Lake and Larry Lake in 1996 (D. Anderson, Marble River Hatchery, pers. comm.). The juveniles are released back to the systems that the broodstock were taken from. The hatchery took 750,000 eggs from 120 female chinook in 1996 and plan to take 150,000 to 200,000 coho eggs and eggs from three steelhead.

2.3.3 Water licenses

There are a number of water licenses on the Marble River (Table 3). BHP Minerals has a license to withdraw 0.9 $m^{3}\cdot sec^{-1}$ from Alice Lake to process ore. A pipeline carries the water from north end of the lake to the Island Copper Mine (previously owned by Utah Mines) along the north shore of Rupert Inlet. The mine will be completely shut down in 1997. Western Pulp and Paper Inc. draws 2.3-2.8 $m^{3}\cdot sec^{-1}$ of water from Victoria Lake (Hamilton 1980) from a pumphouse located mid-way along the western side of the lake. The water is used to produce power and is a source of water for the Port Alice Pulpmill. A timber dam was built at the outlet to Victoria Lake in 1902 to store water for the Port Alice Pulpmill and a timber dam was replaced with a rockfill dam in 1952-53 (Hamilton 1980). The dam has since been partially washed away and is no longer used to store water.

Around 1963, the Coast Copper Company built a 12 m high concrete dam on the outlet to Maynard Lake to supply power for the Benson Lake Mines. The company originally had a license to store 5,902,000 $m^{3}\cdot$ and received an additional storage of 1,604,000 m^{3} in 1970. The maximum amount of water that is allowed through the turbine is 3.8 $m^{3}\cdot sec^{-1}$. Operation and maintenance of the dam ended in 1972 when the mine shut down. The water license is now held by Raging River Power and Mining Inc.

The Department of Fisheries and Oceans has a license to withdraw 0.6 $m^{3}\cdot sec^{-1}$ from the river to run the Marble River Hatchery at the outlet to Alice Lake.

2.3.4 Recreation

The Marble River watershed is a popular area for recreation. Marble River Park literature states that "recreation values associated with the park are high and include fishing, white water kayaking, rafting, hiking, hunting and camping". These activities are popular in the rest of the watershed as well.

Table 3. Water licenses on the Marble River and it's tributaries (MELP data).

Licensee	Quantity	Purpose	Source
Western Pulp Inc.	19,736,000 m^3	storage-power	Victoria Lake
BHP Minerals	24,550,000 $L \cdot day^{-1}$	mining-processing	Alice Lake
Consolidated Hydro Inc.	9,000 KW	power-general	Marble River
Consolidated Hydro Inc.	92,475,000 m^3	storage-power	Marble River
DFO	0.6 $m^3 \cdot sec^{-1}$	hatchery	Alice Lake
Raging River Power and Mining Inc.	5,902,000 m^3	storage-power	Raging River
Raging River Power and Mining Inc.	3.8 $m^3 \cdot sec^{-1}$	power-general	Raging River
Raging River Power and Mining Inc.	1,604,000 m^3	storage-power	Raging River

Camping

There are several campsites throughout the watershed. WFP has a well maintained campground with 33 sites along the lower Marble River just downstream of Alice Lake. In addition, there are picnic tables at the site and a boat launch on Alice Lake. A trail for hiking and anglers extends down the river, through the Marble River Park for 3 km from the campground. Another campground, that is maintained by the Mount Waddington Regional District is located at the mouth of the Link River. This campground has horseshoe pits, a barbecue pit and boat launch. User maintained sites are located near the mouth of Alice Lake unnamed tributary 7 at the end of Port Hardy Main Branch 25 and at the mouth of Pinch Creek. Local residents park their campers and trailers at these two sites over the summer. The Branch 25 site has the capacity for a large number of campers while the Pinch Creek site can accommodate several groups of campers.

WFP maintains a four site campground at Spruce Bay on the east shore of Victoria Lake 2 km north of the Teihsum River. This site has picnic tables, a dock and a forestry interpretation trail. Rustic camping is available at Three Isle Lake and Maynard Lake has limited camping facilities (MELP 1995).

In addition to the campsites there are a number of private summer cabins and a few permanent residences along the west and east sides of Victoria Lake.

Boating

Boating is popular on the many lakes in the watershed. There are concrete boat launches on Alice Lake near the outlet and at the mouth of the Link River. Victoria Lake has a concrete boat launch on the west side of lake at the pulpmill intake. In addition, boats can be launched on the beach at the Branch 25 campsite, the Pinch Creek campsite on Alice Lake and at Spruce Bay on Victoria Lake. Benson Lake, Kathleen Lake, Maynard Lake and Three Isle Lake have boat launches (MELP 1995). The Benson Lake launch is private and the Three Isle Lake launch is a cartop boat launching site.

Fishing

Some steelhead fishing takes place on the lower Marble River, the Link River and the Benson River. As an example of the fishing intensity for steelhead; in 1992, 104 anglers reported spending 246 days fishing in which they released 158 wild steelhead and four hatchery steelhead from the lower Marble and the Link Rivers (Steelhead Harvest Analysis MELP database). In 1987, four anglers reported spending eight days on the Benson River catching eight wild steelhead. No anglers reported fishing the Benson River from 1988 to 1992. Angling effort on the Marble River is low compared to many other Vancouver Island streams.

Most fishing in the watershed takes place on the lakes. Alice Lake, Victoria Lake, Kathleen Lake and Benson Lake contain cutthroat trout, rainbow trout and Dolly Varden (MELP 1995). Maynard Lake, Three Isle Lake and unnamed Lake L1 on lower Marble River tributary 3 (Fielden 1997a) are fished for cutthroat trout.

Fishing restrictions

Coho and chinook are closed to fishing July 1 to December 31 in the Marble River, Alice Lake, Kathleen Lake and Benson Lake (MELP 1994). There is a bait ban on the Marble River. No wild rainbow trout over 50 cm can be taken from Alice Lake. A trout/char release is in effect for the Benson River and the river is open to fly fishing only.

Special attractions

There are a number of karst (limestone) formations in the watershed which are of interest to tourists and spelunkers. Between the Benson Main and the lower Benson River is a small circular lake called the Devil's Bath that is approximately 100 m across with steep 20 m high sides. Several caves were observed near the Devil's Bath that may be of interest to spelunkers. Another interesting feature is the Eternal Fountain located in the Malook watershed near Branch 41 of the Port Hardy Main. At this site, sinkhole with a small underground stream flows out of

the ground near the top and drops about 4 m to the bottom. There are other karst features on the Vanishing and Reappearing river, a tributary to the Raging River .

Hunting
Few hunters were observed during the study. The main species of interest would be ruffed grouse, black bear and blacktail deer.

2.3.5 Trapping

The study area is covered by registered traplines TR0113T807, TR0113T811, T0113T831 and TR0113T808 (Karen Morrison, MELP pers. comm.). Marten is the main species trapped. River otter, raccoon and mink are of secondary importance.

2.3.6 Mining claims

There is one operating mine, as well as six past producing mines, one developed prospect, seven undeveloped prospects and 20 showings in the Marble River watershed (BC Ministry of Energy, Mines and Petroleum Resources MINFILE map 092L). Along the lower Marble River, there are three showings involving copper and one involving gold. In the vicinity of Alice Lake (mainly around the Link River), there are four prospects in which the main commodities are zinc, iron, gold, copper, magnetite and lead. There is one developed prospect with zinc, silver, gold, lead and cadmium as the commodities and there was one past producing limestone quarry near the Link River.

Most of the mining activity in the watershed has taken place around Benson Lake. There have been five past producing mines in the area. The Sportsman copper mine operated around the 1920's and the Benson Lake Copper mine operated from about 1963 until 1972 (Hamilton 1980). The Benson Lake Copper mine was owned by the Coast Copper Company, a subsidiary of Cominco. There were three iron mines in the area called the Merry Widow, Kingfisher and Raven Mines. In addition to the mines, there are three prospects containing magnite, iron, copper and cobalt and there are 16 showings of which seven are magnite and iron, eight are copper and one is cobalt.

A limestone quarry operated by Imasco Minerals Ltd. is the only operating mine in the watershed The quarry has been in operation since 1983. Each year, 45 to 75 metric tons of limestone are hauled by dump truck to Port Alice and shipped to Vancouver for processing (Ken Lysohirka, Imasco Minerals, pers. comm.). The

limestone is used in stucco. It is finely ground and added to paint and other products.

Comments
Heavy metals from the discharge of mine tailings into Benson Lake by the Benson Lake Copper Mine may have had an impact on chinook and coho in the system when the mine was operating (Sprout and Fraser 1981). No information was obtained on whether heavy metal concentrations are a problem at the present time.

The inactive dam and power plant on Maynard Lake probably has had little impact on anadromous fish as there is an impassable falls on the lake outlet.

Fish populations may have been impacted by the removal of water from the system by the WFP pulpmill in Port Alice and the BHP copper mine on Rupert Inlet. The extraction of water could reduce juvenile rearing habitat during the summer in the Link and lower Marble Rivers when flows can reach a low of 1.9 $m^{3} \cdot sec^{-1}$ (WSC 1989). The copper mine is to be closed down in 1997 which will reduce the removal of water by 0.9 $m^{3} \cdot sec^{-1}$.

Of all the industrial activity in the watershed, logging has probably had the most impact on fish populations, particularly in the tributaries feeding the lakes. The valley bottoms throughout most of the watershed have been logged to the stream banks over the past 50 years. Sprout and Fraser (1981) stated that of a number of streams in Areas 26 and 27, fisheries related problems from logging were most notable in the Marble River. Problems from logging along with mining activity may have caused the dramatic decline in chinook and coho stocks in the Marble River (Sprout and Fraser 1981). Logging has likely contributed to channel instability, increased channel widths, reduced large woody debris in the channel and a loss of habitat complexity. The effects of removing old growth forest along a stream channel are well documented in other systems (Hogan 1986; Flebbe and Dolloff 1995; Bisson *et al*. 1987; Bilby 1984).

2.4 Summary of existing information and sources consulted

The following sources of information on the Marble River have been reviewed:

1. Aerial photographs.
2. NTS 1:50,000 maps, TRIM 1:20,000 maps, Aquatic and biophysical maps, MINFILE maps and MoF forest cover maps.

3. The DFO-MELP Stream Information Summary System (SISS) and the DFO Salmon Escapement Database and Report System (SEDS) was reviewed for information on the Marble and Benson River (FHIIP 1991, Serbic 1991). SISS contains information on the species of fish present, data on obstructions and fish distribution. SISS and SEDS contain escapement information on sockeye, chinook, coho, chum and pink for the watershed (Section 2.3.2).

4. DFO habitat management in Nanaimo had no information on file on the Marble River (Rick Higgins, DFO, pers. comm.).

5. Nanaimo MELP files on the Marble River watershed were examined. These files contained lake survey data for Victoria Lake and Alice Lake, float counts of fish in the lower Marble, Link River and Benson River, reports on the Marble River Hatchery and letters concerning the manipulation of flows in the system by a dam on Maynard Lake. The files contained a report of the impact on the Marble River on the extraction of water from Alice Lake for Utah Mines (Higgins 1970). The report contains information on fish passage at Bear Falls, timing of salmon migration and spawning, spawner abundance and distribution and the theoretical salmon potential of the Marble watershed.

6. Logging road maps were obtained from MacMillan Bloedel and Western Forest Products.

7. The American Fisheries Society salmon stocks at risk database was examined for information. The database lists the stocks found in the system (chinook, chum, coho, sockeye, summer steelhead, winter steelhead, odd year pink, even year pink and searun cutthroat.) The sockeye stock is listed as being at risk of extinction and the summer steelhead run is of concern due to logging and poaching impacts.

8. MacMillian Bloedel (M&B) was contacted for stream classification information. Stream assessments were carried out in 1995 for several small creeks that flow into Alice Lake through cutblocks #4301 and 4303 which are to be logged in 1997 (M&B Port McNeill file data). The streams in cutblock #4301 are located on the west side of Alice Lake at UTM coordinates, 09.611100.5592750, 09.611150.5592650, 09.611150. 5592250 and 09.611250.5591900. The first two streams are class S4 for the first 20 m and class S6 above that (BC Environment 1995b). The third and fourth streams are class S3 for the first 245 and 145 m, respectively, and class S6 above that. Eight streams in cutblock #4303 are located on the east side of Alice Lake between UTM coordinates 09.612550.5593800 and

09.612400.5595100. The stream located at 09.612550.5593800 (WSC 930-8652-106) and is class S3 for 170 m and class S5 above that. Five of the other creeks were dry and two are class S4 in the lower 20 m and S6 above that.

9. Western Forest Products (Port McNeill) was contacted for stream classification information. WFP has no new stream classification information. Old classification information exists for the Upper Marble River and the Teihsum River. The Teihsum River is Class B in the lower 3.2 km and Class C above that. The Upper Marble River is Class B.

10. Hamilton (1980) contains information on the Marble River hydrology and salmon distribution, timing and escapement (Section 2.3.2).

No information was found on reach breaks or reach descriptions within the Marble River watershed.

3.0 METHODS

Biophysical (fish habitat) information was collected from sites in most reaches of streams throughout the Marble River watershed. Fish presence-absence information was collected at most of these sites where there was no previous fish information. Fish data was not collected from some sites where other information indicated the presence of fish. Fish presence-absence data was not collected from the lower Marble River, the lower Teihsum River, Reach 1 of the Upper Marble River, Reaches 2, 3 and 4 of the Benson River and Reach 2 of the Link River. Fish presence-absence at the stream survey sites was determined mainly by electroshocker. Visual observations from the bank, beach seine and Gee traps baited with salmon roe were used at some sites. The time spent electroshocking and the settings used were recorded when a site was electroshocked. The length of the channel sampled was also recorded in some instances. The catch per time spent shocking or area shocked does not give an accurate reflection of abundance as the fish in some habitats were much more easily captured than in others. A subjective assessment of fish abundance was made for some sites based on the type of habitat shocked and number of fish captured or observed.

Fish density and habitat capacity information was collected for 21 habitat units at eight sites on eight streams that were accessible to anadromous fish (Appendix E). These sites were located in Reach 1 Site 1 of Sorenson Creek, Link River, Yootook Creek, Howlal Creek, Malook Creek, Benson River and Pinch Creek and Reach 1 Site 2 of Lippy Creek. An assessment of fish densities was made by the isolation of habitat units with nets. Fish populations were then assessed by the removal-

depletion method using a beach seine or electroshocker (Zippin 1958). Four habitat units that could not be beach seined or electroshocked were assessed visually by snorkel survey. These four units were not isolated with nets. Fish densities were compared to theoretical maximum densities weighted by the proportion of usable habitat (weighted usable area) at the sites. Maximum densities were predicted by an empirical density model for coho and another model for other salmonids (chinook, rainbow trout, cutthroat trout, brown trout, Dolly Varden and brook trout) developed by Ptolemy et al. (1991).

3.1 Physical

3.1.1 Biophysical survey

The biophysical survey was conducted between August 17 and October 17, 1996. Reaches of the study streams, that were defined prior to the field survey using topographical maps, were verified in the field. At one site in each reach habitat data was collected following the Fish Habitat Inventory and Information Program format (FHIIP 1986). More than one site within a reach was surveyed on occasion when the reach flowed through logged and unlogged areas or when the reach boundary was in question. No sites were surveyed after the gradient of a stream increased to over 20% and remained over 20%.

Ground estimates were made on habitat proportion, substrate composition, fish cover, bank height, bank stability, flood signs and amount of channel debris. Gradient was measured with a Suunto clinometer. Channel widths were measured with a tape and stream depths under 1 m were measured with a metre stick. Six channel widths were generally taken at the sampling sites in accordance with Forest Practices Code procedures (BC Environment 1995a). Less than six measurements were made at a few sites where the stream could not be crossed due to canyons or deep water. Depths over 1 m deep were visually estimated.

A Garmin 45 GPS was used to determine the positions (undifferentiated) of various features and samples sites. GPS accuracy varied between 15 and 100 m and depended on the number of satellites that could be located which depended on how much of the sky was unobstructed by vegetation and hills. TRIM maps were used to provide coordinates where the GPS did not provide readings. Water temperatures were measured with a hand held alcohol thermometer. Conductivity was measured with a Hanna CONMET 3291 ATC conductivity probe. pH was measured with a bromothymol blue freshwater pH test kit. Total alkalinity was measured with a Hanna 4811 alkalinity test kit.

Most of the stream surveys took place between August 17 and September 8. The system was video taped using a helicopter on October 8, and sites on upper Yootook Creek and a Teihsum River tributary were surveyed on October 8. Portions of lower Marble River tributary 3 and 5 were surveyed between October 6 and 17 during a survey of several lakes and marshes in the area (Fielden 1997a-g).

Discharge was measured at several sites throughout the system. Measurements were made 200 m upstream from the mouths of the lower Marble River (Site 1), the upper Marble River and the Teihsum River (Site 1). To measure discharge, stream depth and water velocity were measured across the stream at 10 to 25 equally spaced points. Velocity measurements were taken at 0.6 depth with a Swoffer model 2100 current meter. Depths were read from a measuring rod. Discharge is the sum of width of each cell in the transect times depth times velocity.

Discharge information was obtained from the weighted usable area transects (Section 3.1.2) at the fish density estimation sites. Ground (visual) estimates of discharge were made at most of the stream survey sites as well.

3.1.2 Weighted usable area

Information on habitat suitability for fish was collected at several sites. The habitat available for use by fry, parr and adult trout and coho juveniles was determined by the weighted usable area method (Bovee 1982). At each site, water depth and velocities were measured across habitat transects. Along each transect, stream depth and water velocity were measured at 10 to 25 equally spaced points, each representing a cell of a specific area along the transect. Velocity measurements were taken at 0.6 depth with a Swoffer model 2100 current meter. Each of these depth and water velocity measurements were subsequently related to a Probability of Use value (PUse) based on Probability of Use curves derived for rainbow trout, cutthroat trout and coho from B.C. observations (R. Ptolemy, MELP, pers. comm.). These probabilities were then multiplied by one another to yield a composite PUse value for each cell in the transect. Each cell PUse value was in turn multiplied by the area of the corresponding cell. These values were summed for all cells, then a PUse value for the length of the transect was computed by dividing this value by the area of the transect to yield a value out of 1.0. Transect PUse was determined for fry (age 0+) less than 100 mm long, parr between 100 and 200 mm and for adults greater than 200 mm. Transect PUse is represented by the following equation:

$$PUse_{Trout} = \sum_{i=1}^{n} (PUse(d)_i \times PUse(v)_i \times A_i) / \sum_{i=1}^{n} A_i$$

where:
- $PUse_{Trout}$ = Probability of Use for transect
- $Puse(d)_i$ = Probability of Use for cell depth
- $Puse(v)_i$ = Probability of Use for cell velocity
- A_i = The area of the cell (cell depth x cell length)

PUse values of 0.75 - 1 indicate that depths and velocities are excellent for fish. Values of 0.5 - 0.75 are good, 0.25 - 5 are fair and 0 to 0.25 are poor. Ideal habitat for rainbow trout fry is shallow (<0.3 m) and has low velocity (<0.24 $m \cdot sec^{-1}$). Ideal parr habitat contains current velocity of about 0.28 $m \cdot sec^{-1}$ and depths greater than 0.3 m. Ideal adult habitat contains velocities of 0.2 to 0.7 $m \cdot sec^{-1}$ and depths of greater than 0.4 m. Coho fry prefer slow velocities (<0.12 $m \cdot sec^{-1}$) and deep water (>0.25 m).

The PUse values were used to factor out unusable habitat so that densities of salmonids could be compared to theoretical maximum densities.

3.2 Biological

3.2.1 Fish population assessments

Data on fish species composition, and abundance was collected at some of the habitat survey sites. Where possible, population estimates were made in various habitat units by the removal-depletion method (Platts *et al*. 1983) using either beach seines or a Smith-Root model 15-D backpack electrofisher. Population assessment areas were isolated using 1 cm stretch mesh nets that were sealed at the bottom with rocks to prevent fish from leaving or entering the site. Float counts by skindiver were also used to assess fish populations in areas that could not be effectively electroshocked or seined.

3.2.2 Fish sampling

All the captured fish were identified and enumerated. Fish were anesthetized in a solution of sodium bicarbonate. Fork lengths were measured on a measuring board (±0.5 mm) and then the fish were weighed on an Ohaus C305 portable electronic scale (±0.1 g.). Scale samples were taken from a sample of sport fish from each size class. The scales were placed between labeled microscope slides and read using a microscope. The ages of the fish that were sampled were used to extrapolate the ages of the rest of the fish measured so that mean sizes for each age group could be calculated.

3.2.3 DNA sampling

Two rainbow trout and five Dolly Varden were sampled for DNA analysis. Rainbow trout DNA samples were collected from Jeune Creek and the Link River. Rainbow trout fry were collected from the Benson River, Yootook Creek and Howlal Creek but no DNA samples were collected from these fish because the adipose fins too small to provide a sample. Dolly Varden DNA samples were sampled from Alice Lake tributary 7. Lower Marble River tributary 5, Malook Creek, Lippy Creek and Pinch Creek.

3.2.4 Maximum salmonid densities (MSD)

Salmonid density estimates, at the sample sites, were compared to those predicted by an empirical model developed by Ptolemy *et al*. (1991). The model was used to determine the total maximum densities of fry, parr and adult salmonids (rainbow trout, cutthroat trout and Dolly Varden) that were present at the Marble River sample sites. The model relates maximum salmonid densities to total alkalinity, non-filterable residue levels (suspended solids), and fish size:

$$\log_{10}(FPU) = 1.56 + 0.50\log_{10}(ALK) - 1.00\log_{10}(SIZE) - 0.30\log_{10}(NFR + 1)$$

where:
- FPU = fish per unit area (fish·100 $m^{2)}$
- ALK = alkalinity ($mg \cdot L^{-1}$)
- SIZE = fish weight in grams
- NFR = non-filterable residue ($mg \cdot L^{-1}$)
- Upper confidence limit = (FPU) * 1.06
- Lower confidence limit = (FPU) * $(1.06)^{-1}$

The equation was used to calculate MSD for fry, parr and adult salmonids from the mean weight of each of these groups found at the 21 habitat units where fish densities were determined.. Generally the mean weight of all trout and Dolly Varden fry and all trout and Dolly Varden parr estimated to be in each habitat unit was used to estimate SIZE in the calculation of fry MSD and parr MSD. At some sites, only fish lengths were measured due to a broken balance. In those cases, fry and parr weights were extrapolated from length-weight regressions. No Dolly Varden or trout parr were captured at some sites so a value of 15.9 g, derived from the average size of parr captured in the Marble River watershed, was used for parr size. In some habitat units where very few fry were captured the average weight of fry at the site was used. No trout or Dolly Varden adults were captured at any of the sites so an adult weight of 200 g was used to calculate adult MSD for all the sites.

All of the streams were clear so non-filterable residue levels (NFR) were assumed to be zero. Stream alkalinities (ALK) ranged from 40 to 180 $mg \cdot L^{-1}$ and were measured at each site using a Hanna 4811 alkalinity test kit.

Ptolemy et al. (1991) determined that coho densities followed a different model than other salmonids:

$$FPU_{coho} = 100^* ALK^{0.4} * SIZE^{-1}$$

where: FPU_{coho} = fish per unit area ($fish \cdot 100\ m^2$)
ALK = alkalinity ($mg \cdot L^{-1}$)
SIZE = fish weight in grams
Upper confidence limit = (FPU) * 1.27
Lower confidence limit = (FPU) * $(1.27)^{-1}$

Coho fry were captured in most of the habitat units so Ptolemy et al.'s (1991) coho model was used to determine maximum coho densities at the 21 habitat units. The mean weight of this fish (or an extrapolation of weight from a length-weight regression) in each unit was used as an estimate of SIZE.

Since the models assume optimal habitat conditions, the MSD estimates for each fish density site were corrected by multiplying fish MSD by the corresponding PUse value for the area that was assessed. The result of this corrected adjustment is to factor out unusable habitat and to report densities on the basis of usable portions only. Actual fish densities were determined (Section 3.2.1) in 21 habitat units within eight streams.

4.0 RESULTS AND DISCUSSION

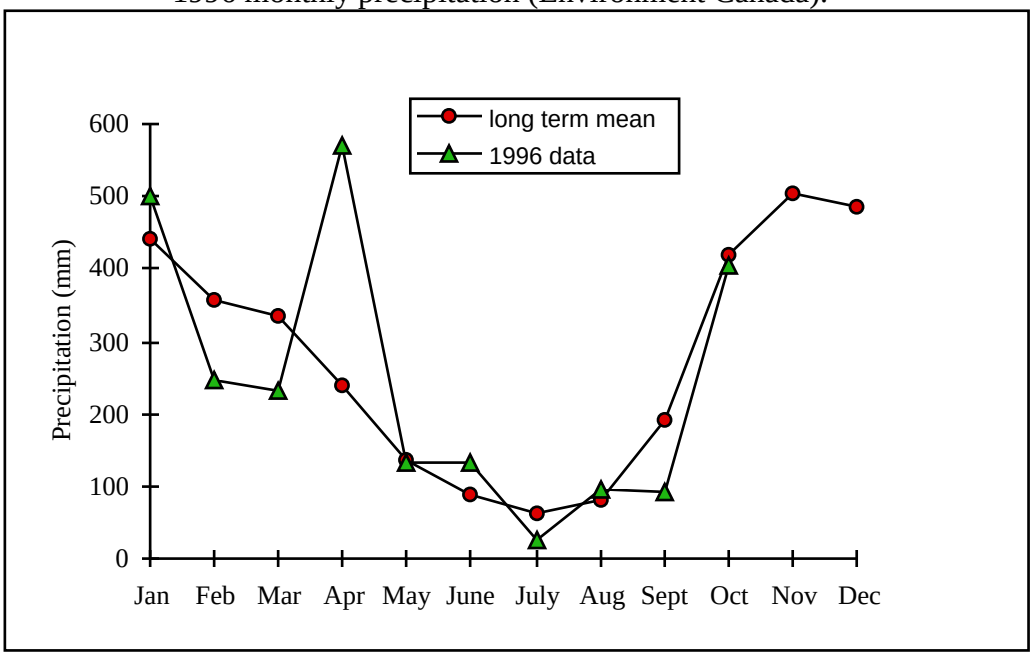
4.1 Physical characteristics

4.1.1 Weather

Precipitation data were available from Environment Canada for Port Alice, located a few kilometers west of the Marble River watershed. Port Alice receives a large amount of precipitation, mainly in the form of rain. The total annual precipitation averaged 3,346 mm for the years 1924 to 1990 (Environment Canada). Maximum precipitation occurs in November (500 mm) and minimum precipitation occurs in July (63 mm; Figure 2). Precipitation in February and March of 1996 was less than normal,April had greater than normal precipitation and precipitation from May to October was close to normal (Figure 3). As precipitation was close to normal from May to October, stream flows during the study were also probably close to normal.

Air temperatures at Port Alice average 9.4°C over the year (Environment Canada climate normals 1924 - 1990). Daily mean monthly temperatures range from a low of 3.7 °C in January to a high of 16.1°C in August (Figure 3).

Figure 2. Long term (1924-1990) mean monthly precipitation at Port Alice and 1996 monthly precipitation (Environment Canada).

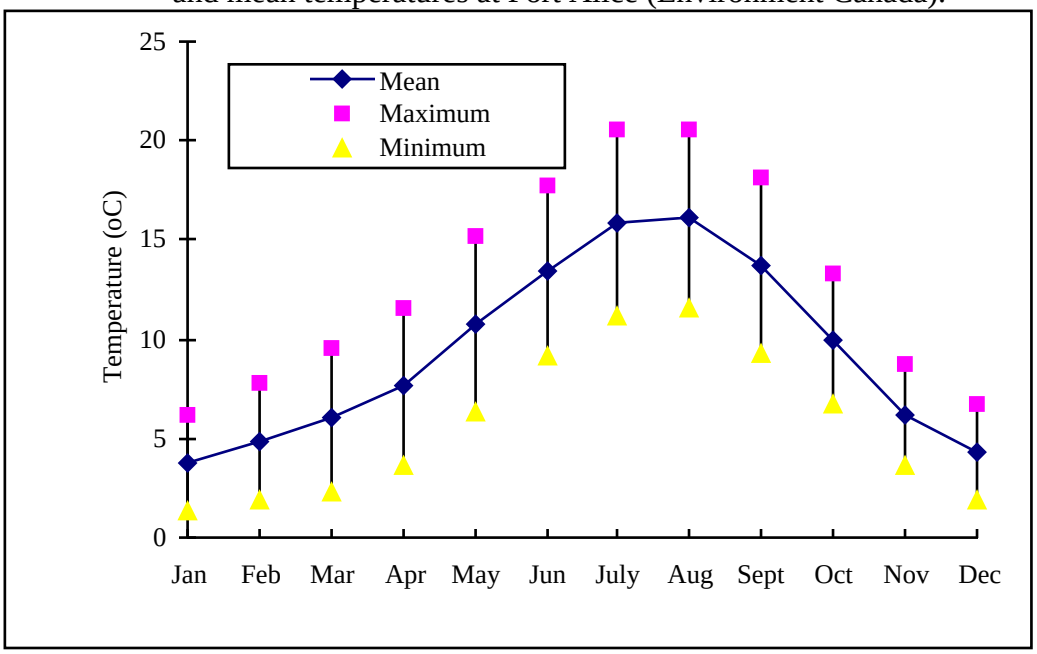


4.1.2 Stream conditions

4.1.2.1 Discharge

Marble River discharge data has been collected by Environment Canada at the outlet to Alice Lake and at the outlet to Victoria Lake (WSC 1989). The Alice Lake discharges were measured periodically for 11 years between 1925 and 1971 and the Victoria Lake discharges were measured for 25 years between 1925 and 1953. Annual mean discharge averaged 44.2 $m^{3}\cdot sec^{-1}$ at the Alice Lake outlet. Generally discharges are highest in December (84.1 $m^{3}\cdot sec^{-1}$) and lowest in August (12.6 $m^{3}\cdot sec^{-1}$, Figure 4). Discharge follows a similar pattern to precipitation (Figure 2) as most of the watershed is low in elevation and most precipitation falls as rain. The maximum daily discharge recorded was 507 $m^{3}\cdot sec^{-1}$ on January 1, 1927 and the minimum daily discharge was 1.9 $m^{3}\cdot sec^{-1}$ on October 23, 1925. Water levels were low at the beginning of the study on August 17, 1996 when the discharge of the lower Marble River 1 km from the mouth was 2.1 $m^{3}\cdot sec^{-1}$. Discharges increased throughout the study as precipitation increased.

Figure 3. Long term (1924 - 1990) monthly average daily maximum, minimum and mean temperatures at Port Alice (Environment Canada).



The discharge at the outlet to Victoria Lake is 30% of the Alice Lake outlet discharge. Annual mean discharge averaged 14.9 $m^3 \cdot sec^{-1}$ at the Victoria Lake outlet. Generally discharges are highest in December (29.2 $m^3 \cdot sec^{-1}$) and lowest in August (4 $m^3 \cdot sec^{-1}$ Figure 4). The maximum daily discharge recorded was 208.1 $m^3 \cdot sec^{-1}$ on December 14, 1953 and the minimum daily discharge was 0.8 $m^3 \cdot sec^{-1}$ on October 23, 1925. The discharge was 1.7 $m^3 \cdot sec^{-1}$ on September 6, 1996 during the study.

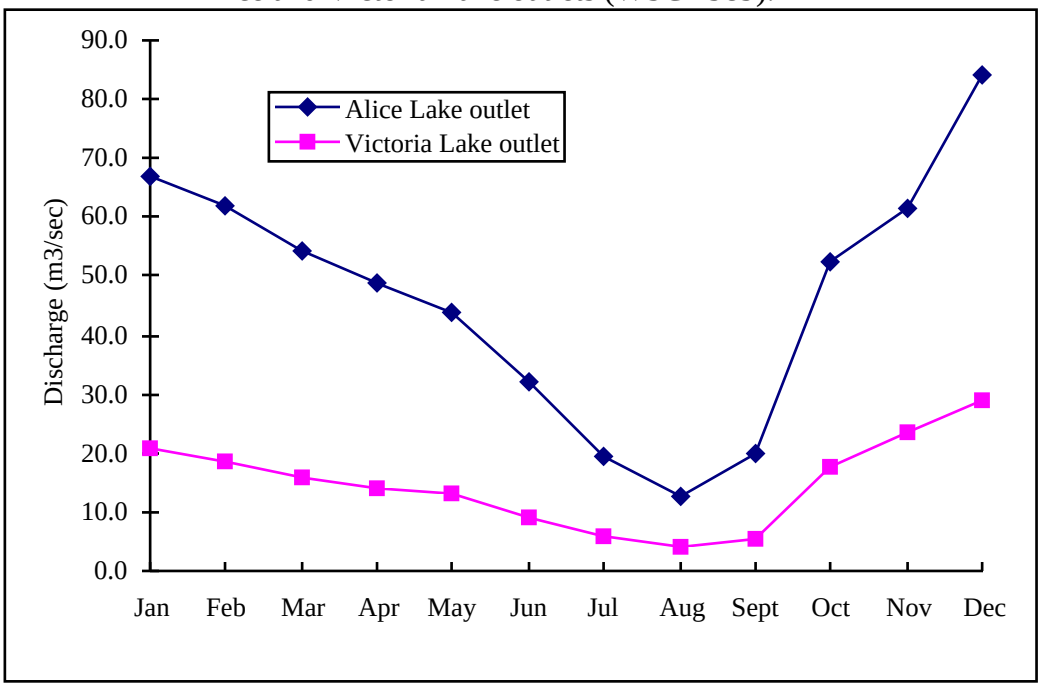
Discharge was estimated or measured at three sites on the mainstem of the Marble River and in a number of Marble River tributaries during the survey (Table 4). Discharges increased slightly over the course of the study due to rainfall in the watershed.

4.1.2.2 Temperature

Water temperatures measured throughout the Marble River watershed during the survey ranged from 8 to 19°C (Table 5). The water temperatures of systems that were lake fed were warm and ranged from 17 to 19°C. These systems were the Link River, Benson River and the lower Marble River. The Benson River cooled as it flowed downstream from Kathleen lake from 18°C in Reach 4 to 11°C in

Reach 1. Systems such as Pinch Creek, Malook Creek and the Teihsum River, that were primarily groundwater fed, had cool temperatures that ranged from 8 to 10°C. The main sources of Pinch Creek and Malook Creek were springs and the Teihsum River had surface flow only in the lower 1.5 km of the river. Victoria Lake tributary 17 also had a cool water temperature (9°C) and was likely groundwater fed close to the survey site. The rest of the systems making up the majority of the creeks surveyed, had surface flows over a relatively long distance and had water temperatures that were more closely tied to air temperatures, with water temperatures ranging from 11 to 14°C.

Figure 4. Long term (1924 - 1990) discharge data for the Marble River at Alice and Victoria Lake outlets (WSC 1989).



4.1.2.3 Water quality

Alkalinity, pH and conductivity were the water quality parameters measured at many of the survey sites. pH ranged from 6.2 to 7.6 and was generally in the range recommended for fish culture (6.5-8.5 SIGMA 1983, CCREM 1987, Nagpal 1995). Many of the systems were slightly basic, probably resulting from the limestone in the watershed. Alkalinity ranged from 22 to 234 $mg \cdot L^{-1}$ and conductivity ranged from 22 - 234 $\mu S \cdot cm^{-1}$. Conductivity averaged 102 $\mu S \cdot cm^{-1}$ and was close to average values for coastal B.C. (96.8 $\mu S \cdot cm^{-1}$, Ptolemy *et al.* 1993).

Table 4. Discharges of the Marble River and some tributaries, August to October, 1996.

System	Reach - Site	Discharge ($m^3 \cdot sec^{-1}$)	Method	Date
Alice Lake tributary 1	1-1	0.000	GE	August 18
Alice Lake tributary 5	1-1	0.002	GE	August 18
Alice Lake tributary 7	1-1	0.02	GE	August 18
Alice Lake tributary 11	1-1	0.004	GE	September 9
Alice Lake tributary 12	1-1	0.001	GE	August 18
Benson River	1-1	4.19	CCT	September 8
Howlal Creek	1-1	0.03	CCT	September 2
Jeune Creek	1-1	0.02	GE	August 23
Link River	1-1	1.75	CCT	September 6
Lippy Creek (top of R1)	1-2	0.02	CCT	September 2
Lippy Creek (bottom of	1-1	0.00	GE	August 18
Lower Marble River	1-1	2.08	CCT	August 17
Lower Marble trib. 2	1-1	0.03	GE	August 19
Lower Marble trib. 3 (R3)	3-4	0.03	GE	October 13
Lower Marble trib. 4	1-1	0.005	GE	August 19
Lower Marble trib. 5	1-1	0.001	GE	October 9
Malook Creek	1-1	0.4	GE	August 27
Pinch Creek	1-1	0.36	CCT	September 1
Sorenson Creek	1-1	0.05	CCT	September 4
Teihsum River	1-1	0.64	CCT	August 31
Upper Marble River	*	1.16	CCT	September 3
Victoria Lake tributary 6	1-1	0.002	GE	September 7
Victoria Lake tributary 12	1-1	0.000	GE	September 7
Yootook Creek	1-1	0.23	CCT	September 1

CCT- Cross channel transect measurements of depth and velocity using a measuring rod and Swoffer model 2100 current meter.

GE - ground estimate

* - 200 m from river mouth

4.1.3 Surrounding terrain

The Marble River watershed has a fairly high relief, particularly in the Victoria Lake area. The highest elevation is 1,420 m.

Table 5. Water temperatures and water quality parameters of the Marble River and some of its tributaries, August-October, 1996.

System	Reach-site	Temp. (°C)	Alkalinity ($mg \cdot L^{-1}$)	pH	Conductivity ($\mu S \cdot cm^{-1}$)	Date
A.lice Lake trib. 5	1-1	13	60	6.8	141	Aug. 18
Alice Lake trib. 7	1-1	11	90	7.2	25	Aug. 18
Alice Lake trib. 11	1-1	12	220	7.4	234	Sept. 09
Alice Lake trib.12	1-1	12	80	n/d	176	Aug. 18
Benson River	1-1	11	90	7.6	150	Aug. 27
Benson River	4-2	18	80	7.6	84	Aug. 28
Howlal Creek	1-1	14	90	7.4	134	Aug. 29
Jeune Creek	1-1	13	90	7.0	92	Aug. 23
Link River	1-1	17	40	7.0	45	Aug. 23
Lippy Creek	1-2	12	180	n/d	73	Aug. 20
Lower Marble River	5-5	19	40	n/d	70	Aug. 17
Lower Marble trib. 2	1-1	14	n/d	n/d	59	Aug. 19
Lower Marble trib. 3	3-4	13	20	6.6	167	Oct. 13
Lower Marble trib. 5	1-1	14	20	6.2	36	Oct. 09
Malook Creek	1-1	10	120	7.5	171	Aug. 27
Pinch Creek	1-1	9	100	7.6	128	Aug. 27
Sorenson Creek	1-1	13	160	7.6	46	Aug. 18
Teihsum River	1-1	8	90	7.5	55	Aug. 31
Upper Marble River	1-1	13	30	6.4	22	Sept. 03
Victoria Lake trib. 6	1-1	12	90	7.2	104	Sept. 07
Victoria Lake trib. 12	1-1	12	40	6.0	51	Sept. 07
Victoria Lake trib. 17	1-1	9	n/d	n/d	nd	Aug. 21
Yootook Creek	1-1	13	80	7.6	116	Aug. 28

n/d - no data

Geology

The majority of the bedrock in the watershed is extrusive rock laid down in the lower Jurassic and upper Triassic periods (MINFILE map 092L). To the east of Alice Lake and the Benson River this rock is basaltic lava and to the west is andesitic to rhyodacitic lava. The bedrock in approximately 25% of the watershed is limestone, siltstone and shale formed in the upper Triassic period. Limestone is located along the lower reaches of the lower Marble River, to the west of Alice Lake in the vicinity of Sorenson Creek and along the Benson River between Alice Lake and Kathleen Lake. Approximately 5% of the bedrock in the watershed is intrusive rock formed during the Jurassic period. Most of the mineral claims are in the areas that the intrusions occur such as at Benson Lake and the Link River.

Vegetation

The majority of the Marble River watershed is low in elevation and is in the submontane very wet maritime coastal western hemlock biogeoclimatic zone (CWHvm1; 1:250,000 biogeoclimatic map). Areas of the watershed that are roughly between 900 and 1,100 m lie in the montane very wet maritime coastal western hemlock zone (CWHvm2). The area of watershed, roughly between 1,100 and 1,200 m in elevation, is in the windward moist maritime mountain hemlock zone (MHmm1). One area of approximately 1 km^2, at an elevation of over 1,200 m on Merry Widow Mountain, between Victoria Lake and Benson Lake, is in the alpine tundra zone (ATc).

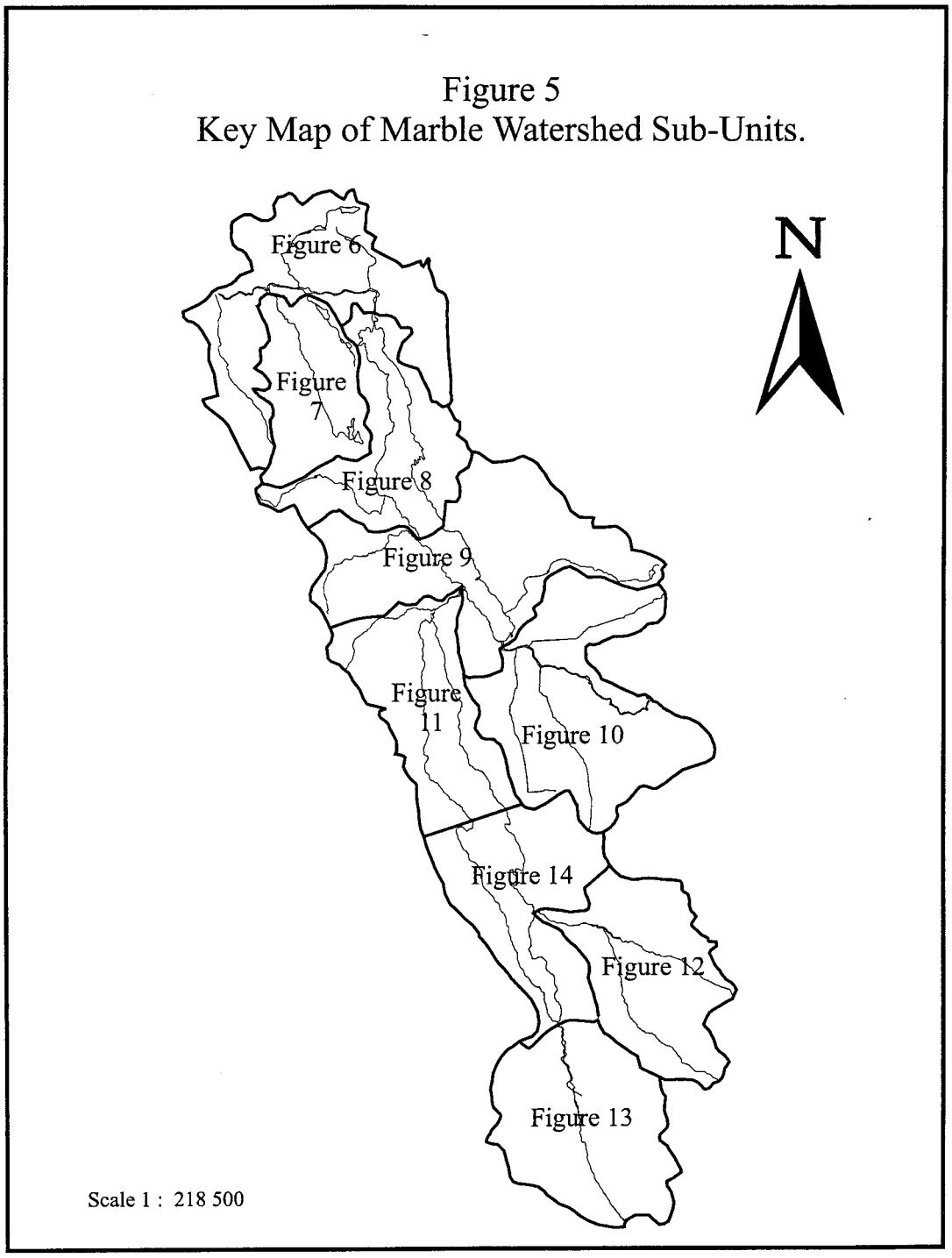
The majority of the watershed in the CWHvm1 zone has been logged over the past 50 years. Douglas fir, hemlock, red cedar and red alder the dominant tree species that have revegetated the area. The oldest trees are 20 to 28 m tall.

The largest parcel of unlogged timber is located below Alice Lake along the lower Marble River. The forest in this area is a reflection of two events. A forest fire swept through the area 180 years ago and then a storm knocked down 15,000 ha of timber in the Varney Bay area in 1906 (Kerry McGourlick, WFP, pers. comm.). Most of the timber along the lower Marble River is 90 year old western hemlock that grew up after the storm. Mixed in with the hemlock are numerous cedar snags and windfalls that are the remains of trees killed in the fire. There are also a few 400 year old cedar and Douglas fir that survived the fire and the storm. As well there are scattered 180 year old Douglas firs that grew up after the fire and survived the 1906 storm along with scattered 90-80 year old Sitka spruce and Amabilis fir. There are few understory plants in the areas dominated by 90 year old hemlock because of the dense canopy. The understory is thick at the edges of the coniferous forest along the larger creeks and around the lakes and marshes. The understory in these areas is dominated by salal and salmonberry. The understory is also quite thick in some areas which are dominated by older trees that survived the 1906 storm.

4.2 Stream habitat characteristics and fish observations

The Marble River watershed was broken into sub units (Figure 5) and the streams within the study area were broken up into reaches. During the 1996 field program, habitat data and fish distribution information were collected at one site in most of the reaches.

Figure 5
Key Map of Marble Watershed Sub-Units.



4.2.1 Lower Marble River (Watershed Code (WSC): 930 - 8652)

The lower Marble River extends from the river mouth to Alice Lake (Figure 6). Most of the river flows through Marble River provincial park. The habitat in this section of river is quite variable with three sets of falls and three entrenched bedrock sections. The lower river is 8 km long with six reaches (Table 6). The surrounding country for at least 1 km on either side of the river has a low relief and has not been logged. Most of the timber is 90 year old western hemlock.

No fish data was collected from the lower Marble River during the 1996 study. However it is known to be an important migration corridor (Hamilton 1980).

4.2.1.1 Lower Marble River Reach 1 (0.0 - 2.8 km)

Reach 1 is confined by a steep walled bedrock canyon that is 2.8 km long (Appendix B; Photos T1 22-25). The river in this section has a low gradient (close to 0%) and is mainly pool habitat. The lower 800 m of Reach 1 is under tidal influence. Twin Falls is situated at the top of the reach (Appendix B, Photo T1 25). The upper falls drops 1.2 m and the lower falls drops 2.4 m (Hamilton 1980). A site in Reach 1 was surveyed 1.1 km upstream from the mouth on August 17, 1996 (Photo 1). At this site the channel width averages 27.7 m, the habitat is 80% pool, and the substrate is mainly boulder and bedrock. The pools appeared to be approximately 5 m deep.

Fish

Pink and chum salmon spawn throughout Reach 1 and in the lower 1.5 km of lower Marble tributary 1 (watershed code 930-8652-022) which flows into the Marble River estuary from the south (Hamilton 1980). Twin Falls is the upper limit of pink and chum access to the system. The amount of spawning habitat available is small so escapements of these two species have been low, particularly for pinks.

4.2.1.2 Lower Marble River Reach 2 (2.8 - 3.8 km)

Reach 2 is a short, 1000 m long reach where the channel is less confined than in the rest of the river (Photo 2; Appendix B photo T2 0-1). At the bottom of the reach is a large accumulation of gravel and small cobble that is being held back by the narrow entrance to the canyon in Reach 1. In the middle of the reach is a large 100 m wide, lateral scour pool on the outside of a large meander. This pool is a chinook brood stock capture site for the Marble River hatchery. On the inside of

Figure 6
Sample Sites on Lower Marble River
and Unnamed Tributaries #3 and #5.

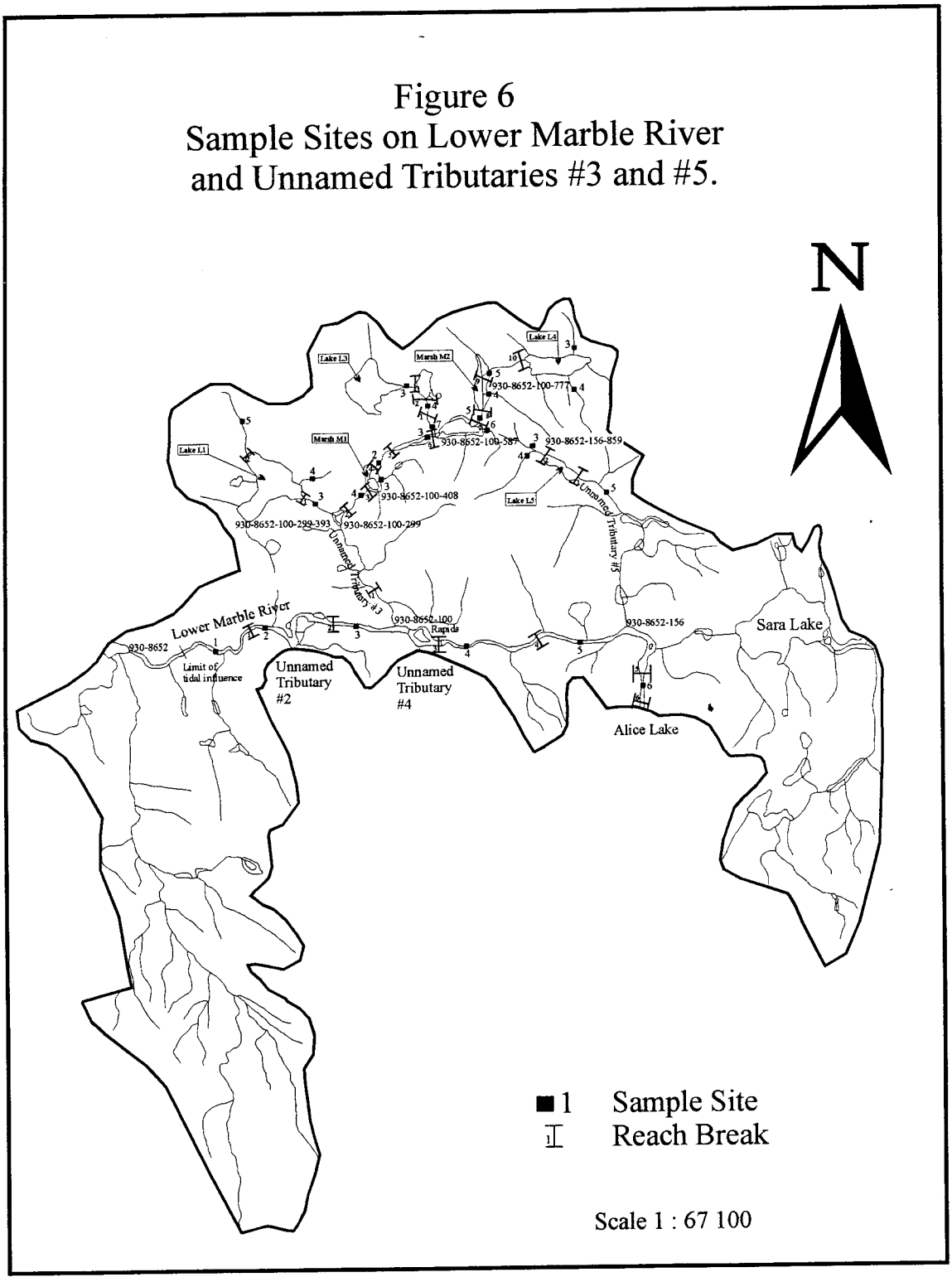


Table 6. Summary of habitat characteristics of the lower Marble River, August 1996.

	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6
Length (km)	2.8	1.0	1.2	0.6	2.0	0.4
Chan. width (m)	27.7	46.0	54.4	25.5	45.5	42.8
Wet. width (m)	13.3	15.0	32.9	12.3	15.2	≈12.0
Riffle depth (cm)	60	30	50	40	40	88
Pool depth (cm)	500	400	180	300	400	250
% pool	80	40	20	70	36	70
% riffle	0	30	50	0	39	0
% glide	0	30	30	0	25	0
% cascades	0	0	0	0	0	8
% rapids	20	0	0	30	0	22
Gradient (%)	≈0	0.5	0.5	0.5	0.5	3.5
Debris area (%)	0	5	0	0	1	0
% stable	-	20	-	-	0	-
% fines	0	5	0	0	0	0
% small gravel	0	5	5	0	5	0
% large gravel	5	40	10	10	15	5
% small cobble	5	40	15	10	20	5
% large cobble	10	10	30	20	30	10
% boulder	40	0	40	30	25	70
% bedrock	40	0	0	30	5	10
D90 (cm)	100	20	100	300	nd	200
Total cover %	50	25	20	50	30	50
% deep pool	50	70	5	50	45	100
% LOD	0	10	0	0	5	0
% boulder	50	0	95	50	50	0
% instream veg.	0	0	0	0	0	0
% over veg.	0	20	0	0	0	0
% cutbank	0	0	0	0	0	0

nd - no data

the meander is a large, logjam that blocks an old river channel. Lower Marble River tributary 2 (WSC: 930-8652-070) flows into the outside of the meander curve. A site was surveyed in Reach 2 just below the large pool. In this area the channel width is 46.0 m and the wetted width was 15 m. The channel in this reach is less stable than other reaches in the lower Marble River.

Photo Page 1 Photos 1-3

Fish

Reach 2 is heavily used by coho and chinook for spawning when passage past Bear Falls is difficult (Hamilton 1980). Marble River hatchery spawning distribution maps indicate that Reach 2 and the lower part of Reach 3 below Bear Falls form the main chinook spawning area for the Marble River.

4.2.1.3 Lower Marble River Reach 3 (3.8 - 5.0 km)

In Reach 3 the channel is straight, confined and stable with a boulder and cobble substrate (Appendix B, photos T1 19, T3 0a, T3 1a, T1 20). There is little large woody debris. The majority of cover for fish is boulder and deep pool. This reach is relatively shallow compared to other reaches as the habitat is mainly wide riffle (50%) that averaged 50 cm deep and 33 m wide. Glide comprised 30% of the habitat and pool comprised 20% of the habitat at the survey site. The channel width is 54.4 m wide.

Bear Falls is located 800 m up the reach (4.6 km upstream from the river mouth; Appendix B, photo T1 21). Bear Falls was identified as a major obstruction to the upstream migration of salmon until a fishway (Appendix B, photo T1 18) was constructed in 1986. Just below the falls is a large deep pool.

Fish

Hamilton (1980) shows that the lower part of Reach 3 downstream of Bear Falls is used by coho and chinook for spawning. The large pool below Bear Falls is likely an important holding area for fish trying to bypass the falls and for fish spawning in the area below the falls.

4.2.1.4 Lower Marble River Reach 4 (5.0 - 5.6 km)

Like Reach 1, Reach 4 is entrenched in a steep walled bedrock canyon (Appendix B, photos T2 12, T1 16). The channel is 25.5 m wide with a bedrock, boulder substrate and a gradient of approximately 0.5%. The habitat was comprised of 70% pool with sections of rapids and cascades. A 1.5 m high cascade is located at the site that was surveyed in this reach. The canyon walls were estimated to be approximately 20 m high.

Fish

A salmon spawning distribution map indicates that this section of river has no spawning habitat (Hamilton 1980). The deep pools in the reach could provide summer holding habitat for summer steelhead as well as juvenile rearing habitat.

4.2.1.5 Lower Marble River Reach 5 (5.6 - 7.6 km)

The channel continues to be confined in Reach 5 although this section no longer flows through a bedrock canyon (Appendix B, photos R1 6 &7, T1 17). The reposed banks in this area are boulder and cobble. The channel is 45.5 m wide, the substrate is 50% cobble, 25% boulder and 20% gravel and the gradient is 0.5%. The reach contains little large woody debris. Cover for fish is primarily deep pool and boulders. The habitat is comprised of 39% riffle, 36% pool and 25% glide. At the top of the reach is a large pool.

Two tributaries flow into this reach. Tributary 5 (WSC: 930-8652-156) flows into the middle of the reach from the north (Figure 6). This tributary drains an unnamed lake (lake L5) 2 km upstream from the Marble River (Fielden 1996f). The lake tributaries and 400 m of the outlet to the lake were surveyed.

A tributary (WSC: 930-8652-163) draining Sara Lake, flows into Reach 5 from the east near the top of Reach 5 (Figure 6). This creek was not surveyed.

Fish

Hamilton (1980) indicates that coho, chinook and sockeye spawn throughout Reach 5. Hamilton (1980) indicates that the creek draining Sara Lake is also used by coho for spawning.

4.2.1.6 Lower Marble River Reach 6 (7.6 - 8.0 km)

The channel again becomes entrenched by reposed bedrock banks in Reach 6 (Appendix B, photos R1 3-5). This reach is short and is the steepest of all the reaches in the lower Marble River with a gradient of 3.5%. The habitat consists of 70% pool, 22% rapids and 8% cascades. The substrate is primarily boulder with some cobble and bedrock. The channel averages 42.8 m wide.

The lake outlet falls is located near the top of the reach (Appendix B, photo R1 5). This falls drops 3.6 m and would be impassable to fish if it was not for a natural channel around the falls along the left side. (Appendix B, photo R1 5). This channel can easily be negotiated by salmon.

At the top of Reach 6 the river is crossed by the Port Alice highway. Upstream of the highway is Alice Lake (Appendix B, photos R1 1 and 2).

Fish

Reach 6 has little spawning habitat due to the lack of gravel. Pools in this reach may provide juvenile rearing habitat and holding habitat for salmon and steelhead.

4.2.2 Lower Marble River tributary 2 (WSC: 930-8652-070).

Lower Marble tributary 2 was surveyed on foot for 1.4 km. This tributary drains Larry Lake located 6.4 km upstream. The watershed of this creek covers an area of 17.3 km^2.

4.2.2.1 Lower Marble River tributary 2 Reach 1 (0.0 - 3.7 km)

Reach 1 has a low gradient (0.8%), frequently confined channel with primarily a gravel substrate (Table 7, Figure 7, photo 3, Appendix B photos T3 2a-7a). The channel width at the Site 2 is 10.6 m. Flows were at a low stage with a discharge of 30 $L \cdot sec^{-1}$. The silt, gravel banks are 1.5 m high. There is an abundance of cover for fish (40%) in the form of overstream vegetation, large woody debris, cutbanks and deep pools. Ninebark, salmonberry and devil's club grow thickly along the banks of the creek. A few large spruce trees grow along the channel, particularly in the lower reaches. The area along this reach has not been logged. Fresh water mussels were observed growing in the creek.

Fish

Tributary 2 is probably an important spawning and rearing area for coho as the creek appears have excellent spawning and rearing habitat for coho. Thousands of coho fry were observed visually from the bank in the lower 1.4 km of the creek. The reach was not sampled by electroshocker.

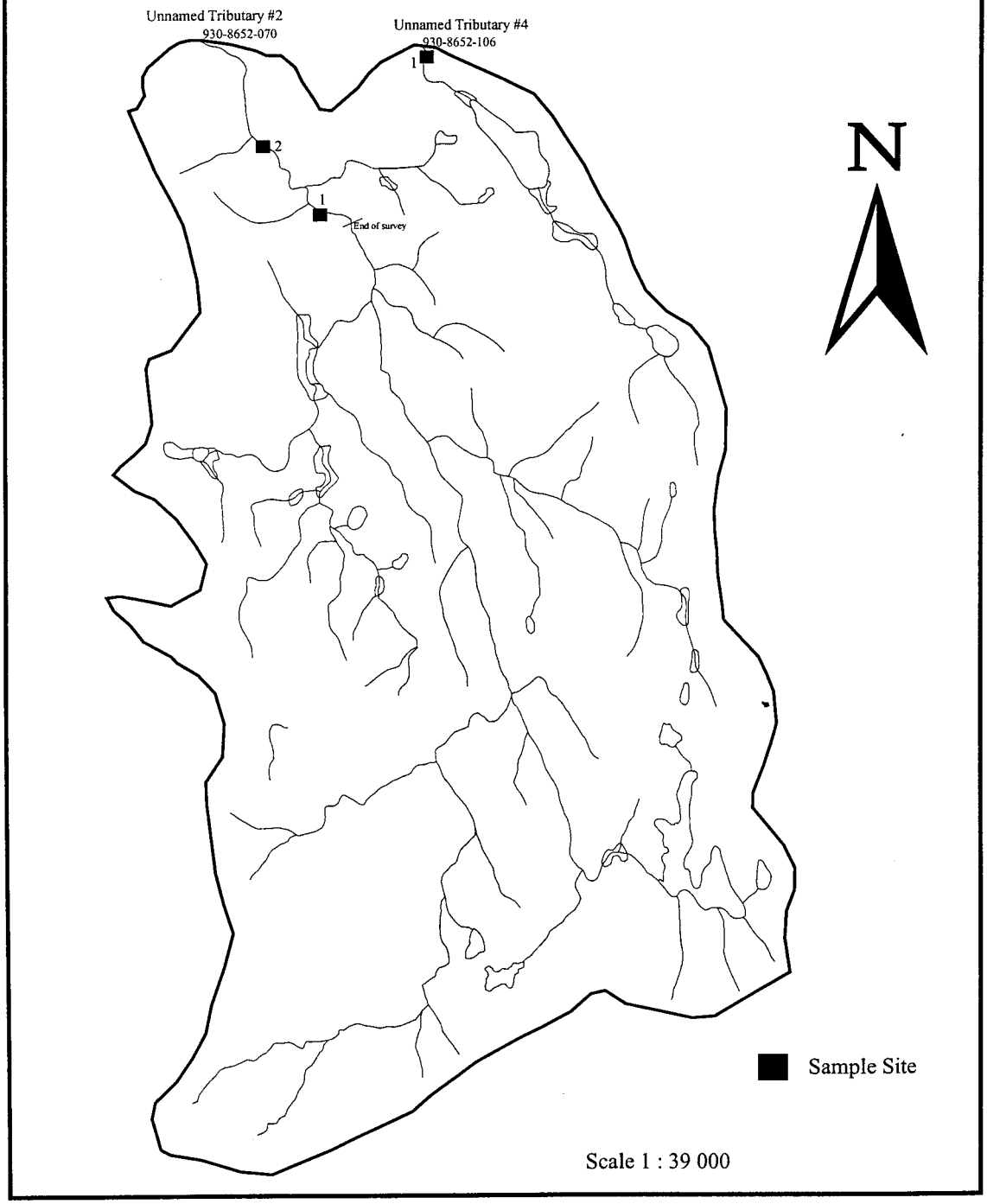
4.2.3 Lower Marble River tributary 3 (WSC: 930-8652-100).

Approximately 200 m below Bear Falls, tributary 3 flows in from the north (Figure 6). The creek is 5 km long. There are four unnamed lakes and two unnamed marshes in the watershed of this tributary that were surveyed in 1996 (Fielden 1997a-d,f,g). The survey labeled the lakes L1, L2, L3, L4 and L5 and the marshes M1 and M2. The creek has seven reaches in addition to two marshes and two lakes on the mainstem for a total of 11 reaches. The majority of the creek flows through an area forested by 90 year old hemlock. Some logging has taken place along Reaches 3, 4 and 7 over the last eight years.

Table 7. Summary of habitat characteristics of the lower Marble River tributaries 2 and 3, August-October, 1996.

	Trib.2 Reach 1	Trib. 3 Reach 3	Trib. 3 Reach 5	Trib. 3 Reach 6	Trib. 3 Reach 8	Trib. 3 Reach 10
Length (km)	3.7	0.3	0.2	0.6	0.2	0.4
Chan. width (m)	10.6	6.4	8.4	5	8.5	4.2
Wet. width (m)	4.6	3.8	4.7	5	3.2	1.9
Riffle depth (cm)	15	13	8	-	5	9
Pool depth (cm)	97	77	23	≈100	20	22
% pool	70	30	70	100	60	60
% riffle	10	70	30	0	20	40
% glide	20	0	0	0	20	0
% cascades	0	0	0	0	0	0
% rapids	0	0	0	0	0	0
Gradient (%)	0.8	5	5	0	0.5	6
Debris area (%)	20	5	10	0	15	10
% stable	90	100	100	-	100	100
% fines	10	0	0	100	10	5
% small gravel	70	0	10	0	30	5
% large gravel	20	10	20	0	20	10
% small cobble	0	25	20	0	20	25
% large cobble	0	40	30	0	10	30
% boulder	0	20	20	0	10	20
% bedrock	0	5	0	0	0	5
D90 (cm)	5	40	50	<0.2	30	100
Total cover %	40	20	30	100	30	30
% deep pool	10	0	0	0	0	0
% LOD	30	20	30	0	20	40
% boulder	0	50	50	0	10	50
% instream veg.	0	10	0	50	10	0
% over veg.	50	20	10	50	50	10
% cutbank	10	0	10	0	10	0

Figure 7
Sample Sites On Unnamed Marble River Tributaries #2 and #4.



4.2.3.1 Lower Marble River tributary 3 Reach 1 (0.0 - 0.5 km)

Reach 1 was not examined during the survey. It has a gradient of 4% and is 0.5 km long.

4.2.3.2 Lower Marble River tributary 3 Reach 2 (0.5 - 1.5 km)

Reach 2 was not examined during the survey. The reach has a lower gradient (2%) with much of it flowing through marsh. The outlet from Lake L1 (WSC: 930-8652-100-299), which is 400 m long, flows into this reach from the west at 1.35 km (Fielden 1997a).

Fish

Some tributaries to Lake L1 and the outlet to Lake L1 were sampled for fish during the lake survey. No coho juveniles were captured in the lake or in the lake tributaries and outlet. It is possible that somewhere in Reaches 1 and 2 of tributary 3 is a barrier to the upstream migration of fish. The species of fish captured in the Lake L1 system were cutthroat trout, kokanee, prickly sculpin and threespine stickleback. Cutthroat trout, prickly sculpin and threespine stickleback are probably present in Reaches 1 and 2 as well.

4.2.3.3 Lower Marble River tributary 3 Reach 3 (1.5 - 1.8 km)

Reach 3 extends from the top of Reach 2 to marsh M1 (Fielden 1997f). This reach was an overall gradient of ≈5% gradient and is 300 m long. Reach 3 was surveyed 100 m downstream of the marsh above a set of cascades that probably block the passage of anadromous fish. The channel width is 6.4 m and the substrate is primarily cobble and boulder.

Marsh M1 (Reach 4) covers an area of 4.5 ha and it has a 1.3 ha open water area in the middle. The marsh has a maximum depth of 6.2 m.

Fish

Reach 3 (Site 4) was sampled by electroshocker. The site appeared to have moderate densities of cutthroat trout and prickly sculpin. The marsh had high densities of cutthroat trout. No stickleback were captured upstream of Reach 2 indicating that the Reach 3 cascades could be a barrier to this species.

4.2.3.4 Lower Marble River tributary 3 Reach 5 (2.1 - 2.3 km)

Reach 5 extends 0.2 km above marsh M1 (Appendix B, photo 4 24). The substrate is cobble and gravel, the channel width is 8.4 m and gradient is 4%. The discharge was approximately 0.01 $m^3 \cdot sec^{-1}$ on October 13, 1996. Fish cover is 40% and consists of large woody debris, boulder, overstream vegetation and cutbank. The habitat appears to be good salmonid rearing and spawning habitat.

Fish
Cutthroat juveniles and prickly sculpins, captured by electroshocker from Site 2, appeared to be fairly numerous in this section of the creek with 11 cutthroat trout and 4 prickly sculpins captured in 494 sec of shocking. This reach is probably a significant spawning and rearing area for marsh M1 cutthroat trout.

4.2.3.5 Lower Marble River tributary 3 Reach 6 (2.3 - 2.9 km)

Reach 6 extends for 0.6 km to lake L3 (Fielden 1997c; Appendix B, photo 4 8). The creek in this reach meanders through marsh habitat that is up to 50 m wide. The creek is deep and slow flowing in this area with a channel width of about 5 m. Aquatic vegetation is growing in the channel and hardhack is growing thickly along the banks.

Reach 7 is lake L3.

Fish
Reach 6 was not sampled for fish but it probably is rearing habitat for cutthroat trout. This reach is more suitable for adult trout than juvenile trout due to its deep slow flowing nature. The reach has no salmonid spawning habitat due to the fine substrate. Lake L3 has high densities of cutthroat trout but they are small in size.

4.2.3.6 Lower Marble River tributary 3 Reach 8 (3.3 - 3.5 km)

Reach 8 extends from lake L3 to marsh M2 (Fielden 1997g), a distance of 200 m (Appendix B, photos 4 1,2). This reach has a channel width of 8.5 m, a gradient of 0.5% and a gravel cobble substrate. The creek is heavily overhung by salmonberry bushes and salal and flows through a 90 year old hemlock forest. The creek had a discharge of 5 $L \cdot sec^{-1}$ on October 11, 1996. The creek appears to have good cutthroat trout spawning and rearing habitat.

Marsh M2 (Reach 9) covers an area of 6 ha. It contains a 2 ha open water area with a maximum depth of 1.4 m.

Fish

Six cutthroat fry were captured at Site 5 in Reach 8 when the site was electroshocked for 439 sec. The site appeared to have low densities of cutthroat trout juveniles. This reach is probably a significant spawning area for lake L3 cutthroat trout. Marsh M2 contains small numbers of cutthroat trout adults (Fielden 1997f).

4.2.3.7 Lower Marble River tributary 3 Reach 10 (3.8 - 4.2 km)

Reach 10 is 400 m long and extends from marsh M2 to lake L4 (Appendix B, photos 4 15 and 16). A 1 m high beaver dam is located at the lake outlet. Twenty metres downstream of the lake the outlet creek drops 6 m over a distance of about 15 m in a series of cascades (Appendix B, photos 5 14 and 15). The presence of the cascades and the beaver dam would make it difficult for fish to pass upstream into the lake. The outlet was surveyed just above marsh M2 on October 11, 1996 (Fielden 1997f). At that point the creek has a channel width of 4.2 m and has a primarily cobble and boulder substrate. The gradient is 6% and the discharge was only 4 $L \cdot sec^{-1}$.

Fish

Prickly sculpins and moderate densities of juvenile cutthroat trout were captured in this reach by electroshocker. This reach appears to have no potential rearing or spawning habitat for lake L4 fish due to the cascades and beaver dam at the lake outlet. Trout from marsh M2 and lake L3 probably utilize this reach for spawning and rearing.

4.2.3.8 Lower Marble River tributary 4 (WSC 930-8652-106)

Tributary 4 is a 2.5 km long creek that flows into the Marble River from the southeast, 200 m above Bear falls (Figure 7; Appendix B, photo R1 18). This tributary drains a small lake 500 m upstream of the Marble River. The tributary was briefly examined approximately at 0.2 km August 19, 1996. At this site the channel width is 5 m, the gradient is approximately 3% and the substrate is small cobble. The discharge was 5 $L \cdot sec^{-1}$.

Fish

Tributary 4 had coho fry at the site examined 200 m upstream from the Marble River. The fish were visually observed from the bank.

4.2.4 Lippy Creek (WSC: 930-8652-372)

Lippy Creek flows east into Alice Lake midway along the western shore (Figure 8). The creek is 6.4 km long, drains an area of 5.8 km^2 and has four reaches (Table 8). The entire watershed was logged to the stream banks, approximately 25 years ago. Hemlock, Douglas fir, red cedar and alder are the dominate tree species that have revegetated the area. Alders are particularly prevalent along the stream banks. The trees are up to 20 m in height.

4.2.4.1 Lippy Creek Reach 1 (0 - 0.6 km)

The channel in Reach 1 is irregular and unconfined with a 2% gradient (Photo 4 and 5; Appendix B, photos R1 17, T3 15a, T3 16a, T7 6). The substrate is primarily cobble and gravel. The channel width averaged 6.4 m at the two sites examined in the reach. The lower 500 m of the reach was dry when the creek was surveyed on August 18 and 20, 1996 (Photo 5). The upper part of the reach had a flow of 1 $L \cdot sec^{-1}$ before the flow became subsurface. The channel appears to be unstable and there is little large woody debris due, at least in part, to the logging of the stream side vegetation. Cover for fish is provided by a heavy overhang of salmonberry bushes, some old growth stumps, cutbanks and some boulders in the upper part of the reach.

Fish

There is little summer rearing habitat in most of Reach 1 due to the lack of flow. The upper part of the reach had high densities of juvenile coho, cutthroat trout and Dolly Varden at Site 2 on September 2, 1996. Fish densities and habitat capacity was assessed at this site (Section 4.3.5). Hamilton (1980) indicates that coho spawn throughout Reach 1.

4.2.4.2 Lippy Creek Reach 2 (0.6 - 2.6 km)

The channel becomes entrenched and the gradient increases to 10% (mean gradient at Sites 7 and 12) in Reach 2 (Appendix B, photos R1 24, R1 25, T3 9a, T3 14a). The 1:20,000 TRIM map indicates the gradient is 8%. A 1.5 m high falls at the bottom of the reach is likely the upper limit for coho in this system (Appendix B, photo T3 14a). This reach is 2 km long and extends from just above SEM4 to a point just above the Port Alice highway. At the two points that were examined at the top and bottom of the reach the channel averages 4.5 m in width, and the substrate is mainly cobble, boulder and bedrock. The discharge was 1 - 2 $L \cdot sec^{-1}$. Although the area has been logged to the stream banks it is not likely that there has

Figure 8
Sample Sites on Tributaries of Northern Alice Lake.

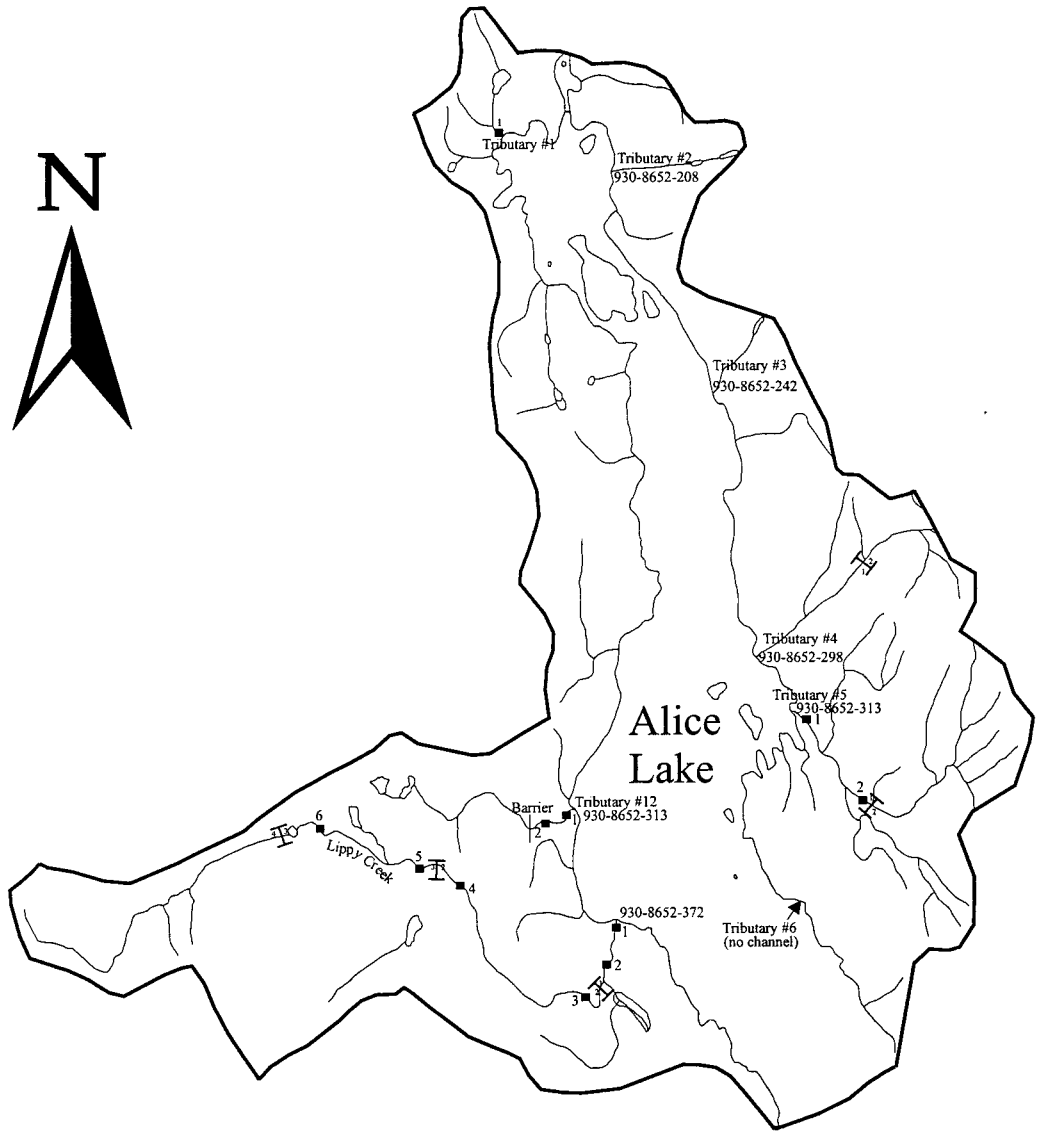


Table 8. Summary of habitat characteristics of Lippy Creek, August 1996.

	Reach 1	Reach 2	Reach 3
Length (km)	0.6	2.0	1.2
Chan. width (m)	6.4	4.5	6.5
Wet. width (m)	1.2	1.2	0
Riffle depth (cm	3	5	0
Pool depth (cm)	35	25	20
% pool	50	50	100
% riffle	50	50	0
% glide	0	0	0
% cascades	0	0	0
% rapids	0	0	0
Gradient (%)	1	10	5
Debris area (%)	5	20	50
% stable	50	50	80
% fines	5	5	60
% small gravel	5	5	10
% large gravel	20	20	10
% small cobble	30	20	10
% large cobble	20	20	10
% boulder	10	10	0
% bedrock	10	20	0
D90 (cm)	25	30	15
Total cover %	20	30	50
% deep pool	0	0	0
% LOD	20	30	50
% boulder	20	50	0
% instream veg	0	0	0
% over veg.	40	10	25
% cutbank	20	10	25

Photo Page 2 - photos 4-6

been a significant impact to fish habitat as the stream is entrenched and stable along this reach.

Lippy Creek passes underneath the Port Alice highway through a 1.5 m wide culvert (Appendix B, photo T3 9a). The downstream end of the culvert is elevated 70 cm above the surface of a large plunge pool and is a barrier to the upstream migration of fish.

Fish
Cutthroat trout were captured by Gee trap at the top of this reach and are probably distributed throughout the reach.

4.2.4.3 Lippy Creek Reach 3 (2.6 - 3.8 km)

In Reach 3 the channel is confined to frequently confined (Appendix B, photos R1 21, T3 10a, T3 11a). The gradient at the two sites that were examined is 5% and the channel width averages 6.5 m. The substrate is fines (60%), gravel (20%) and cobble (20%). At the top of the reach the creek had no flow on August 20, 1996, although there were a few isolated pools. At the powerline crossing, closer to the bottom of the reach, the creek had a flow of 1 $L \cdot sec^{-1}$. Logging along this reach has likely affected the channel stability and fish cover. The creek has substantial amounts of woody debris but most of it is from alder windfalls that would be less stable than large conifers. Cutbanks and overstream vegetation also provide cover for fish.

Fish
Fish, that were probably cutthroat trout, were observed from the bank in this reach at the powerline crossing. Cutthroat trout had been captured by Gee trap a few hundred metres downstream at the top of Reach 2. Near the top of Reach 3, there were only a few small isolated pools that were not sampled.

4.2.4.4 Lippy Creek Reach 4 (3.8 - 6.4 km)

Above Reach 3 the gradient increases substantially and had no flow. At the bottom of the reach the gradient is 15% and it increases to 30%, 400 m upstream. This reach probably has no fish habitat due to the steep gradient and lack of flow.

4.2.5 Sorenson Creek (WSC: 930-8652-385)

Sorenson Creek flows into Alice Lake from the west, midway along the western shore just south of Lippy Creek (Figure 9). This creek has a watershed area of

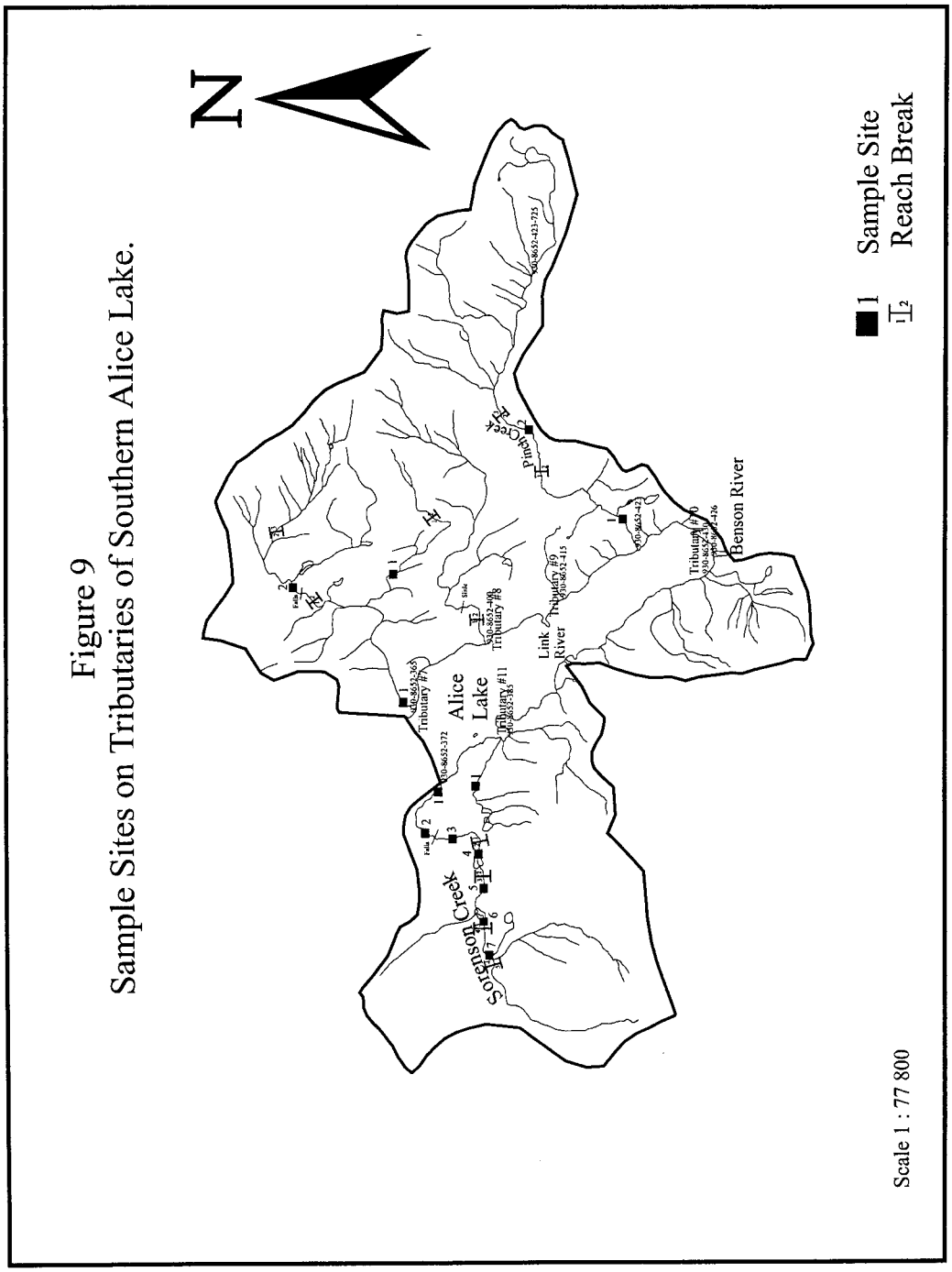


Figure 9
Sample Sites on Tributaries of Southern Alice Lake.
N
Alice Lake
Sorenson Creek
Pinoe Creek
Link River
Benson River
Tributary #A
Tributary #8
Tributary #9
Tributary #10
Tributary #11
1 Sample Site
Reach Break
Scale 1 : 77 800

9.7 km^2, it is 6.0 km long and it has seven reaches (Table 9). The entire watershed has been logged. The lower portion of the watershed was logged to the stream banks, approximately 25 years ago and the upper portion of the watershed was logged approximately 40-50 years ago. Hemlock, Douglas fir, red cedar and red alder are the dominant tree species that have revegetated the area. Alders are particularly prevalent along the stream banks. The trees are up to 25 m in height.

4.2.5.1 Sorenson Creek Reach 1 (0.0 - 0.8 km)

The channel in Reach 1 irregularly meanders and is frequently confined (Photo 6; Appendix B, photos R1 14, R1 15, T7 25-27, R2 0). The gradient is 2% at the two sites in the reach and 2.5% according to the 1:20,000 TRIM map. The substrate increases in size from gravel and cobble at the bottom of the reach to primarily cobble at the top of the reach. The channel width averages 9.2 m at the two sites examined. The wetted width was 4.3 m and the discharge was low at 20 $L \cdot sec^{-1}$. Logging along this reach has likely lead to some bank destabilization, a loss of large woody debris and a loss of channel complexity. The large woody debris, that is present, is generally alder with some large stumps and logs that remain from the old growth that was in the area. Alders are the dominant tree species along the banks. The underbrush, consisting of salmonberry and ninebark, is thick and overhangs the channel in many areas providing cover for fish (Photo 6). Cutbanks are another significant type of cover in this reach.

Fish

Reach 1 appears to be good salmonid spawning habitat due to the large amount of gravel, although high flows at times could reduce egg to fry survivals. Prickly sculpins, cutthroat trout juveniles and coho juveniles were captured at Site 1 that was sampled by electroshocker in the lower part of the reach on September 4, 1996. The Marble River hatchery uses Sorenson Creek as a source of coho broodstock.

4.2.5.2 Sorenson Creek Reach 2 (0.8 - 1.8 km)

The channel in Reach 2 becomes entrenched in a limestone canyon with walls up to 15 m in height (Appendix B, photos T4 3-5, T3 17a-19). This reach has a 4% gradient (from 1:20,000 TRIM map), the bed material is primarily cobble, boulder and bedrock and the channel width is 5.6 m. This reach has four barriers. Near the bottom, 400 m below the road SEM4 and 0.8 km from the mouth, is an 8 m high falls that blocks all fish from passing upstream (Appendix B, photo T3 19a). Two, 2 m high falls are located 1.5 km from mouth (Appendix B, photo T3 18a) and

Table 9. Summary of habitat characteristics of Sorenson Creek, August 1996.

	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6
Length (km)	0.8	1.0	0.2	0.4	0.5	1.5
Chan. width (m)	9.2	5.6	9.8	6.1	7.4	4.6
Wet. width (m)	4.3	4.0	7	4.0	7.4	0
Riffle depth (cm)	12	1.7	-	11	-	0
Pool depth (cm)	65	56	60	43	93	0
% pool	55	50	100	80	100	-
% riffle	40	0	0	10	0	-
% glide	5	0	0	10	0	-
% cascades	0	0	0	0	0	-
% rapids	0	50	0	0	0	-
Gradient (%)	2	4	0	1	0	1.3
Debris area (%)	8	1	10	5	15	5
% stable	75	0	100	100	100	20
% fines	0	0	100	10	100	40
% small gravel	5	10	0	10	0	30
% large gravel	30	20	0	45	0	30
% small cobble	40	20	0	20	0	0
% large cobble	20	30	0	10	0	0
% boulder	5	10	0	5	0	0
% bedrock	0	10	0	0	0	0
D90 (cm)	20	28	<0.2	10	<0.2	3
Total cover %	20	10	30	15	80	0
% deep pool	0	30	25	10	25	-
% LOD	30	10	25	10	25	-
% boulder	0	20	0	0	0	-
% instream veg.	0	20	25	0	25	-
% over veg.	35	20	25	40	25	-
% cutbank	35	0	0	40	0	-

1.45 km from mouth (Appendix B, photo T3 17a). Near the top of the reach (1.8 km from the mouth) are more falls and cascades that drop a total of 10 m over a distance of 25 m (Appendix B, photo T4 3). The area alongside this reach was logged about 25 years ago. The salal underbrush is very thick along this section of the creek making walking difficult.

Fish

The waterfall at the bottom of this reach prevents anadromous fish from accessing the rest of this creek and it may have prevented other species from colonizing the upper reaches. One coho juvenile was captured by electroshocker in ≈300 sec of shocking at Reach 2 Site 3. This fish along with other coho captured upstream are outplants from the Marble River hatchery (Debbie Anderson pers. comm.). No other species of fish were captured by electroshocker, beach seine or Gee trap above the falls so it appears that the upper reaches of this creek are normally barren of fish. The total sampling effort above the falls was ≈300 sec of shocking at Site 3 in Reach 2, three sets with a beach seine at Site 5 in Reach 4 and 10 Gee traps baited with salmon roe set overnight at Site 6 in Reach 5. More extensive sampling needs to be conducted to determine if the reaches above the falls are normally barren of fish.

4.2.5.3 Sorenson Creek Reach 3 (1.8 - 2.0 km)

In Reach 3, Sorenson Creek flows through a 200 long, 75 m wide marsh (Appendix B, photo T4 6 and 7). The creek is deep (≈0.6 m), slow flowing pool habitat. The channel is 9.8 m wide, the substrate is 100% fines and the gradient is close to zero. Hardhack and sedge grow along the banks and throughout the marsh.

Fish

This reach was not sampled for fish. It is likely that some coho outplants from the Marble River hatchery would be present.

4.2.5.4 Sorenson Creek Reach 4 (2.0 - 2.4 km)

The gradient increases to 1% in Reach 4 (Appendix B, photo R1 23 and 24). The 6.1 m wide channel irregularly meanders and is occasionally confined. The substrate is mainly gravel. The discharge was approximately 20 $L \cdot sec^{-1}$ and the wetted width was 4.0 m on August 20, 1996. The habitat consists of 80% pool, 10% riffle and 10% glide. This reach appeared to have good salmonid rearing and spawning habitat due to the abundance of gravel and cover (30%) in the form of deep pools, instream vegetation, overstream vegetation and some large woody debris. The banks appear to be stable. There was little large woody debris possibly as a consequence of logging.

Fish

Numerous, relatively large (fork length = 68-82 mm; n= 12) coho juveniles were captured by beach seine at the sample site in Reach 4. These fish were hatchery outplants.

4.2.5.5 Sorenson Creek Reach 5 (2.4 - 2.9 km)

In Reach 5 the creek again meanders through a 500 m long marsh (Appendix B, photo T4 1). The habitat is deep (≈1 m) slow flowing pool with 100% fine substrate. The channel averages 7.4 m in width. Hardhack, sedge and alder grow along the banks and throughout the marsh.

Fish

Ten Gee traps baited with salmon roe were left to fish overnight in this reach. No fish were captured.

4.2.5.6 Sorenson Creek Reach 6 (2.9 - 4.4 km)

The gradient in Reach 6 increases to 1.3% (Appendix B, photos T4 8, R2 8-11). The creek in this reach is occasionally confined, it irregularly meanders and it appears to be unstable as 50% of the banks were failing at the site that was surveyed. The channel width averages 4.6 m and the substrate is gravel and fines. The reach was dry on August 22, 1996.

Fish

No fish were present, as there was no water at the survey site.

4.2.5.7 Sorenson Creek Reach 7 (4.4 - 6.0 km)

The Southeast main crosses Sorenson Creek at the bottom of Reach 7 (Appendix B, photo T4 0). The gradient averages 33% in this reach and the creek was dry. The steep gradient and lack of summer flow makes it unlikely that the reach has potential fish habitat at any time of the year. The creek flows north down a gulley along a 847 m high hillside in this reach.

4.2.6 Pinch Creek (WSC: 930-8652-423)

Pinch Creek flows west down the slopes of a small 1,200 m high mountain to the southeast end of Alice Lake (Figure 9). The creek drains an area of 8.2 km^2, is 7.2 km in length and has three reaches (Table 10). In the upper part of the watershed the creek is steep as it flows down the mountain side through several

Table 10. Summary of habitat characteristics of Pinch Creek and the Benson River, August 1996.

	Pinch Reach 1	Pinch Reach 2	Benson Reach 1	Benson Reach 4
Length (km)	1.8	0.8	1.9	2.1
Chan. width (m)	13.1	13.3	49.4	25.4
Wet. width (m)	2.9	0	39.6	15.1
Riffle depth (cm)	18	0	20	62
Pool depth (cm)	42	0	225	184
% pool	20	0	19	67
% riffle	80	0	44	0
% glide	0	0	38	5
% cascades	0	0	0	0
% rapids	0	0	0	28
Gradient (%)	4	7	0.2	1
Debris area (%)	10	5	2	1
% stable	20	20	50	0
% fines	10	0	0	0
% small gravel	10	5	0	0
% large gravel	20	10	30	10
% small cobble	20	10	30	10
% large cobble	20	25	30	20
% boulder	20	50	5	30
% bedrock	0	0	5	20
D90 (cm)	40	50	20	150
Total cover %	30	0	10	50
% deep pool	0	0	30	30
% LOD	10	0	10	2
% boulder	70	0	5	68
% instream veg.	0	0	0	0
% over veg.	10	0	55	0
% cutbank	10	0	0	0

coarse (cobble, gravel and boulder). The channel width averages 13.1 m at the site examined in the reach while the average wetted width was 2.9 m. The discharge on August 27, 1996 ranged from approximately 40 $L \cdot sec^{-1}$ at the bottom of the reach to no discharge at the top of the reach. The majority of the flow originated from a spring that is 550 m upstream from the mouth (Photo 7; Appendix B, photo R3 1).

Photo page 3 - Photos 7-9

gulleys. The gradient decreases in the last few kilometers from the base of the mountainside to the lake.

All but the upper most portion of the watershed has been logged. Much of the unlogged area is semi alpine. The area around the lower reaches was logged 25 to 30 years ago while the area around the upper reaches was logged 15 to 20 years ago. No timber was left along the banks of the creek when the area was logged.

4.2.6.1 Pinch Creek Reach 1 (0 - 1.8 km)

The channel in Reach 1 is confined and relatively straight with a 4% gradient at the sample site and 6% for the reach on the 1:20,000 TRIM map (Appendix B, photos T4 25, R3 2, R3 20, R3 21, T5 0-3, R3 1). As a result of the steep gradient the habitat is 80% riffle and the substrate is mainly boulder.

The spring is located along the main channel and contributed about 40 $L \cdot sec^{-1}$ of flow while the mainstem, just upstream, only had about 4 $L \cdot sec^{-1}$ of flow. The spring helps to maintain flows during the summer and is probably important in maintaining summer rearing habitat for salmonids.

The majority of cover for fish in this reach is from boulders. Stumps and logs that remain from the old growth forest provide a small amount of cover as well. Logging in the watershed has likely lead to a loss of large woody debris in the channel and greater channel instability. The riparian vegetation along the creek is now dominated by 20 to 30 cm diameter alders which do not contribute to much stable woody debris. As the channel is confined, channel stability may not have been affected by logging as much as in some lower gradient, less confined streams in the area.

Approximately 1.2 km upstream (UTM: 09.616580.558844) a section of bank has slumped into the creek and has become a source of sediment at high flows (Appendix B, photo T4 25). Approximately 1.4 km upstream from the mouth is a logjam that has created a 1.5 m high waterfall (Appendix B, photos T5 0 and 1). The waterfall could create fish passage problems, although above the falls there is little summer rearing habitat due to low flows.

Fish

The lower part of Reach 1 was sampled for fish by electroshocker on September 1, 1996. Coho, rainbow trout and Dolly Varden juveniles were captured. The density

of all three species was low. Coho fry densities were above predicted levels (Section 4.2.5) despite the low densities due to the low habitat suitability for this species. The habitat is more suited for trout and Dolly Varden juveniles (Section 4.3.4) but densities were below predicted levels.

Due to the steeper nature and coarse substrate of this reach it does not appear to be ideal salmonid spawning or rearing habitat. The spring helps to maintain flows and rearing habitat in the summer, however, high flows in the winter likely lead to reduced egg to fry survivals. High water refuge areas may be limiting due to the small amount of stable woody debris, the high proportion of riffle habitat and the lack of off channel habitat.

4.2.6.2 Pinch Creek Reach 2 (1.8 - 2.6 km)

In Reach 2 the gradient averages 7% at the two sample sites (12% on 1:20,000 TRIM map), the substrate is mainly boulder and cobble and the channel width averages 13.3 m (Appendix B, photos T5 4-6). This reach had no flow when it was examined on August 27, 1996. The channel is frequently confined and it appears to be fairly unstable with an estimated 30% of the banks failing. The channel contains little large woody debris. The riparian vegetation is dominated by small 15 year old alder and Douglas fir trees.

Fish
As this reach was dry when it was surveyed there were no fish present. It is unlikely that many fish would inhabit the reach during periods that it had flow due to its steep nature and due to the 1.5 m high waterfall in Reach 1.

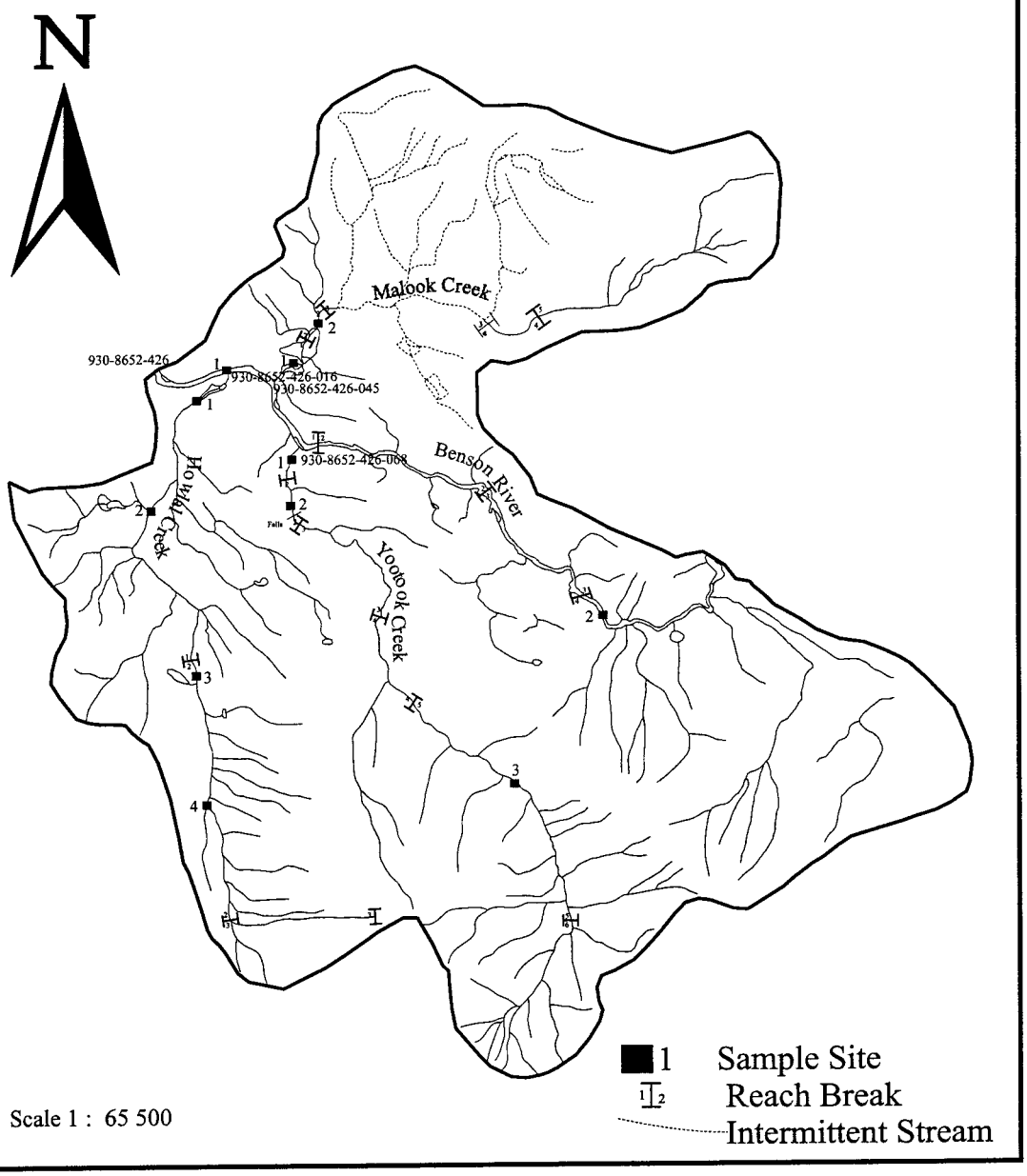
4.2.6.3 Pinch Creek Reach 3 (2.6 - 4.6 km)

In Reach 3 the creek flows through gulleys down the mountain. Due to the steep gradient (19%) there is little potential fish habitat. The reach was not sampled for fish. A small 5 ha lake is situated at the top of the reach at an elevation of 998 m.

4.2.7 Benson River (Alice Lake to Kathleen Lake) (WSC: 930-8652-426)

The Benson River is a large system draining an area of 300 km^2 (Figures 9, 10). The mainstem of the river flows northwest for 26 km to the south end of Alice Lake. Two lakes, Kathleen Lake and Benson Lake, are located 7 km and 10.5 km, respectively, upstream from the mouth on the mainstem of the river. Kathleen Lake is 4.3 km long and Benson Lake is 2.0 km long.

Figure 10
Sample Sites on Benson River, Yootook Creek,
Malook Creek and Howlal Creek.



The Raging River is a Benson River tributary draining an area of 114 km^2 that flows into Benson Lake. The Raging River drains Maynard Lake 600 m upstream. Maynard Lake is 3 km long. A 12 m high dam was built at the outlet to Maynard Lake around 1963 by the Coast Copper Company to provide hydro power for the Benson Lake Mines (Hamilton 1980). The dam and power plant were shut down in 1972 when the mine closed. The water licenses for the dam are currently held by Raging River Power and Mining Inc. (Table 3).

The lower portion of the watershed below Kathleen Lake, the upper Benson River above Benson Lake and the Raging River above Maynard Lake have been extensively logged. The watershed to the north of Kathleen Lake, Benson Lake and Maynard Lake still has substantial unlogged areas.

Only the lower portion of the Benson River, downstream of Kathleen Lake was surveyed during the 1996 survey. This section of river has four reaches (Table 10).

4.2.7.1 Benson River Reach 1 (0.0 - 1.9 km)

Reach 1 has a low gradient (0.2%; 1:20,000 TRIM map). The occasionally confined channel averages 49.4 m in width and the substrate is cobble and gravel (Appendix B, photos T5 7 and 8 and T8 8-13). The habitat (Photo 8) is mainly slow flowing glide (38%), shallow riffle (44%) and pool (19%). The wetted width averaged 39.6 m on August 27, 1996 and the discharge was 4 $m^{3} \cdot sec^{-1}$ on September 8, 1996. The channel appears to be stable. The riparian vegetation was logged about 30 years ago. Spruce, hemlock and cedar are growing along the banks of the river in amongst alder which is the dominant type of vegetation.

There was little cover for fish in the reach (10%). Overstream vegetation comprised 55% of the cover, deep pool comprised 30%, large woody debris 10% and boulder 5%.

Fish

Low densities of coho juveniles, rainbow trout juveniles and prickly sculpins were observed at a Reach 1 site that was sampled for fish on September 8, 1996. Hamilton (1980) indicates that coho, chinook and sockeye spawn in Reach 1. The Benson River is considered to be a main coho spawning area in the watershed.

4.2.7.2 Benson River Reach 2 (1.9 - 3.5 km)

The river is entrenched in a limestone canyon through Reach 2. The gradient is 4% in one 500 m section. The substrate consists primarily of limestone boulders and bedrock. The canyon walls are steep and approximately 15 m high. The reach

contains very little large woody debris. Most of the cover for fish is boulders and deep pool. The habitat is primarily pool and rapids. There are two points of difficult passage for fish located 3.4 km upstream from the mouth in this reach (Higgins 1970). The first point is a split falls. The right channel of the falls drops 1.8 m while the left channel drops 1.8 m over a distance of 18 m. The left channel is dry at low stages. Approximately 50 m upstream is a rock shelf (3.45 km) that may also be a point of difficult passage. At low flows the river runs under the shelf and at a medium stage the shelf is covered. A stream survey form (Appendix C) was not filled out for this reach.

Fish

No fish data was collected for Reach 2 during the 1996 survey. The lower half of Reach 2 is mainly a migration corridor and some of the pools may be used for holding by adult chinook, coho and steelhead. Salmonid juveniles probably rear in the pools throughout the reach.

4.2.7.3 Benson River Reach 3 (3.5 - 4.9 km)

The channel is confined in Reach 3, the channel width increases and the gradient decreases to <0.5%. The majority of habitat is pool and the substrate is gravel and cobble.

Fish

Hamilton (1980) indicates that coho, chinook and sockeye spawn throughout Reach 3. The extensive gravel and cobble beds in this section of river probably make it a significant spawning area. The reach was not sampled for fish during the 1996 survey.

4.2.7.4 Benson River Reach 4 (4.9 - 7.0 km)

As in Reach 2, the river again becomes entrenched in a limestone canyon through Reach 4 (Appendix B, photos T5 9-11). At the sample site the channel width averages 25.4 m and the gradient is 1%. The habitat is 67% pool, 5% glide and 28% rapids. The substrate consists primarily of limestone boulders and bedrock. The canyon walls at the sample site are steep and approximately 15 m high. A narrow greenstrip of timber was left along the edge of the canyon when the area was logged 15 to 20 years ago. The reach contains very little large woody debris. Most of the cover for fish is boulders and deep pool. The channel was dry for approximately 200 m in the vicinity of the Devil's Bath when the river was surveyed on August 28, 1996. The surface flow disappeared into the substrate just upstream of the Devil's bath and reemerged just downstream.

Fish

Spawning distribution maps (Hamilton 1980) indicate that sockeye spawn in Reach 4. The reach was not sampled for fish during the 1996 survey.

4.2.8 Malook Creek (WSC: 930-8652-426-045)

The Malook Creek watershed is situated just south of Pinch Creek (Figure 10). This creek flows west and joins the Benson River 1.4 km upsteam from the river mouth. Malook Creek drains an area of 10.4 km^2 and is 5.8 km in length. The creek has five reaches (Table 11). The majority of the watershed was logged 15 to 25 years ago. Limestone underlies much of the watershed.

4.2.8.1 Malook Creek Reach 1 (0.0 - 0.6 km)

Malook Creek meanders through a 500 m long by 200 m wide marsh in Reach 1 (Appendix B, photoT6 6 and 7). The channel width averages 8.1 m, the substrate is 100% fines and the habitat is 100% pool with average maximum depths of 92 cm. The discharge was approximately 40 $L \cdot sec^{-1}$ on August 30, 1996 and the wetted width averaged 7.2 m. The vegetation along the banks and throughout the marsh consists of hardhack, red osier dogwood and sedge. Instream vegetation and overstream vegetation were the dominant cover components for fish and they were estimated to provide 10% cover.

Fish

Gee traps set in Reach 1 captured coho juveniles, Dolly Varden and prickly sculpins. There is no salmonid spawning habitat in Reach 1 as the substrate is 100% fines.

4.2.8.2 Malook Creek Reach 2 (0.6 - 1.0 km)

The gradient increases from almost zero in Reach 1 to 0 - 0.5% in Reach 2 (photo 9; Appendix B, photos T6 8 and 9, R3 13 and 14). The channel width averages 6.0 m, the substrate contains 60% gravel and 30% fines and the habitat is primarily pool (50%) and glide (40%). The rest of the habitat is riffle (10%). The creek in this reach flows through swamp. The riparian vegetation is thick and consists of alder, willow, salmonberry, skunk cabbage and ninebark. The creek has an abundance of cover estimated to cover 50% of the channel. Large woody debris from the alder and willow comprises 50% of the cover, overstream vegetation comprises 40% and cutbanks comprise 10%. The fine, 0.6 m high banks appear to be stable.

Table 11. Summary of habitat characteristics of Malook Creek and Yootook Creeks, August 1996.

	Malook Reach 1	Malook Reach 2	Yootook Reach 1	Yootook Reach 2	Yootook Reach 5
Length (km)	0.6	0.4	0.2	0.4	2.5
Chan. width (m)	8.1	6.0	16.4	9.5	12.6
Wet. width (m)	7.2	5.3	4.3	4.9	4.2
Riffle depth (cm)	-	-	2	15	15
Pool depth (cm)	92	70	30	88	43
% pool	100	50	20	43	10
% riffle	0	10	80	40	90
% glide	0	40	0	9	0
% cascades	0	0	0	0	0
% rapids	0	0	0	8	0
Gradient (%)	0	<0.5	3	5	6
Debris area (%)	5	30	2	10	5
% stable	100	100	50	50	20
% fines	100	30	5	5	5
% small gravel	0	30	5	5	5
% large gravel	0	30	10	10	10
% small cobble	0	10	25	25	20
% large cobble	0	0	25	25	40
% boulder	0	0	30	20	20
% bedrock	0	0	0	10	0
D90 (cm)	<0.2	10	50	50	60
Total cover %	10	50	30	10	20
% deep pool	0	0	0	0	0
% LOD	0	50	5	10	10
% boulder	0	0	95	90	90
% instream veg.	50	0	0	0	0
% over veg.	50	40	0	0	0
% cutbank	0	10	0	0	0

At the top of the reach the channel completely disappears. The creek flows from a small cave at the base of a limestone outcrop (Appendix B, photo T6 10).

Fish

Reach 2 of Malook Creek appears to have good spawning and rearing habitat for salmonids (Photo 9). There is an abundance of cover for juveniles, the creek is stable and flows are maintained throughout the summer from groundwater. There

is an abundance of gravel for spawning. Coho and other salmonids likely spawn throughout this reach. The reach was not sampled for fish during the 1996 survey.

4.2.8.3 Malook Creek Reach 3 (1.0 - 2.7 km)

Throughout most of Reach 3, Malook Creek flows underground. There are short sections along the reach where there are surface flows and there are numerous areas where underground caves created by the creek have collapsed (Appendix B, photos R3 16-18). A popular tourist attraction called the Eternal Fountain lies within the Reach 3 drainage area and may be connected to Malook Creek (Appendix B, photos J1 3 and 4). The Eternal Fountain is an underground creek that appears at the top of a sinkhole and falls several metres to the bottom of the sinkhole.

Fish
Reach 3 has no fish habitat as most of the flow is underground.

4.2.8.4 Malook Creek Reach 4 (2.7 - 3.1 km)

Approximately 2.7 km upstream from the mouth, the creek again has surface flow (Appendix B, photo R3 19). Just above the point where the creek disappears underground it is crossed by the Port Hardy Main (Appendix B, photo R3 15). At this point the channel width is approximately 5 m and the gradient is 10%. The flow was approximately 30 $L \cdot sec^{-1}$ on August 29, 1996.

The reach was not sampled for fish during the 1996 survey.

4.2.8.5 Malook Creek Reach 5 (3.1 - 5.8 km)

The gradient increases substantially to 38% in Reach 5. In this reach the creek flows down a mountainside from an elevation of 1,193 m through several gulleys. The hillside was logged to the top of the ridge ≈15 years ago. This reach is unlikely to contain fish habitat due to the steep gradient. The reach was not sampled for fish during the 1996 survey.

4.2.9 Yootook Creek (WSC: 930-8652-426-068)

Yootook Creek, flowing north, joins the Benson River 2 km upstream from the river mouth (Figure 10). This steep, fast flowing creek is 7.4 km long and drains an area of 8.9 km^2. Small mountains lying at the back and sides of the valley rise steeply to 1,300 m. The Yootook valley was heavily logged approximately 15 to 20 years ago. All of the timber was removed from the valley bottom. Some timber

was left along the ridges and steep sides of the valley along the upper reaches. Yootook Creek appears to have six reaches (Table 11). Sites in only three of the reaches were surveyed and not all the reach boundaries were verified.

4.2.9.1 Yootook Creek Reach 1 (0.0 - 0.2 km)

Reach 1 is a short, unconfined section where the creek runs across the flood plain of the Benson River (Appendix B, photos T6 4, R3 4). The gradient is 3%, the channel width averages 16.4 m and the substrate is primarily cobble and boulder. The habitat is 80% riffle and 20% pool. The discharge was approximately 30 $L \cdot sec^{-1}$ on August 28, 1996 and 180 $L \cdot sec^{-1}$ on September 1, 1996. Cover for fish is primarily boulder as there was little large woody debris in the channel. The riparian vegetation is dominated by alders.

Fish

Hamilton (1980) indicates that coho, chinook and sockeye spawn in Reach 1 of Yootook Creek. Coho, Dolly Varden and rainbow trout juveniles were captured by electroshocker in Reach 1 on September 1, 1996. Dolly Varden was the most prevalent of the three species. Reach 1 appears to contain poor coho spawning and rearing habitat due to the coarse substrate and the lack of pools and cover.

4.2.9.2 Yootook Creek Reach 2 (0.2 - 0.8 km)

In Reach 2, Yootook Creek is entrenched in a steep walled limestone canyon (Appendix B, photos T6 3, R3 3). The walls of the canyon are approximately 20 m high. The channel width averages 9.5 m, the substrate is mainly cobble and boulder and the habitat is mainly pool, riffle and rapids. The gradient is 5% at Site 2 in this reach but the 1:20,000 TRIM map indicates the gradient is 20% over the length of the reach. There are several obstructions and most of the cover for fish is from boulders. Approximately 450 m upstream there is a set of cascades that drops 6 m over a distance of 20 m. At 500 m upstream a logjam has created a 1.2 m high waterfall (Appendix B, photo T6 3) and at 600 m upstream a larger logjam has created a 6 m high waterfall which is impassable to fish (Photo 11).

Fish

The suitability of Reach 2 for rearing trout and coho juveniles is low and the reach has little spawning habitat due to the lack of gravel. As in Reach 1, Reach 2 may be more suitable habitat for Dolly Varden. The logjam at 600 m is the upper limit of anadromous fish access to the system. Hamilton (1980) and MELP file data

insert photos 10,11,12

indicates that anadromous fish could at one time pass beyond Reach 2 by at least 400 m. The reach was not sampled for fish during the 1996 survey.

4.2.9.3 Yootook Creek Reach 3 (0.8 - 2.4 km)

In Reach 3 the channel is no longer entrenched in a steep walled canyon. The channel flows an irregular pattern and is confined. The gradient averages 5% (1:20,000 TRIM map). MELP (Nanaimo) file data indicates that there is a 6 m high waterfall in the reach, approximately 1.3 km from the mouth, that was considered as the upper limit for anadromous fish in this system. This reach was not examined during the 1996 survey.

4.2.9.4 Yootook Creek Reach 4 (2.4 - 3.4 km)

The channel becomes more entrenched and the gradient increases to 10% in Reach 3. The habitat is largely rapids and the substrate is cobble and boulder. Two high falls were observed from the helicopter. This reach was not examined during the 1996 survey.

4.2.9.5 Yootook Creek Reach 5 (3.4 - 5.9 km)

A site was surveyed using a helicopter for access on Reach 5 on October 8, 1996. The gradient is 6% at Site 3 (the 1:20,000 TRIM map indicates a gradient of 8% for the reach. The channel is confined and has an irregular pattern (Appendix B, photos 2 14-16). The substrate is primarily cobble and boulder, the habitat is mainly riffle and the channel width averages 12.6 m. The riparian vegetation consists of alder to 10 m in height and hemlock to 15 m in height.

Fish

No fish were captured at Site 3 which was sampled by electroshocker for 350 sec (conductivity = 65 μS, water temperature = 8°C). Falls downstream of Reach 5 have probably prevented fish from colonizing this reach. Further sampling by electroshocker should be done to determine if the area is barren of fish.

As in the lower reaches, this reach has a low suitability for salmonid rearing and spawning due to the coarse substrate, the lack of large woody debris and the lack of channel complexity. The reach may be more suited for Dolly Varden which seem to prefer streams with higher gradient and coarser substrate than other salmonids.

4.2.9.6 Yootook Creek Reach 6 (5.9 - 7.4 km)

Reach 6 has no fish habitat due to the gradient which averages 47%. The creek flows down a steep gulley at the end of the valley in this reach.

4.2.10 Howlal Creek (WSC: 930-8652-426-016)

Howlal Creek flows south for 7.1 km before flowing into the Benson River 500 m upstream from the mouth of the river (Figure 10). The Howlal Creek watershed, which lies just east of Victoria lake, covers an area of 10.0 km^2. The watershed was extensively logged between 15 and 35 years ago. Unlike most of the smaller creeks in the Marble River watershed, much of Howlal Creek has a low gradient. Three reaches were identified (Table 12).

4.2.10.1 Howlal Creek Reach 1 (0.0 - 3.1 km)

In Reach 1 the gradient averages 1.9% (Appendix B, photos 6 5, R3 5-8, R3 22 and 23). The channel is fairly straight and is frequently confined through most of the reach. The lower portion of the reach is unconfined as it crosses the flood plain of the Benson River. Two sites were surveyed in Reach 1.

Site 1 is located 0.4 km upstream from the creek mouth. At this site the channel width is 11.9 m, the habitat is primarily riffle (60%) and the substrate contains cobble (50%), gravel (20%) and boulder (15%). The channel appears to be stable (Photo 10). The discharge was estimated at 30 $L \cdot sec^{-1}$ on August 29, 1996 and the wetted width was 5.5 m. The riparian vegetation had been logged approximately 35 years ago. Alders to 30 cm in diameter now dominate the riparian area (Photo 10). There is little large woody debris in the reach as a consequence of logging. Some old growth logs and stumps covered approximately 5% of the channel. Boulders provide the majority of cover for fish.

A second site (Site 2) was surveyed 1.4 km up the reach where a patch of first growth timber was left alongside the creek. Alder still dominates the riparian zone although there were also scattered large conifers mainly along the west bank. There appeared to be at least twice as much large woody debris in the channel in this area. The substrate composition was similar to Site 1. The channel width averages 9.5 m. Cascades were observed in the reach approximately 2.2 km and 2.6 km upstream from the creek mouth. The first set of cascades drops 1.5 m over a distance of 2 m (Appendix B, photo R3 8) and the second set drops 2.5 m over a distance of 20 m. Both these sets of cascades are passable to coho and steelhead.

Table 12. Summary of habitat characteristics of Howlal Creek, Link River and Jeune Creek, August 1996.

	Howlal Reach 1	Howlal Reach 2	Link Reach 1	Link Reach 2	Link Reach 3	Jeune Reach 1
Length (km)	3.1	2.8	0.5	0.8	0.4	0.8
Chan. width (m)	11.9	8.8	35.7	16.3	36.7	11.1
Wet. width (m)	5.5	4.3	13.9	6.4	4.1	2.4
Riffle depth (cm)	10	20	31	50	52	19
Pool depth (cm)	73	45	200	160	175	68
% pool	30	20	31	52	20	10
% riffle	60	80	20	0	0	70
% glide	10	0	49	21	0	20
% cascades	0	0	0	0	80	0
% rapids	0	0	0	27	0	0
Gradient (%)	1.9	4.3	1.5	3	15	7.5
Debris area (%)	5	2	5	0	0	5
% stable	70	50	50	-	-	20
% fines	5	5	5	0	0	5
% small gravel	5	5	5	0	0	5
% large gravel	15	15	10	0	0	10
% small cobble	25	25	15	10	0	25
% large cobble	35	30	30	20	0	35
% boulder	15	15	35	40	10	20
% bedrock	0	5	0	30	90	0
D90 (cm)	30	35	50	90	30	35
Total cover %	25	10	20	40	10	20
% deep pool	0	0	0	20	100	0
% LOD	30	10	10	0	0	10
% boulder	60	70	80	80	0	80
% instream veg.	0	0	0	0	0	0
% over veg.	0	20	10	0	0	0
% cutbank	10	0	0	0	0	10

Fish

Fish densities were assessed near Site 1 in Reach 1. There were high densities of coho trout juveniles and small numbers of rainbow trout juveniles at the site. Hamilton (1980) indicates that coho spawn throughout Reach 1.

4.2.10.2 Howlal Creek Reach 2 (3.1 - 5.9 km)

In Reach 2, the gradient increases to 4.3%. Two sites, located 3.2 km and 4.6 km upstream, were surveyed. At these sites the substrate was coarser and there was a higher proportion of riffle habitat than in Reach 1. Riffle comprised 80% of the habitat, boulder and cobble comprised 80% of the substrate and the channel width averaged 8.3 m. The discharge ranged from 20 $L \cdot sec^{-1}$ near the bottom of the reach to no discharge just above Site 4.

Fish

Coho fry were observed from the bank all throughout Reach 2 to Site 4. Coho fry were very numerous at Site 3 and became less numerous towards Site 4. Hamilton (1980) indicates that coho spawn throughout Reach 2.

4.2.10.3 Howlal Creek Reach 3 (5.9 - 7.1 km)

The gradient increases to 60% throughout Reach 3, therefore, this reach has no fisheries potential. The creek flows down the mountainside through a gulley in this reach.

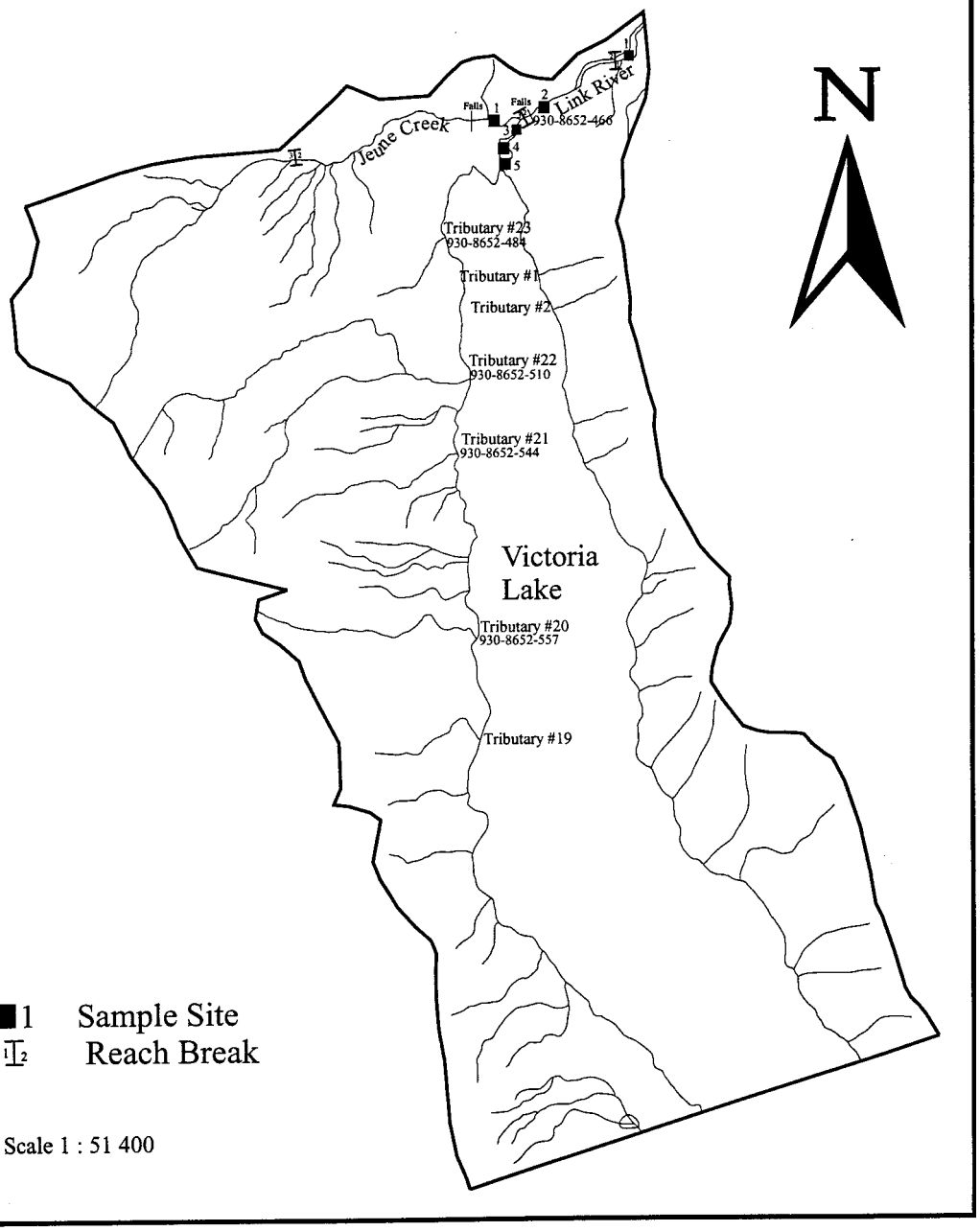
4.2.11 Link River (Middle Marble River)

The Link River flows for 1.7 km from Victoria Lake to Alice Lake (Figures 9 and 11). The river drains an area of 140 km^2 which is 30% of the Marble River watershed. Between 1925 and 1953 the discharge here averaged 14.9 $m^{3} \cdot sec^{-1}$ (WAC 1989; Figure 3). The discharge was 1.7 $m^{3} \cdot sec^{-1}$ on September 6, 1996. The area in the vicinity of the lower third of the river was logged approximately 30 years ago while the area above that has been logged within the last 15 years. The Link River has three reaches (Table 12).

4.2.11.1 Link River Reach 1 (0.0 - 0.5 km)

In Reach 1 the channel is unconfined as it crosses a large alluvial fan (Appendix B, photos T4 9-11, T7 32-37, R2 13-15). The channel is unstable, the gradient averages 1.5% and the substrate is primarily cobble and boulder (Photo 12). There are remnants of old channels parallel to the main channel across the fan and the present channel splits near the mouth. The habitat is 49% glide, 31% pool and 20% riffle. The channel width averages 35.7 m. The north bank of the river has been stabilized with riprap to protect the regional campsite situated at the river mouth. There is little cover for fish in the reach other than boulder. The riparian vegetation is mainly large alder and willow trees.

Figure 11
Sample Sites on Northern Victoria Lake and Link River.



Fish

Fish densities were assessed at a site in Reach 1 on September 6, 1996. Coho juveniles, rainbow trout juveniles, Dolly Varden and prickly sculpins were observed. Coho juveniles were the most prevalent. Reach 1 does not appear to be ideal rearing habitat for coho due to the lack of cover. Hamilton (1980) indicates that coho, chinook and sockeye spawn in Reach 1. Summer steelhead have been observed in the river as well (Nanaimo MELP file data).

4.2.11.2 Link River Reach 2 (0.5 - 1.3 km)

The Link River is entrenched in a steep walled canyon in Reach 2 (Appendix B, photos T4 17, 23 and 24. The majority of the canyon is basalt but there are some limestone areas. The sides of the canyon are approximately 20 m high. Old growth trees that were over hanging the canyon and could not be fallen were left along the edge of the canyon when the area was logged 10 - 15 years ago. The channel width averages 16.3 m, the substrate is boulder and bedrock and the gradient is 3%. The habitat is 52% pool, 27% rapids and 21% glide. There is an abundance of cover for fish in the form of boulders and deep pool. At the top of the reach at 1.3 km is a waterfall that is impassable to all species of fish (Photo 13, Appendix B, photo 2 17). The falls are split during low flows. The lowest falls are 6 m high.

Fish

All of Reach 2 is accessible to anadromous. The reach appears to be good trout rearing habitat but poor coho rearing habitat due to the faster flowing nature of this reach and lack of large woody debris. There is little gravel in this reach for spawning. The area may be a good holding area for summer steelhead. The reach was not sampled for fish during the 1996 survey.

4.2.11.3 Link River Reach 3 (1.3 - 1.7 km)

Through most of Reach 3, the river is entrenched with reposed bedrock banks (Appendix B, photo T4 18-22). Just above the falls at the bottom of the reach, the gradient is 15%, the channel averages 36.7 m wide and the habitat is cascades and rapids for 125 m (Appendix B, photo T4 22. Upstream of the cascades is a large 200 m long by 100 m wide pool (Appendix, photo T4 21). Between Victoria Lake and the large pool is another short section of cascades and rapids (Appendix B, photo T4 18). Cascades above the pool drop approximately 8 m over a distance of 20 m (40% gradient). At the lake outlet there is an old concrete and wood dam

photos 13,14,15

that has raised the level of Victoria lake by 1 m (Appendix B, photo T4 19). The channel is 54 m wide at the dam.

Fish

Victoria Lake has populations of rainbow trout, cutthroat trout and Dolly Varden (Nanaimo MELP file data). These species of fish are probably present in Reach 3 but they would be stream resident, as fish from Victoria Lake could have difficulty ascending the cascades just downstream of the lake outlet. The large pool is the only area that has much rearing habitat as the rest of the reach is mainly cascades. The reach was not sampled for fish during the 1996 survey.

4.2.12 Jeune Creek (WSC: 930-8652-466)

Jeune Creek lies just south of Sorenson Creek and flows east to join the Link River 1.2 km from the mouth just downstream of the Link River falls (Figure 11). The creek is 4.4 km long and drains an area of 4.5 km^2. Hills at the back of the watershed rise to 900 m in height. The watershed was almost completely logged between 15 and 30 years ago except for a few patches of timber in the upper part of the watershed. Only the lower 400 m of the creek was assessed during the 1996 survey. The creek has three reaches (Table 12).

4.2.12.1 Jeune Creek Reach 1 (0.0 - 0.8 km)

Reach 1 of Jeune Creek is confined, has a 7.5% gradient (1:20,000 TRIM map) and an average channel width of 11.1 m (Appendix B, photo T4 12-15, R2 12). The creek has a cobble, boulder substrate and the habitat is primarily riffle. The creek had an estimated discharge of 20 $L \cdot sec^{-1}$ on August 23, 1996 and the wetted width averaged 2.4 m. The channel is subjected to high flows and is unstable in some areas. An estimated 25% of the banks were failing. There is little large woody debris in the channel. Logging along this reach has likely lead to a loss of channel stability and there has been a loss of large woody debris. At the bottom of the reach is a set of cascades that drop 3.5 m over a distance of 9 m (39% gradient) and is likely a barrier to anadromous fish (Photo 15). Approximately 400 m upstream from the mouth is a second barrier where the creek drops 10 m over a distance of 25 m. One waterfall in this area is 2.5 m in height (Appendix B, photo T4 13).

The West main crosses Jeune Creek approximately 200 m upstream from the mouth. The bridge is in danger of being washed out during high flows as there is only 89 cm between the bottom of the bridge and the creek bed (Photo 14).

Fish

Rainbow trout were captured by electroshocker 200 m above the lower barrier in Reach 1 of Jeune Creek on September 7, 1996. One trout was maturing indicating that it was probably stream resident and also indicating that the reach is not utilized by anadromous fish due to the barrier at the bottom.

4.2.12.2 Jeune Creek Reach 2 (0.8 - 1.8 km)

The channel becomes narrower and more entrenched in Reach 2. The habitat is mainly cascades and rapids and the gradient averages 10%. No sites were surveyed in 1996.

4.2.12.3 Jeune Creek Reach 3 (1.8 - 4.4 km)

The gradient increases to 24% in Reach 3.

4.2.13 Teihsum River (WSC: 930-8652-725)

The Teihsum River (Green River) flows northwest for 8.8 km to the eastern shore of Victoria Lake (Figure 12). The watershed covers an area of 29.5 km^2. The watershed has a high relief with low elevation mountains rising to 1,326 m in height. The valley bottom from the river mouth to the headwaters has been extensively logged over the last 25 - 30 years. The Teihsum River has a large tributary (WSC: 930-8652-725-259) that joins the river 2.5 km upstream from the mouth. The Teihsum River has six reaches and its main tributary has four reaches (Tables 13 and 14).

4.2.13.1 Teihsum River

In Reach 1, the channel has an irregular meander pattern and is unconfined (Appendix B, photo T6 11-13, J1). The gradient is 2%, the channel averages 16.6 m in width and the substrate is primarily cobble and gravel. The discharge was 0.64 $m^3 \cdot sec^{-1}$ and the wetted width was 9.6 m on August 31, 1996. A few large trees were left along the river banks when the area was logged several decades ago. Some of these trees that have fallen into the river have created large pools. Second growth alder and hemlock now dominate the riparian zone (photo 16). Some of the gravel-cobble banks are failing.

Figure 12
Sample Sites on Teihsum River and Tributaries.

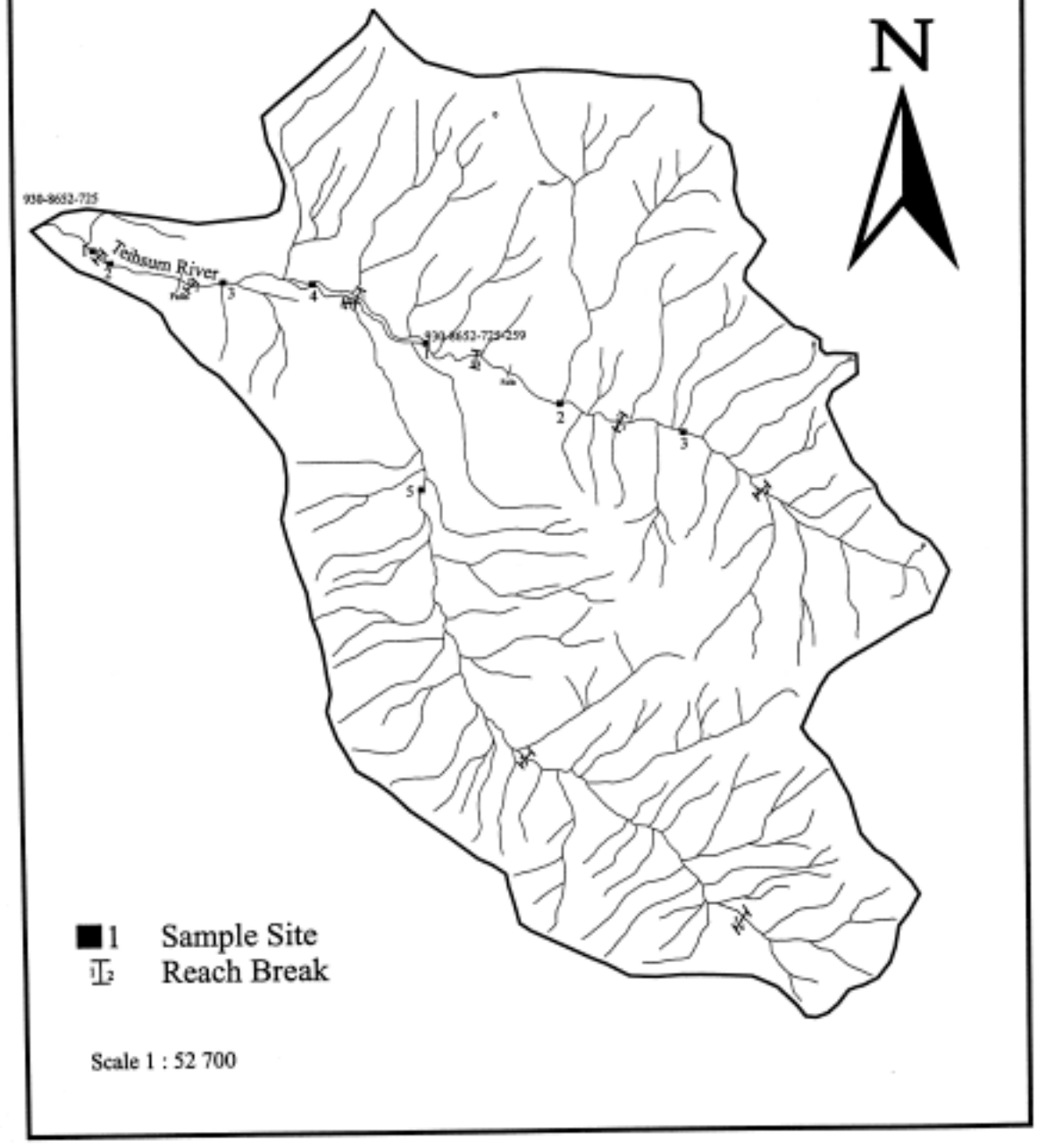


Table 13. Summary of habitat characteristics of the Teihsum River, August 1996.

	Reach 1	Reach 2	Reach 3	Reach 4
Length (km)	0.6	0.5	1.4	2.0
Chan. width (m)	16.6	12	41.3	22.9
Wet. width (m)	9.6	7	0	0
Riffle depth (cm)	18	25	0	0
Pool depth (cm)	95	165	0	0
% pool	42	60	0	0
% riffle	40	0	0	0
% glide	18	0	0	0
% cascades	0	20	0	0
% rapids	0	20	0	0
Gradient (%)	2	2.7	1	2
Debris area (%)	10	0	10	5
% stable	80	-	0	25
% fines	15	5	10	5
% small gravel	10	10	10	5
% large gravel	25	10	30	20
% small cobble	30	10	30	30
% large cobble	15	15	20	30
% boulder	5	40	0	10
% bedrock	0	10	0	0
D90 (cm)	25	200	20	26
Total cover %	15	40	0	10
% deep pool	0	20	0	0
% LOD	60	0	50	34
% boulder	0	80	0	33
% instream veg.	0	0	0	0
% over veg.	20	0	50	33
% cutbank	20	0	0	0

Fish

A few redds were observed in this reach and a pair of salmonids, probably Dolly Varden, were observed spawning during early September. Reach 1 appears to have excellent trout and Dolly Varden spawning habitat due to the high proportion of gravel in 20 cm deep glide and riffle. Cutthroat trout and Dolly Varden juveniles were captured in this reach during a stream classification survey on November 1987 conducted by Western Forest Products (WFP file data). The reach was not sampled for fish during the 1996 survey.

Table 14. Summary of habitat characteristics of the unnamed tributary (WSC 930-8652-725-259) to the Teihsum River and the upper Marble River, August 1996.

	Trib. Reach 1	Trib. Reach 2	Trib. Reach 3	U. Mar. Reach 1	U. Mar. Reach 2	U. Mar. Reach 3
Length (km)	1.2	1.4	1.2	4.5	1.5	1.5
Chan. width (m)	25.5	13	11.5	51.9	15.2	6.1
Wet. width (m)	4.7	2	5.0	10.3	8.4	4.6
Riffle depth (cm)	23		20	30	18	-
Pool depth (cm)	70		42	120	58	55
% pool	0	30	20	26	27	90
% riffle	0	0	80	33	33	0
% glide	0	0	0	41	0	10
% cascades	0	35	0	0	0	0
% rapids	0	35	0	0	40	0
Gradient (%)	1.5	8	3.8	0.5	5	≈0
Debris area (%)	5	0	5	5	3	5
% stable	20	-	20	20	50	100
% fines	0	0	5	5	0	30
% small gravel	5	0	5	5	5	20
% large gravel	10	10	10	20	15	30
% small cobble	20	10	20	30	15	10
% large cobble	35	20	40	30	35	10
% boulder	30	40	20	10	30	0
% bedrock	0	20	0	0	0	0
D90 (cm)	40	200	60	30	100	13
Total cover %	20	20	20	15	15	30
% deep pool	0	50	0	10	0	0
% LOD	20	0	10	30	5	10
% boulder	60	50	85	40	95	0
% instream veg.	0	0	0	0	0	80
% over veg.	20	0	5	10	0	10
% cutbank	0	0	0	10	0	0

photos 16 and 17

4.2.13.2 Teihsum River Reach 2 (0.6 - 1.1 km)

In Reach 2, the channel becomes entrenched by a steep bedrock canyon where the habitat is primarily pools, rapids and cascades (Appendix B, photos 14 and 15). The channel is approximately 12 m wide, the gradient is 2.7% and the substrate is predominately large boulders and cobble. The canyon walls are approximately 10 m high. A falls in the canyon blocks fish from migrating upstream (WFP file data).

Fish

This reach has an abundance of pool habitat with large boulders for cover. The reach probably contains good rearing habitat for trout. The reach was not sampled for fish during the 1996 survey.

4.2.13.3 Teihsum River Reach 3 (1.1 - 2.5 km)

The channel in Reach 3 is wide, unstable, braided and has a gradient of 1%. There was no flow in most of the reach on September 2, 1996 (Appendix B, photos T7 19 and 20). Alders now dominate the riparian zone which was logged approximately 30 years ago. Spruce and hemlock are scattered in amongst the alders. Logging has probably had a big impact on this reach by destabilizing the banks which in turn has lead to increases in channel widths, and a loss of woody debris and channel complexity. The wide unstable channel and the alluvial material deposited in the reach from increased erosion in the watershed may have lead to the lack of surface flows. At the bottom of the reach the river runs into a single narrower channel that had flow on September 7, 1996 (Appendix B, photos T8 6 and 7). The substrate in Reach 3, which has a gradient of 1%, is primarily cobble and gravel.

Fish

A stream classification survey of this reach was conducted in November 1989 by WFP. Under the B.C. Coastal Fisheries/Forestry Guidelines, Reach 3 of the Teihsum River was classified as Class B (WFP file data). No sites were sampled during the 1996 survey.

4.2.13.4 Teihsum River Reach 4 (2.5 - 6.5 km)

Reach 4 lies above the main Teihsum River tributary and is similar in character to Reach 3 but it has a narrower channel width (22.9 m). The channel is unstable, has a high bedload movement and the substrate is primarily cobble and gravel. As in Reach 3 logging has had a significant impact on this reach.

Fish

Reach 4 was dry, therefore, it had no fish on September 3, 1996. The 1989 WFP stream classification survey classified the lower 600 m of the reach as Class B indicating that non andromous fish are present.

4.2.13.5 Teihsum River Reach 5 (6.5 - 8.0 km)

The gradient increases to 8% in Reach 5. This reach was not surveyed. Aerial photographs indicate that the channel is more confined and stable than Reach 4. The valley bottom along this reach was logged approximately 20 years ago.

4.2.13.6 Teihsum River Reach 6 (8.0 - 8.8 km)

The gradient increases to 27% in Reach 6 as the river flows down steep slopes at the head of the valley. This reach was not sampled.

4.2.14 Teihsum River unnamed tributary (WSC: 930-8652-725-259)

This creek is 5 km long and flows west to join the Teihsum River 2.5 km upstream from the mouth (Figure 12). The valley bottom along this tributary has been extensively logged. The roads in the watershed have washed out or have become overgrown.

4.2.14.1 Teihsum River unnamed tributary Reach 1 (0.0 - 1.2 km)

Like Reach 3 of the Teihsum River, Reach 1 (Table 14) of the main Teihsum River tributary is wide (25.5 m) and unstable (Appendix B, photos T7 13-15). Alders now dominate the riparian zone which was logged approximately 20 years ago. Spruce and hemlock are scattered in amongst the alders. Logging has probably had a big impact on this reach by destabilizing the banks which has lead to increases in channel widths, a loss of woody debris and a loss of channel complexity. The wide unstable channel and the bedload deposition may have lead to low summer flows. The lower half of the reach had no flow. Site 1 in the middle of the reach had a flow of only 4 $L \cdot sec^{-1}$ of flow on September 3, 1996. The substrate in this reach is primarily cobble and gravel and the gradient is 1.5% (Photo 16).

Fish

The 1989 WFP stream classification survey labeled the lower 600 m of the reach as Class B indicating that non andromous fish are present. The river was unclassified upstream of that point. The reach was not sampled during the 1996 survey. The lower half of the reach was dry and had no fish.

4.2.14.2 Teihsum River unnamed tributary Reach 2 (1.2 - 2.6 km)

The creek in Reach 2 flows through a bedrock canyon that has several impassable barriers. The gradient averages 8%, the channel width was approximately 13 m at the survey site and the habitat is primarily cascades and rapids (Appendix B, photo T7 18). First growth timber, that was leaning over the river and could not be fallen, has been left along the edge of the canyon. The discharge in this reach was approximately 60 $L \cdot sec^{-1}$ on September 3, 1996. A large tributary (WSC 930-8652-259-392) located 800 m up the reach, has cut a new 400 m long channel down a logging road and down the hillside(Appendix B, Photos T7-16 and T7-17). The creek was diverted by a blocked bridge.

Fish

Reach 2 has little potential fish habitat due to steep slope and numerous barriers. Fish are probably not present in the reach.

4.2.14.3 Teihsum River unnamed tributary Reach 3 (2.6 - 3.8 km)

The channel is confined and fairly straight with a 3.8% gradient (1:20,000 TRIM map) in Reach 3. The channel width averages 11.5 m, the substrate is cobble and boulder and the habitat is primarily riffle (Appendix B, photos 2 10 and 11). The valley bottom was logged about 10 years ago along this reach.

Fish

No fish were captured at Reach3 Site 3 during 397 sec of electroshocking (conductivity = 57 µS; water temperature = 12 °C) on October 8, 1996. The barriers in Reach 2 appear to have prevented fish from colonizing this reach. Further sampling by electroshocker should be done to determine if the reach is barren of fish.

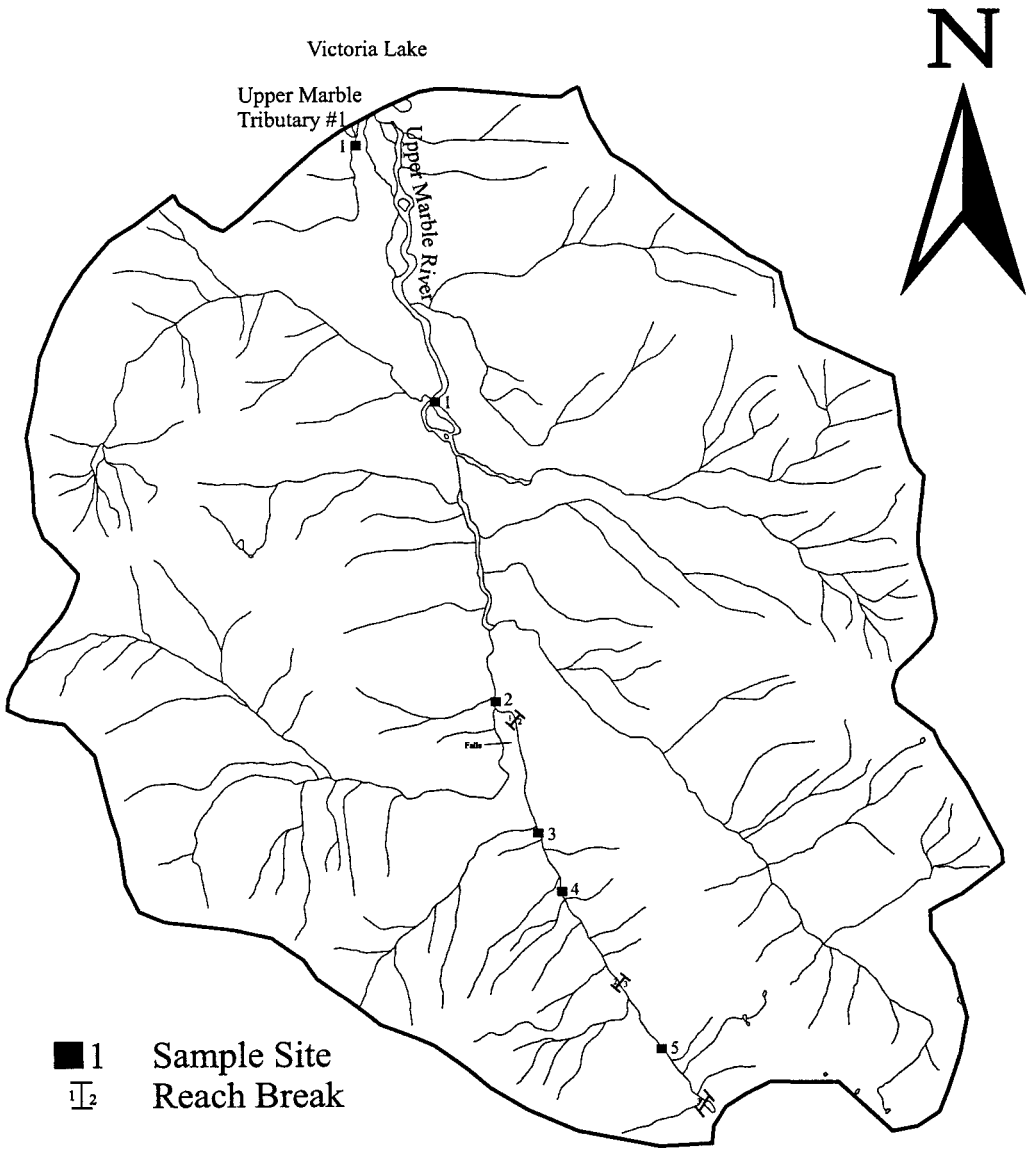
4.2.14.4 Teihsum River unnamed tributary Reach 4 (3.8 - 5.4 km)

The gradient increases to 26% in Reach 4 as the river flows down the steep slopes at the head of the valley. This reach was not sampled for fish.

4.2.15 Upper Marble River

The upper Marble River flows north to the south end of Victoria Lake (Figure 13). The river drains an area of 35.7 km^2 and is 8 km long. The majority of timber has been logged from the valley bottom over the last 25 years. Much of the timber

Figure 13
Sample Sites on Upper Marble River.



along the sides of the valley has not yet been logged. The river had a discharge of 1.2 $m^{3}\cdot sec^{-1}$ on September 3, 1996. The river has three reaches (Table 14).

4.2.15.1 Upper Marble River Reach 1 (0.0 - 4.5 km)

The channel in Reach 1 is low gradient (0.5%), is irregularly meandering and frequently confined (Appendix B, photos T7 8 and 9, T6 16-18, T6 24 and 25). The channel is wide (51.9 m) and unstable. The habitat is almost equal proportions of glide, pool and riffle and the substrate is primarily cobble and gravel. Logging that occurred about 20 years ago has likely had a significant impact on this reach. Removal of trees in the riparian zone has destabilized banks resulting in a wider, more braided, less stable and less complex channel (Photo 17). There is little large woody debris in the channel (5%) due to the removal of first growth timber from the riparian zone. A site at the top of the reach in which the riparian zone was unlogged had substantially more large woody debris in the channel (10%) and the banks appear to be more stable.

Fish

MELP Nanaimo file data notes that Reach 1 of upper Marble River is a spawning area. This reach has extensive gravel beds that are probably utilized for spawning by Victoria Lake Dolly Varden, cutthroat trout and rainbow trout. The reach was not sampled for fish during the 1996 survey.

4.2.15.2 Upper Marble River Reach 2 (4.5 - 6.0 km)

The river becomes more confined and the gradient increases to 5% in Reach 2 (Appendix B, photos T6 19, 20 and 23). The habitat is largely rapids and riffle and the substrate is cobble and boulder. The channel averages 15.2 m in width, and is stable with little woody debris. No barriers to fish were observed in the reach.

Fish

Cutthroat trout juveniles were captured at Site 4 after 502 sec of electroshocking. Trout densities appeared to be low.

4.2.15.3 Upper Marble River Reach 3 (6.0 - 7.5 km)

The gradient decreases to almost zero in Reach 3 (Appendix B, photos T6 21 and 22). The habitat is primarily pool with a gravel and fine substrate. The channel averages 6.1 m in width. The discharge was estimated at 10 $L\cdot sec^{-1}$ on August 31, 1996. The area along Reach 3 was logged about 10 years ago. At the top of the reach the creek drains a small pond. There are a large number of logs floating in

the pond as a result of a slide (7.3 km upstream) that has come down the mountainside through an unlogged area into the pond.

Fish

No fish were captured in Reach 3 at Site 5, after 322 sec of electroshocking (conductivity = 24 µS; water temperature = 11 °C). More extensive sampling needs to be done in this reach to determine fish presence or absence as no barriers were observed downstream of Reach 3 that could block fish. Further sampling that could be done would be electroshocking of a higher gradient area at the bottom of the reach and the placement of Gee traps and a gillnet in the pond at the top of the reach.

4.2.16 Alice Lake tributaries

There are 14 tributaries to Alice Lake that have no stream names but are marked on the 1:20,000 TRIM map (Figures 8 and 9). These tributaries were surveyed for potential fish habitat (Table 15). The tributaries were numbered from 1 to 14 in a clockwise direction starting from a tributary at the north end of the lake. Some of these tributaries, although marked on the map, did not exist. 4.2.16.1 Tributary 1 (WSC: none; UTM: 09.610571.5597492)

4.2.16.1 Tributary 1 (WSC: 930-865200-19900; UTM: 09.610571.5597492)

Tributary 1 is a small low gradient creek that was surveyed for 100 m below the Port Alice highway (Figure 8; Appendix B, photos R1 8 and 9, T2 2). The channel was not well defined and averaged 5.4 m in width. It has a 1% gradient, the substrate is 100% fines. The creek flows through ≈50 year old second growth conifers with a thick understory of salmonberry and salal. The creek was dry except for a few small pools. This creek has very little fish habitat potential as no spawning gravel was observed and the creek is largely dry in the summer. An interim locational point of AL-1 was assigned to this stream.

4.2.16.2 Tributary 2 (WSC: 930-8652-208; UTM: 09.611402.5597368)

NTS map 92 L/11 indicated a creek located 500 m south of the outlet along the eastern shore of Alice Lake (Figure 8) but no creek was observed.

Table 15. Summary of habitat characteristics of Alice Lake unnamed tributaries, August 1996.

	Trib. 4 Reach 1	Trib. 5 Reach 1	Trib. 7 Reach 1	Trib. 7 Reach 2	Trib. 7 trib. Reach 1	Trib. 11 Reach 1	Trib. 12 Reach 1
Length (km)	0.9	0.8	2.5	1.0	3.0	1.0	0.8
Chan. width (m)	5.4	5.4	8.3	6.1	1.7	1.3	2.8
Wet. width (m)	0.3	2.3	2.8	3.5	1.1	1.3	1.0
Riffle depth (cm)	5	5	7	9	5	-	3
Pool depth (cm)	15	25	62	45	22	29	20
% pool	50	80	70	48	70	100	50
% riffle	50	20	30	41	30	0	50
% glide	0	0	0	11	0	0	0
% cascades	0	0	0	0	0	0	0
% rapids	0	0	0	0	0	0	0
Gradient (%)	16	4	2	2	2.5	4	5
Debris area (%)	40	10	10	10	10	5	25
% stable	80	80	80	90	100	100	80
% fines	5	0	5	5	5	10	15
% small gravel	5	5	5	5	20	40	5
% large gravel	15	10	40	20	40	40	30
% small cobble	20	20	40	30	25	10	20
% large cobble	30	25	10	30	10	0	20
% boulder	25	20	0	10	0	0	10
% bedrock	0	10	0	0	0	0	5
D90 (cm)	40	100	13	26	20	6	40
Total cover %	50	40	20	30	20	50	50
% deep pool	0	0	0	0	0	0	0
% LOD	20	20	30	20	40	10	50
% boulder	30	50	0	40	0	0	0
% instream veg.	0	0	0	0	0	70	0
% over veg.	30	20	40	20	50	20	25
% cutbank	20	10	30	20	10	0	25

4.2.16.3 Tributary 3 (WSC: 930-8652-242; UTM: 09.612182.5595868)

The NTS map 92 L/11 indicated a creek located 2.1 km south of the outlet along the eastern shore of Alice Lake (Figure 8) but no creek was observed.

4.2.16.4 Tributary 4 (WSC: 930-8652-298; UTM: 09.612506.5593792)

Tributary 4 flows southwest to the eastern shore of Alice Lake, 4 km from the northern end (Figure 8; Appendix B, photos T2 3-5). This tributary drains a small lake 2.1 km upstream from Alice Lake. The creek has two reaches. The first reach is 900 m long and has a gradient that averages 16% (1:20,000 TRIM map). The second reach is 1.2 km long and has a gradient of 3%. A site 100 m upstream from Alice Lake was surveyed on August 18, 1996. The creek has an average channel width of 5.2 m, a gradient of 5% and a cobble, boulder substrate at this site. The creek only had a wetted width of 0.3 m with a flow of 2 $L \cdot sec^{-1}$. The channel appears to be unstable with a heavy bedload movement and an abundance of large woody debris. The creek flows through thick 16 year old second growth timber. A small tributary to this creek flows through MB cutblock #4303 which is to be logged in 1997. The confluence of this tributary and the mainstem is 500 m upstream from Alice Lake.

Fish

Coho fry were observed in the creek from the bank but it appears to have a low suitability for salmonid spawning and rearing, at least in the lower reach, due to the steep gradient, the coarse substrate, the unstable nature of the creek and the low summer flows.

A stream classification assessment was conducted on this creek on November 5, 1995 (MB file data). Cutthroat trout and coho juveniles were found in the creek to a debris jam 175 m upstream. No fish were captured above the debris jam.

Marble River hatchery spawning distribution maps indicate that coho spawned in this creek as far upstream as ≈500 m in 1982 (Nanaimo MELP file data).

4.2.16.5 Tributary 5 (WSC: 930-8652-313-143; UTM: 09.612790.5593433)

Tributary 5 flows into Alice Lake along the eastern shore 5 km from the northern end of the lake (Figure 8; Appendix B, photos R1 10 and 11, T2 6, T7 21). This creek has two reaches, each 800 m long. The first reach has a gradient of 4%. At the bottom of the reach, the creek has a channel width of 5.4 m and the substrate is primarily boulder and cobble with 15% gravel. The creek flows through 20 year old second growth alder and cedar with a heavy understory of salal and salmonberry. The creek had a flow of 2 $L \cdot sec^{-1}$ and a wetted width of 2.3 m on August 18, 1996. The habitat mainly consisted of a series of shallow (25 cm) pools. Another site was examined 800 m further up the reach on September 4,

1996. The habitat characteristics at this site were similar to that of the lower site. The flow at this site was intermittent and was likely dry earlier in the summer.

The gradient increases to 13% in Reach 2. The amount of potential fish habitat at the time of the survey is low due to the steep gradient and low summer flows. Fish could possibly move into the reach at other times of the year when flows are higher.

Fish

There were numerous coho juveniles in the pools in lower Reach 1. The remains of a broomstick fence were found at the mouth of the creek. The Marble River hatchery collected broodstock from the creek in 1982 (Nanaimo MELP file data). No fish were captured from Site 2 in the upper part of Reach 1 after 120 sec of electroshocking on September 4, 1996. The creek at this site was likely dry during August which may be why no fish were captured. It is possible that fish are present at this site at other times of the year. Reach 1 of tributary 5 is probably a significant spawning and rearing area for coho.

4.2.16.6 Tributary 6 (WSC: none; UTM: 09.612850.5592000)

No channel was found for tributary 6 located 6 km from the southern end of Alice Lake along the eastern shore (Figure 8).

4.2.16.7 Tributary 7 (WSC: 930-8652-365; UTM: 09.613640.5590600)

Tributary 7 is the largest unnamed creek draining into Alice Lake. This tributary is located 4.3 km from the southern end of the lake on the eastern side. The creek drains an area of 8.9 km^2 and is 5.7 km long. It has three reaches and a tributary that flows into the creek from the southeast, 1.7 km from the mouth.

4.2.16.7.1 Tributary 7 Reach 1 (0.0 - 2.5 km)

Reach 1 is 2.5 km long. A 9 m high falls marks the upper end of the reach. All of Reach 1 is accessible to anadromous fish (MELP file data). A site was surveyed just upstream from the mouth on August 18, 1996 (Appendix B, photos R1 12 and 13, T2 6, R3 24). The channel width averages 8.3 m and the substrate is mainly cobble and gravel (photo 18). The creek was at a low stage with an approximate discharge of 20 $L \cdot sec^{-1}$ and a wetted width of 2.8 m. The riparian vegetation is dominated by approximately 25 year old alder and Douglas fir. The channel appears to be moderately unstable with an estimated 30% of the banks failing.

Fish

Tributary 7 is a significant coho stream. Reach 1 appears to have very good salmonid spawning and rearing habitat. The creek appears to have high densities of coho fry judging by the numerous fry observed from the bank and a set made through a pool with a beach seine.

4.2.16.7.2 Tributary 7 Reach 2 (2.5 - 3.5 km)

A site in Reach 2 was surveyed where the creek is crossed by the Port Hardy Main 2.7 km upstream (Appendix B, photo T7 22). Reach 2 is 1.0 km long and has a gradient of 2%. The channel width averages 6.1 m and the substrate is primarily cobble and gravel (Photo 18). The riparian area is dominated by approximately 40 year old alder and hemlock. The channel appears to be fairly stable. The habitat consists of 48% pool, 41% riffle and 11% glide. The discharge was estimated at 20 $L \cdot sec^{-1}$ and the wetted width averaged 3.5 m on September 4, 1996.

Above Reach 2, where the gradient increases to an average of 26%, there is little potential for fish habitat.

Fish

Stream resident Dolly Varden and cutthroat trout were captured by electroshocker at Site 2 in Reach 2. This reach appears to have good salmonid rearing and spawning habitat. Densities of Dolly Varden and cutthroat trout appeared to be high.

4.2.16.7.3 Tributary 7 Tributary (WSC: 930-865200-36500-41764)

The tributary to tributary 7 was surveyed in Reach 1 where it is crossed by the Port Hardy Main (UTM: 09.615431.5590859). Reach 1 is 3 km long and has an average gradient of 6% (1:20,000 TRIM map). The channel width averages 1.7 m, the substrate is gravel and cobble and the habitat is 70% pool and 30% riffle (Appendix B, photos J1 1 and 2). The creek had a discharge of 2 $L \cdot sec^{-1}$ on September 5, 1996.

Fish

Cutthroat trout were captured at Site 1 of the tributary 7 tributary. Although this creek has fish, it is a small creek with little flow in the summer. One of the cutthroat captured was maturing indicating that it was stream resident. The presence of stream resident cutthroat and the lack of coho could indicate that there is a barrier lower down the reach.

photos 18 and 19

4.2.16.8 Tributary 8 (WSC: 930-8652-400; UTM: 09.614480.5589660)

Tributary 8 had no flow and was mainly dry on September 3, 1996 (Appendix B, photos T7 23 and 24.. The creek has a channel width of 5 m and a gradient of 4% (1:20,000 TRIM map) in the lower 2 km. The lower 200 m of the creek could have some salmonid spawning habitat but the creek has no summer rearing habitat. Approximately 400 m upstream from the mouth the gradient increases to 20% for a few hundred metres. The steep gradient in combination with no flow makes it unlikely the creek above this steep section is utilized by fish. Just above the steep section (600 m upstream) is an area where about 1 ha of side hill slumped depositing a large volume of mud into the creek about 20 years ago.

Fish

Marble River hatchery 1982 spawning distribution maps indicate that coho, chinook and sockeye spawn in the lower 200 m of Tributary 8 (Nanaimo MELP file data). The creek was completely dry and contained no fish on September 3, 1996.

4.2.16.9 Tributary 9 (WSC: 930-8652-415; UTM: 09.615000.5588800)

No channel was found for Tributary 9 located 2.6 km from the northern end of Alice Lake along the eastern shore (Figure 9).

4.2.16.10 Tributary 10 (WSC: 930-8652-430; UTM: 09.615500.5586500)

No channel was found for Tributary 10 located at the northern end of Alice Lake, west of the mouth of the Benson River (Figure 9).

4.2.16.11 Tributary 11 (WSC: 930-8652-385; UTM: 09.613200.5589450)

Tributary 11 is located 4 km from the northern end of Alice Lake along the western shore (Figure 9). The creek drains two small lakes 1 km upstream from the mouth and has an overall gradient of 4% (1:20,000 TRIM map). For the first 150 m the creek flows through the Port Alice Fish and Wildlife rifle range. Site 1e on the creek was surveyed 600 m upstream from the mouth on September 6, 1996 (Appendix B, photos T7 30 and 31). The creek flows through a 20 m wide marsh in this area. The channel width averages 1.3 m, the substrate is gravel. The discharge was 4 $L \cdot sec^{-1}$.

Fish

Coho fry were electroshocked from Site 1. Dolly Varden have been seen in the creek as well and the two small lakes contain cutthroat trout (Ed Hinkley, Port Alice Fish and Wildlife Club, pers. comm.).

4.2.16.12 Tributary 12 (WSC: 930-865200-31300; UTM: 09.611220.5592831)

Tributary 12 is located 7.8 km from the northern end of Alice Lake along the western shore (Figure 8). This creek is a small 1.4 km long stream that drains two ponds, each about 1 ha in size. The overall gradient is steep at 17%. The lower 800 m has a 10% gradient. The lower 240 m of the creek flows through old growth cedar, hemlock and balsam forest which will be logged in 1997 (Appendix B, photos T2 10 and 11, T3 12a and 13a). The area has a thick understory of salal and salmonberry. This creek is accessible to anadromous fish up to a barrier located 245 m upstream from Alice Lake. The channel width is 3.5 m, the substrate is cobble and gravel and the habitat is a series of small pools and riffles. The creek only had a discharge of 1 $L \cdot sec^{-1}$ on August 18, 1996. The creek appears stable and contains an abundance of large woody debris.

Fish

A stream classification assessment was conducted on tributary 12 on November 5, 1995 (MB, Port McNeill file data). Coho and cutthroat juveniles were found in the creek up to the barrier, 245 m upstream. In addition, five coho adults were observed spawning in the lower reaches of the creek. Upstream of the barrier the creek received an S6 classification indicating that no fish were present.

Coho fry were observed from the bank in the lower reaches of the creek on August 18, 1996.

4.2.17 Victoria Lake unnamed tributaries

There are 23 tributaries to Victoria Lake that have no stream names but are marked on the 1:20,000 TRIM map (Figures 11 and 14). These tributaries were surveyed for potential fish habitat (Table 16). The tributaries were numbered from 1 to 23 clockwise starting from the north end of the lake. The area surrounding Victoria Lake has a high relief so many of the small tributaries flowing into the lake are steep and have intermittent flows (photo 19). No channels were observed for a few of the unnamed tributaries marked on 1:50,000 NTS maps.

Figure 14
Sample Sites on Tributaries to Southern Victoria Lake.

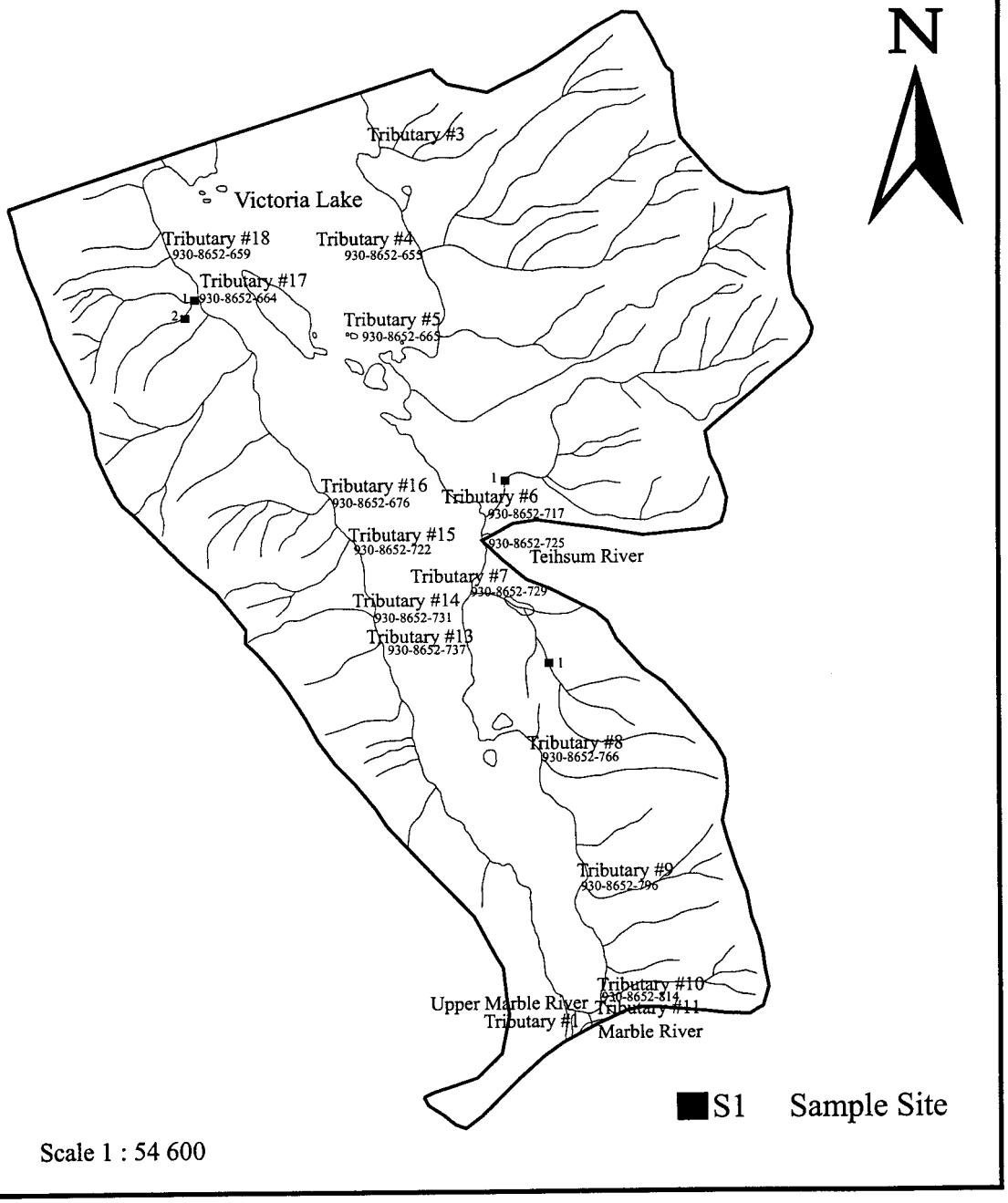


Table 16. Summary of habitat characteristics of unnamed Victoria Lake tributaries, August 1996.

	Trib. 6 Reach 1	Trib. 12 Reach 1	Trib. 12a Reach 1	Trib. 17 Reach 1	Trib. 17 trib. Reach 1
Length (km)	0.3	0.9	0.2	0.1	0.1
Chan. width (m)	5.4	2.8	2.9	28.5	1.9
Wet. width (m)	4	2.8	1.0	0.8	0.9
Riffle depth (cm)	nd	-	3	3	3
Pool depth (cm)	68	28	9	24	24
% pool	90	100	80	40	60
% riffle	10	0	20	60	40
% glide	0	0	0	0	0
% cascades	0	0	0	0	0
% rapids	0	0	0	0	0
Gradient (%)	0.5	0	2	6	6
Debris area (%)	15	5	5	5	20
% stable	100	100	100	0	100
% fines	50	100	5	0	5
% small gravel	25	0	5	10	20
% large gravel	25	0	45	40	40
% small cobble	0	0	40	30	25
% large cobble	0	0	5	20	10
% boulder	0	0	0	0	0
% bedrock	0	0	0	0	0
D90 (cm)	5	<0.2	15	20	10
Total cover %	30	80	10	20	50
% deep pool	0	0	0	0	0
% LOD	30	10	50	30	50
% boulder	0	0	0	0	0
% instream veg.	30	80	25	0	0
% over veg.	30	10	25	40	25
% cutbank	10	0	0	30	25

nd - no data

4.2.17.1 Tributary 1 (UTM: 09.61470.5582000)

No channel was found for Tributary 1 located 5.3 km from the northern end of Victoria Lake along the eastern shore (Figure 11).

4.2.17.2 Tributary 2 (UTM: 09.615300.5581400)

No channel was found for Tributary 2 located 6.2 km from the northern end of Victoria Lake along the eastern shore (Figure 11).

4.2.17.3 Tributary 3 (UTM: 09.616100.5579700)

No channel was found for Tributary 3 located 8.1 km from the northern end of Victoria Lake along the eastern shore (Figure 14).

4.2.17.4 Tributary 4 (WSC: 930-8652-655; UTM: 09.616225.5579385)

Tributary 4 is located 8.3 km from the northern end of the lake along the eastern shore (Figure 14). This creek has a 6 m wide channel, the gradient is 10% in the lower reaches and the substrate is cobble and gravel. The channel was dry when inspected on August 20 and September 7, 1996. This creek has little potential salmonid rearing and spawning habitat.

4.2.17.5 Tributary 5 (WSC: none; UTM: 09.616450.5578700)

No channel was found for Tributary 5 located 9.2 km from the northern end of Victoria Lake along the eastern shore (Figure 14).

4.2.17.6 Tributary 6 (WSC: 930-8652-717; UTM: 09.616900.5577100)

Tributary 6 is located 10.7 km from the northern end of Victoria Lake along the eastern shore (Figure 14). The lower 300 m of this tributary creek has a low gradient (≈0.5%) as is flows across the flood plain near mouth of the Teihsum River. Above this section the gradient gradually increases to 20%, 1.2 km further upstream. The creek was surveyed 300 m upstream from the mouth on September 7, 1996 where it is crossed by the Victoria Lake Main. At this site the creek has a channel width of 5.4 m, the substrate is 50% fines and 50% gravel and the majority of the habitat is pool. The discharge was low at 2 $L \cdot sec^{-1}$ and the wetted width was 4 m. The creek flows through a swamp with skunk cabbage, alder and hemlock in the riparian zone. The area was logged several decades ago.

Cutthroat trout fry were captured by electroshocker at the sample site.

4.2.17.7 Tributary 7 (WSC: 930-8652-729; UTM: 09.616600.5575926)

Tributary 7 is located just south of the Teihsum River, 3.7 km from the southern end of the lake along the eastern shore (Figure 14; Appendix B, photos T8 4

and 5). The creek was surveyed on September 7, 1996 where it is crossed by the Victoria Lake Main. It has a channel width of 2.5 m, a cobble and gravel substrate and a gradient of ≈2%. The reach is 800 m long. The channel is heavily overhung with salmonberry bushes. The channel was dry so it contained no summer salmonid rearing habitat in the vicinity of the survey site.

4.2.17.8 Tributary 8 (WSC: 930-8652-766; UTM: 09.617300.5575200)

Tributary 8 is located 2.1 km north of the southern end of the lake along the eastern shore (Figure 14). The channel width is approximately 10 m wide and the substrate is gravel, cobble and boulder. The gradient is 10% near the mouth and it increases substantially a short distance upstream. The creek appears to be unstable due to a heavy bedload and the braided channel. The creek was dry when surveyed on August 20, 1996 near the creek mouth. The steep gradient and zero discharge in the summer indicates that it has little potential as fish habitat.

4.2.17.9 Tributary 9 (WSC: 930-8652-812; UTM: 09.617600.5574200)

Tributary 9 is located 0.8 km north of the southern end of the lake along the eastern shore (Figure 14).

4.2.17.10 Tributary 10 (WSC: 930-8652-814; UTM: 09.617900.5573000)

Tributary 10 is at the northern end of Victoria Lake, east of the upper Marble River (Figure 14). No channel was observed at this site.

4.2.17.11 Tributary 11 (WSC: none; UTM: 09.617900.5572900)

Tributary 11 is located at the northern end of Victoria Lake, east of the upper Marble River. No channel was observed at this site.

4.2.17.12 Tributary 12 (WSC: 930-8652-868-399; UTM: 09.617500.5572694)

Tributary 12 is located at the southern end of Victoria Lake, west of the upper Marble River (Figure 14, Appendix B, photos T7 38, T8 1). This small tributary flows for 800 m across the flood plain near the mouth of the upper Marble River and drains into Victoria Lake. The creek was surveyed on September 7, 1996 where it is crossed by the Port Alice Main. The creek has a channel width of 2.8 m and has a 100% fine substrate with a gradient that is close to 0%. The creek flows through marsh. The habitat is 100% pool with an abundance of sedge and skunk cabbage growing in the channel. The creek had no flow. No fish were captured during 328 sec of electroshocking (conductivity = 51 µS; water temperature =

12 °C) at the sample site possibly because the creek is small, is choked with vegetation and has a low suitability as salmonid spawning habitat due to the fine substrate. It is possible that other areas of the creek contain fish which should be further investigated for the presence of fish.

4.2.17.13 Tributary 13 (WSC: 930-8652-737; UTM: 09.616100.5575900)

Tributary 13 is located 3.4 km north of the southern end of the lake along the western shore (Figure 14). The gradient is 10% in the first 30 m after which it increases to 40%. The channel width is 3 m and the substrate is cobble and gravel. The channel was dry on August 20, 1996. This creek has very little potential as fish habitat due to the steep gradient and lack of summer flows.

4.2.17.14 Tributary 14 (WSC: 930-8652-731; UTM: 09.616000.5576200)

Tributary 14 is located 3.9 km north of the southern end of the lake along the western shore (Figure 14). The gradient is 20%, the channel width is 9 m and the substrate is boulder and cobble. The channel was dry on August 20, 1996. This creek has very little potential as fish habitat due to the steep gradient, the coarse substrate and lack of summer flows.

4.2.17.15 Tributary 15 (WSC: 930-8652-722; UTM: 09.615900.5576700)

Tributary 15 is located 4.2 km north of the southern end of the lake along the western shore (Figure 14). There is a scree slope at the site of this tributary. No channel was observed.

4.2.17.16 Tributary 16 (WSC: 930-8652-676; UTM: 09.615700.5577000)

Tributary 16 is located 4.6 km north of the southern end of the lake along the western shore. The gradient is 17%, the channel width is 3 m and the substrate is cobble and gravel. The channel was dry on August 20, 1996. This creek has very little potential as fish habitat due to the steep gradient and lack of summer flows.

4.2.17.17 Tributary 17 (WSC: 930-8652-664; UTM: 09.614450.5578950)

Tributary 17 is located 6.7 km north of the southern end of the lake along the western shore. This creek has a gradient that increases from 13% in the lower reach to 40%, 150 m upstream. The creek flows through old growth timber in the lower 75 m (Appendix B, photos R2 3 and 4). In this area the channel is unstable, has a large bedload and has a channel width of 28.5 m at the mouth. The creek was dry at the mouth when surveyed on August 20, 1996. The creek appears to be

subjected to extremely high flows at times. A small tributary joins the main creek 50 m upstream from the mouth (WSC 930-865200-66400-46878; Appendix B, photos R2 3 and 4). The channel in the tributary averaged 1.9 m wide, had a gravel cobble substrate and appeared to be stable. The creek had flow of 1 $L \cdot sec^{-1}$ and appeared to contain good salmonid rearing and spawning habitat in the lower reaches. The creek was not sampled for fish.

4.2.17.18 Tributary 18 (WSC: 930-8652-659; UTM: 09.614300.5579100)

Tributary 18 is located 7.1 km north of the northern end of the lake along the western shore (Figure 14). No channel was observed at this site. An interim locational point of VL-9 is assigned to this watershed code.

4.2.17.19 Tributary 19 (WSC: none; UTM: 09.613100.5583400)

Tributary 19 is located 3.7 km south of the northern end of the lake along the western shore (Figure 11). No channel was observed at this site. An interim locational point of VL-10 is assigned to this watercourse shown on 1:20,000 TRIM maps.

4.2.17.20 Tributary 20 (WSC: 930-8652-557; UTM: 09.613000.5584000)

Tributary 20 is located 3.0 km south of the northern end of the lake along the western shore (Figure 11; Appendix B, photo R2 7). The lower portion of this creek flows across a fairly large alluvial fan. The creek in this area has a gradient of 10%. The creek appears to be flashy and unstable. The channel width was approximately 4 m and had no flow when examined on August 20, 1996. A resident, that lives by the creek, reported that it takes three days of heavy rain before the creek starts to flow and then after a few days the creek dries at the mouth. He claimed that fish used to spawn in the creek to the West Main, 250 m upstream, before the upper watershed was logged.

The creek appears to have little potential at the present time as fish habitat due to the lack of flow at the mouth.

4.2.17.21 Tributary 21 (WSC: 930-8652-544; UTM: 09.6112900.5585000)

Tributary 21 is located 2.1 km south of the northern end of the lake along the western shore (Figure 11, Appendix B, photo R2 5). This creek has a 15% gradient at the mouth, the channel width is ~8 m and the substrate is cobble, boulder and gravel. The channel was dry on August 20 , 1996. The creek appears to have little

fish habitat potential due to the steep gradient, the coarse substrate and lack of flow.

4.2.17.22 Tributary 22 (WSC: 930-8652-510; UTM: 09.613000.5585500)

Tributary 22 is located 1.7 km south of the northern end of the lake along the western shore (Figure 11, Appendix B, photo R2 6). This creek has a 10% gradient in the lower reaches, the channel width is ≈20 m and the substrate is boulder and cobble. The creek flows through old growth timber in the lower 50 m. The creek appears flashy, has a heavy bedload and is unstable. The creek had no flow on August 20, 1996. Due to the lack of flow the creek has no summer rearing habitat for salmonids.

4.2.17.23 Tributary 23 (WSC: 930-8652-484; UTM: 09.612900.5586800)

Tributary 23 is located 0.3 km south of the northern end of the lake along the western shore (Figure 11). This creek has a gradient of 15% in the lower reaches and the channel width is 2 m. The creek was dry on August 20, 1996 and has little potential as fish habitat due to the steep gradient and lack of flow.

4.3 Fish age, growth and other observations

4.3.1 Fish distribution

Various sites were sampled for fish throughout the Marble River watershed during the 1996 survey. The six species of fish that were found at these sites were prickly sculpin, threespine stickleback, coho salmon, cutthroat trout, rainbow trout and Dolly Varden (Table 17). Coho juveniles were the most ubiquitous species of fish in the anadromous areas. The exception was in Sorenson Creek where coho outplants from the Marble River hatchery were found in non-anadromous reaches.

Rainbow trout juveniles were found in the lower reaches of Pinch Creek, Benson River, Howlal Creek, Link River, and Yootook Creek. These areas were accessible to Alice Lake rainbow and steelhead. Rainbow trout were also found in Reach 1 of Jeune Creek (Figure 11) although these fish were likely stream resident as the bottom of this reach has a barrier and some of the fish captured were maturing.

Cutthroat trout were captured in many of the smaller systems. All of the cutthroat trout sampled were probably nonanadromous as falls in the lower river probably

Table 17. Presence and absence of various fish species sampled from streams in the Marble River watershed, August - October, 1996.

System	Reach	CAS	TSB	CO	CT	DV	RB
Lower Marble T 2	1	?	?	+	?	?	?
Lower Marble T 3	3	+	-	-	+	-	-
Lower Marble T 3	4	+	-	-	+	-	-
Lower Marble T 3	5	+	-	-	+	-	-
Lower Marble T 3	6	+	-	-	+	-	-
Lower Marble T 3	7	+	-	-	+	-	-
Lower Marble T 4	1	?	?	+	?	?	?
Lower Marble T 5	1	+	+	+	+	+	-
Lippy Creek	1	+	-	+	+	+	-
Lippy Creek	2	-	-	-	+	-	-
Lippy Creek	3	-	-	-	+	-	-
Sorenson Creek	1	+	-	+	+	-	-
Sorenson Creek	2	-	-	+[1]	-	-	-
Sorenson Creek	3	-	-	+[1]	-	-	-
Sorenson Creek	4	-	-	+[1]	-	-	-
Sorenson Creek	5	-	-	-	-	-	-
Sorenson Creek	6	-	-	-	-	-	-
Pinch Creek	1	-	-	+	-	+	+
Pinch Creek	2	-	-	-	-	-	-
Benson River	1	+	-	+	-	-	+
Malook Creek	1	+	-	+	-	+	-
Howlal Creek	1	+	-	+	-	-	+
Howlal Creek	2	?	-	+	?	?	?
Yootook Creek	1	-	-	+	-	+	+
Yootook Creek	5	-	-	-	-	-	-
Link River	1	+	-	+	-	+	+
Jeune Creek	1	-	-	-	-	-	+
Teihsum River - T1	3	-	-	-	-	-	-
Upper Marble River	2	-	-	-	+	-	-
Upper Marble River	3	-	-	-	-	-	-
Alice Lake T4	1	-	-	+	*	-	-
Alice Lake - T5	1	?	?	+	?	?	?
Alice Lake - T7	1	?	?	+	?	?	?
Alice Lake - T7	2	-	-	-	+	+	-
Alice Lake - T7 trib.	1	-	-	-	+	-	-
Alice Lake - T11	1	-	-	+	*	*	-
Alice Lake-T12	1	-	-	+	*	-	-
Victoria Lake-T6	1	-	-	-	+	-	-

Species codes: CAS- prickly sculpin; CO- coho; CT- cutthroat trout; DV- Dolly Varden
RB- rainbow trout; TSB - threespine stickleback.

System codes: T - Tributary.

- species was not found in reach; + species found in reach; ? sampling was insufficient to determine presence or absence; * species not found but presence is likely based on other information.

[1] Hatchery outplants

restrict sea run cutthroat to the tributaries of the lower Marble River. There appear to be two types of cutthroat trout present: fluvial (stream resident) and adfluvial (lake resident as rearing adults). The adfluvial cutthroat trout are associated with lakes and only age 0+ and 1+ juveniles were found in the streams where the fish had lake access. Adfluvial cutthroat trout were sampled from lower Marble River tributary 3 (Figure 6), lower Marble River tributary 5 (Figure 6), Reach 1 Lippy Creek (Figure 8), Sorenson Creek (Figure 9), and Victoria Lake tributary 7 (Figure 14).

Fluvial cutthroat trout were found in Lippy Creek Reach 2 and 3, Alice Lake tributary 7 Reach 2 (Figure 9), tributary to Alice Lake tributary 7, upper Marble River Reach 2 (Figure 13). Access to lake habitat for fish in these areas was either difficult or impossible. Adfluvial cutthroat trout were more widespread than fluvial rainbow trout. The only population of fluvial rainbow trout was from Jeune Creek
which contained some larger, older individuals that were not found in adfluvial populations.

As with cutthroat trout, there appeared to be fluvial and adfluvial populations of Dolly Varden in the Marble River watershed with the fluvial populations being associated with areas inaccessible to lake resident fish. Dolly Varden with lakeaccess were found in Yootook Creek, Lippy Creek, Malook Creek and the Link River. The Dolly Varden captured in these areas were generally age 0+ and 1+. The one exception was an immature age 3+ Dolly Varden captured from Malook Creek which is all deep pool habitat. The only adfluvial population of Dolly Varden was found in Alice Lake tributary 7 Reach 2. Some of these fish were mature. A pair of spawning fish observed in Reach 1 of the Teihsum River were likely Dolly Varden from Victoria Lake.

4.3.2 Fish densities

Fish densities were determined at sites in the lower reach of eight systems within the watershed in areas that are accessible to anadromous fish (Table 18). Coho were generally the most numerous species of fish and were captured at all the sites. Coho densities ranged from 0.01 fish·100m^{-2} in Reach 1 of Yootook Creek to 274 fish·100m^{-2} at the top of Reach 1 in Lippy Creek. Coho densities were greatest in pool habitat. Dolly Varden fry were generally most numerous in faster flowing areas with bouldery riffle habitat. Dolly Varden fry densities ranged up to 45.2 fish·100m^{-2} in Lippy Creek and they were captured in three of the seven sites. Pinch Creek and Yootook Creek also had relatively high densities of Dolly Varden

fry at 26.9 and 15.6 fish·100m^{-2}, respectively. Few Dolly Varden parr were captured. Lippy Creek had the highest densities at 2.0 fish·100m^{-2}. Cutthroat trout fry were captured at only two of the seven sites. The greatest densities were in Lippy Creek at 88.6 fish·100m^{-2}. Cutthroat fry densities were 6.3 fish·100m^{-2} in Sorenson Creek. Rainbow trout fry were captured at five of the seven sites. Densities in these sites ranged from 0.7 fish·100m^{-2} to 14.3 fish·100m^{-2}. Rainbow fry densities were highest in Howlal Creek (14.3 fish·100m^{-1}) and the Benson River (8.1 fish·100m^{-1}). Low densities of rainbow trout parr were found in Howlal Creek (0.6 fish·100m^{-2}) and Link River (0.1 fish·100m^{-2}).

Table 18. Fish densities (fish·100m^{-2}) of streams (Reach 1 - Site 1) within the Marble River watershed with 95% confidence limits, August-September, 1996.

System	Area (m^2)	DV 0+	DV parr	CAS	CT 0+	RB 0+	RB parr	C0 0+
Benson R*	1,431	0.0	0.0	11.1	0.0	8.1	0.0	1.9
Howlal C	116	0.0±0.0	0.0±0.0	2.0±0.0	0.0±0.0	14.1±12.4	0.6±0.0	104.8±7.0
Link R*	532	0.0	0.0	3.2	0.0	0.1	0.1	12.4
Lippy C **	45	45.2±9.5	2.0±0.0	0.0±0.0	88.6±43.7	0.0±0.0	0.0±0.0	274±0.0
Malook C*	302	0.0	0.0	0.0	0.0	0.0	0.00	16.5
Pinch C	68	26.9±8.7	0.8±0.0	0.0	0.0	3.0±0.0	3.0±0.0	36.4±27.2
Sorenson C	101	0.0±0.0	0.0±0.0	20.4±4.1	6.3±0.0	0.0	0.0	73.5±2.3
Yootook C	90	15.6±8.1	0.0±0.0	0.0±0.0	0.0±0.0	0.7±0.0	0.7±0.0	0.0±0.0

*Fish densities in some habitat units were determined by float counts. No confidence limits are available in these instances.

**Site 2

Species codes: CAS- prickly sculpin; CO- coho; CT- cutthroat trout; DV- Dolly Varden; RB- rainbow trout.

4.3.3 Fish morphology and age.

Size data were collected from 789 fish sampled from 11 tributaries and five species in the Marble River watershed (Table 19). Scales and otoliths were collected from a portion of the salmonids to determine age.

4.3.3.1 Non salmonids

Prickly sculpins

Prickly sculpins were sampled from seven tributaries. These fish averaged 66.8 mm fork length (n=63, stdev=25.3 mm) and ranged from 32 to 125 mm long.

Table 19. Length, weight and condition (K) of fish sampled from the Marble River watershed, August - October 1996.

System	Species	Age	Reach	Site	Fork Length (mm)					Weight (g)					Condition Factor (K)				
					n	average	stand. dev.	min.	max.	n	average	stand. dev.	min.	max.	n	average	stand. dev.	min.	max.
All	CAS	all	all	all	63	66.8	25.3	32	125	14	3.20	3.58	1.00	14.00	15	0.95	0.28	1.10	1.21
Benson River	CAS	all	1	1	6	55.3	11.7	47	77	6	1.92	1.40	1.00	4.60	6	1.00	0.11	0.90	1.21
Howlal Creek	CAS	all	1	1	1	95.0	-	95	95	0	-	-	-	-	-	-	-	-	-
L. Marble trib#3	CAS	all	all	all	5	79.8	18.6	62	108	5	6.00	4.87	2.50	14.00	5	1.00	0.10	0.84	1.11
L. Marble trib#5	CAS	all	all	all	2	58.5	13.4	49	68	0	-	-	-	-	-	-	-	-	-
Link River	CAS	all	1	1	13	61.5	22.2	32	125	0	-	-	-	-	-	-	-	-	-
Malook Creek	CAS	all	1	1	11	108.5	12.6	86	120	0	-	-	-	-	-	-	-	-	-
Sorenson Creek	CAS	all	1	1	25	50.9	7.8	35	71	0	-	-	-	-	-	-	-	-	-
All	CO	all	all	all	527	65.1	15.2	41	115	164	3.09	2.08	0.70	12.80	164	1.04	0.10	0.66	1.41
Alice Lake trib#7	CO	all	1	1	37	82.2	17.9	45	115	0	-	-	-	-	-	-	-	-	-
Benson River	CO	all	1	1	14	66.9	6.6	55	79	14	3.34	0.94	2.10	5.10	14	1.09	0.07	0.99	1.26
Howlal Creek	CO	all	1	1	176	62.6	14.7	41	95	23	2.80	1.58	0.90	5.70	23	0.98	0.07	0.88	1.18
Link River	CO	all	1	1	34	80.1	8.4	61	100	34	5.57	1.79	2.00	10.70	34	1.05	0.08	0.66	1.18
Lippy Creek	CO	all	1	1	144	60.6	13.0	41	90	17	2.44	1.49	0.70	5.60	17	1.02	0.10	0.82	1.26
Pinch Creek	CO	all	1	1	26	76.7	10.8	56	98	5	3.34	1.07	1.70	4.70	5	1.08	0.07	0.97	1.14
Sorenson Creek	CO	all	all	all	83	59.1	11.6	44	108	71	2.08	1.67	0.90	12.80	71	1.05	0.12	0.68	1.41
Sorenson Creek	CO	all	1	1	71	56.4	10.3	44	108	71	2.08	1.67	0.90	12.80	71	1.05	0.12	0.68	1.41
Sorenson Creek	CO	all	4	5	12	75.0	3.9	68	82	0	-	-	-	-	-	-	-	-	-
Yootook Cr	CO	all	1	1	1	71.0	-	71	71	0	-	-	-	-	-	-	-	-	-
Malook Creek	CO	all	1	1	12	73.1	9.9	59	87	0	-	-	-	-	-	-	-	-	-
All	CT	all	all	all	107	54.4	12.9	28	86	70	2.38	1.35	0.30	5.90	70	1.03	0.12	0.77	1.37
Alice Lake-T7 trib	CT	all	2	2	1	33.0	-	33	33	1	0.30	-	0.30	0.30	1	0.83	-	0.83	0.83
Alice Lake trib#7	CT	all	2	2	5	57.5	6.6	50	64	0	-	-	-	-	-	-	-	-	-
L. Marble trib#3	CT	all	all	all	52	62.0	12.0	-	86	51	2.62	1.46	0.50	5.90	51	1.03	0.13	0.77	1.37
L. Marble trib#5	CT	all	all	all	4	58.3	4.5	52.0	62	4	2.05	0.48	1.50	2.50	4	1.02	0.08	0.92	1.10
Lippy Creek	CT	all	1	1	31	41.8	5.6	28	58	0	-	-	-	-	-	-	-	-	-
Sorenson Creek	CT	all	1	1	4	53.3	1.9	52	56	4	1.38	0.28	1.10	1.70	4	0.90	0.10	0.78	1.01
Victoria L. trib.#6	CT	all	1	1	10	54.1	8.7	42.0	69	10	1.93	0.80	0.90	3.40	10	1.10	0.00	1.10	1.10
All	CT	1+			15	107.7	13.7	89	135	11	13.45	5.90	7.10	25.60	11	1.00	0.09	0.90	1.24
Alice Lake-T7 trib	CT	1+	2	2	1	96.0	-	96	96	1	8.10	-	8.10	8.10	1	0.92	-	0.92	0.92
Alice Lake trib#7	CT	1+	2	2	1	124.0	-	124	124	0	-	-	-	-	-	-	-	-	-
Species codes: CAS - prickly sculpins; CO - coho; CT - cutthroat trout; DV - Dolly Varden; RB - rainbow trout																			
L. Marble trib#3	CT	1+	1	1	10	109.4	14.6	-	135	10	13.99	5.93	7.10	25.60	10	1.01	0.09	0.90	1.24
Upper Marble R.	CT	1+	2	3	3	100.3	7.8	94	109	0	-	-	-	-	-	-	-	-	-

Table 19. Length, weight and condition (K) of fish sampled from the Marble River watershed, August - October 1996.

System	Species	Age	Reach	Site	Fork Length (mm)					Weight (g)					Condition Factor (K)				
					n	average	stand. dev.	min.	max.	n	average	stand. dev.	min.	max.	n	average	stand. dev.	min.	max.
All	CT	2+	all	all	3	128.3	13.3	117	143	3	21.10	6.35	15.70	28.10	3	0.98	0.02	0.96	1.00
Alice Lake-T7 trib	CT	2+	2	2	2	121.0	5.7	117	125	2	17.60	2.69	15.70	19.50	2	0.99	0.01	0.98	1.00
L. Marble trib. #5	CT	2+	all	all	1	143.0	-	-	143	1	28.10	-	28.10	28.10	1	0.96	-	0.96	0.96
Alice Lake-T7 trib	CT	all	2	2	4	92.8	41.7	33	125	4	10.90	8.51	0.30	19.50	4	0.93	0.07	0.83	1.00
All	CT	all	all	all	125	62.6	24.0	28	143	84	4.50	5.57	0.30	28.10	84	1.02	0.11	0.77	1.37
L. Marble trib#3	CT	all	all	all	62	69.6	21.5	-	135	61	4.48	5.01	0.50	25.60	61	1.02	0.12	0.77	1.37
L. Marble trib#5	CT	all	all	all	5	75.2	38.1	52.0	143	5	7.26	11.66	1.50	28.10	5	1.01	0.07	0.92	1.10
Alice Lake trib#7	CT	all	2	2	6	68.6	27.8	50	124	0	-	-	-	-	-	-	-	-	-
All	DV	0+	all	all	38	55.3	7.8	42	79	8	2.54	0.39	1.90	2.90	8	1.08	0.09	0.88	1.18
Lippy Creek	DV	0+	1	1	19	50.8	8.5	42	79	0	-	-	-	-	-	-	-	-	-
Pinch Creek	DV	0+	1	1	9	61.4	2.9	56	64	8	2.54	0.39	1.90	2.90	8	1.08	0.09	0.88	1.18
Yootook Cr	DV	0+	1	1	10	58.2	2.8	54	62	0	-	-	-	-	-	-	-	-	-
All	DV	1+	all	all	4	100.5	12.6	87	117	0	-	-	-	-	-	-	-	-	-
Lippy Creek	DV	1+	1	1	1	87.0	-	87	87	0	-	-	-	-	-	-	-	-	-
Malook Creek	DV	1+	1	1	2	106.5	14.8	96	117	0	-	-	-	-	-	-	-	-	-
Pinch Creek	DV	1+	1	1	1	102.0	-	102	102	0	-	-	-	-	-	-	-	-	-
All	DV	2+	all	all	4	115.8	7.9	106	124	0	-	-	-	-	-	-	-	-	-
Alice Lake trib#7	DV	2+	2	2	4	115.8	7.9	106	124	0	-	-	-	-	-	-	-	-	-
All	DV	3+	all	all	3	154.0	8.7	148	164	0	-	-	-	-	-	-	-	-	-
Alice Lake trib#7	DV	3+	2	2	2	149.0	1.4	148	150	0	-	-	-	-	-	-	-	-	-
Malook Creek	DV	3+	1	1	1	164.0	-	164	164	0	-	-	-	-	-	-	-	-	-
All	DV	all	all	all	48	70.2	30.7	42	164	8	2.54	0.39	1.90	2.90	8	1.08	0.09	0.88	1.18
Alice Lake trib#7	DV	all	2	2	6	126.8	18.2	106	150	0	-	-	-	-	-	-	-	-	-
Lippy Creek	DV	all	1	1	20	52.7	11.6	42	87	0	-	-	-	-	-	-	-	-	-
Malook Creek	DV	all	1	1	3	125.7	34.8	96	164	0	-	-	-	-	-	-	-	-	-
All	RB	0+	all	all	19	55.9	14.3	37	77	8	3.58	1.10	1.70	4.60	8	1.04	0.11	0.96	1.29
Benson River	RB	0+	1	1	5	70.4	5.9	63	77	5	3.54	0.84	2.40	4.50	5	1.00	0.05	0.96	1.08
Howlal Creek	RB	0+	1	1	10	43.6	3.6	37	50	0	-	-	-	-	-	-	-	-	-
Jeune Creek	RB	0+	1	1	1	71.0	-	71	71	1	4.60	-	4.60	4.60	1	1.29	-	1.29	1.29
Species codes: CAS - prickly sculpins; CO - coho; CT - cutthroat trout; DV - Dolly Varden; RB - rainbow trout																			
Link River	RB	0+	1	1	1	75.0	-	75	75	1	4.60	-	4.60	4.60	1	1.09	-	1.09	1.09
Pinch Creek	RB	0+	1	1	1	56.0	-	56	56	1	1.70	-	1.70	1.70	1	0.97	-	0.97	0.97
Yootook Creek	RB	0+	1	1	1	73.0	-	73	73	0	-	-	-	-	-	-	-	-	-
All	RB	1+	all	all	6	110.2	11.3	92	126	6	15.90	4.42	9.60	21.40	6	1.17	0.14	1.00	1.34

Table 19. Length, weight and condition (K) of fish sampled from the Marble River watershed, August - October 1996.

System	Species	Age	Reach	Site	Fork Length (mm)					Weight (g)					Condition Factor (K)				
					n	average	stand. dev.	min.	max.	n	average	stand. dev.	min.	max.	n	average	stand. dev.	min.	max.
Jeune Creek	RB	1+	1	1	5	107.0	9.1	92	117	5	15.08	4.40	9.60	21.40	5	1.21	0.13	1.02	1.34
Link River	RB	1+	1	1	1	126.0	-	126	126	1	20.00	-	20.00	20.00	1	1.00	-	1.00	1.00
All	RB	all	all	all	25	69.0	27.2	37	126	14	8.86	6.94	1.70	21.40	14	1.10	0.14	0.96	1.34
Jeune Creek	RB	all	1	1	6	101.0	16.8	71	117	6	13.33	5.81	4.60	21.40	6	1.22	0.12	1.02	1.34
Link River	RB	all	1	1	2	100.5	36.1	75	126	2	12.30	10.89	4.60	20.00	2	1.05	0.06	1.00	1.09
Pinch Creek	RB	all	1	1	1	56.0	-	56	56	1	1.70	-	1.70	1.70	1	0.97	-	0.97	0.97
Howlal Creek	RB	all	1	1	10	43.6	3.6	37	50	0	-	-	-	-	-	-	-	-	-
Benson River	RB	all	1	1	5	70.4	5.9	63	77	5	3.54	0.84	2.40	4.50	5	1.00	0.05	0.96	1.08
Yootook Creek	RB	all	1	1	1	73.0	-	73	73	0	-	-	-	-	-	-	-	-	-

Species codes: CAS - prickly sculpins; CO - coho; CT - cutthroat trout; DV - Dolly Varden; RB - rainbow trout

The smallest fish were sampled from riffle habitat in the Benson River (average length = 55.3 mm, n=6, stdev=11.7 mm) and the largest fish were sampled from Malook Creek (average length = 108.5, n=11, stdev=12.6 mm.). The largest sculpins were generally captured from pool habitat.

4.3.3.2 Salmonids

Coho

A total of 527 coho were sampled from nine different sites within the Marble River watershed. Scales taken from 37 of these fish were all age 0+ except for one age 1+, indicating that most of the coho fry in the system were age 0+. The fish that was age 1+ was from the Link River and was 78 mm long, less than the average length of coho at that site.

Coho from the nine sites ranged from 59.1 mm fork length (n=83, stdev=11.6 mm) in Sorenson Creek to 82.2 mm (n=37, stdev=17.9 mm) in Alice Lake tributary 7.

The smaller fish were generally captured in sites with higher coho densities (Table 18). Reach 1 of Lippy Creek, Howlal Creek and Sorenson Creek had the highest fish densities and the smallest fish. Fish densities were not estimated in Alice Lake tributary 7, although fish densities appeared to be high despite having large fish.The coho fry outplants captured in Reach 3 of Sorenson Creek (an nonanadromous area) averaged 75.0 mm fork length (n=12, stdev=3.9 mm) and were larger than wild coho fry captured in Reach 1 which averaged 56.4 mm (n=71, stdev=10.2 mm).

Rainbow trout

Rainbow trout sampled from five systems averaged 69.0 mm fork length (n=25, stdev=27.2 mm) and ranged in age from 0+ to 1+. Age 0+ rainbow trout averaged 55.9 mm (n=19, stdev=14.3 mm) and ranged from 43.6 mm (n=10, stdev=3.6 mm) in Howlal Creek to 75 mm (n=1) in the Link River. The smallest fish were captured in Howlal Creek and Pinch Creek which were streams with relatively high densities of coho fry. The Link River had the warmest water temperatures which, along with the moderately low coho densities, may have contributed to the large size of the rainbow trout fry in that system.

The rainbow trout parr that were captured were all age 1+. These fish were captured in two systems and they had a mean fork length of 110.2 mm (n=6, stdev=11.3 mm). The one fish from the Link River had a mean length of 126 mm and the fish from Jeune Creek had a mean length of 101.0 mm (n=5, stdev=16.8 mm).

Dolly Varden

Dolly Varden sampled from five systems had an average fork length of 70.2 mm (n=48, stdev=30.7) and ranged in age from 0+ to 3+. Age 0+ Dolly Varden were captured from three systems. Average mean fork lengths ranged from 50.8 mm (n=19, stdev=8.5 mm) in Lippy Creek to 61.4 mm in Pinch Creek (n=9, stdev=4.4 mm). The high fish densities in Lippy Creek probably account for the smaller size in that creek. Age 1+ Dolly Varden were captured in three creeks. These fish averaged 100.5 mm long (n=4, stdev=12.6 mm). Age 2+ Dolly Varden were captured in Alice Lake tributary 7 (average fork length =115.8 mm, n=4, stdev=7.9 mm) and three age 3+ Dolly Varden was captured from Malook Creek and Alice Lake Tributary 7 (average fork length =154.0 mm, stdev=8.7 mm).

Cutthroat trout

A total of 125 cutthroat trout were sampled from seven tributaries of the Marble River. These fish were all juveniles that had a mean fork length of 62.3 mm (stdev=24.0 mm) and ranged in age from 0+ to 2+. The age 0+ cutthroat trout averaged 54.4 mm fork length (n=107, stdev=12.9 mm). The smallest fish were sampled from Alice Lake tributary 7 tributary (fork length = 33.0, n=1) and the largest were sampled from Lower Marble tributary 3 (average fork length = 62.0 mm, n= 52, stdev=21.5 mm). Age 1+ cutthroat trout were collected from four areas and they averaged 109.2 mm fork length (n = 10, stdev=14.6 mm). The three age 2+ cutthroat trout averaged 128.3 mm (stdev=13.3 mm).

4.3.4 Habitat capability

The proportion of habitat available to various species of fish and various stages of fish based on depth and velocity probability of use values was calculated for sites in Reach 1 of eight systems (Table 20). Pinch Creek and Lippy Creek had the highest proportion of habitat (0.52 and 0.50, respectively) available for trout (rainbow and cutthroat fry) due to a high proportion of shallow, slow flowing riffle habitat. Malook Creek had the smallest proportion of habitat available for trout fry (0.15) as Reach 1 was all deep pool habitat which was highly suitable habitat for parr and adult trout and coho fry (available habitat proportion = 0.75 - 98). The proportion of habitat available for coho fry was lowest in Yootook Creek which had mainly shallow, fast flowing riffle habitat.

Table 20. Summary of proportion of habitat available for use by various species and stages of fish at sites in the Marble River watershed, August-September 1996.

System	Rainbow fry	Rainbow parr	Rainbow adult	Cutthroat fry	Cutthroat parr	Coho fry
Benson R.	0.38	0.55	0.51	0.38	0.63	0.16
Howlal Cr.[1]	0.30	0.36	0.29	0.30	0.39	0.25
Malook Cr.	0.15	0.96	0.75	0.15	0.98	0.75
Link R.	0.32	0.78	0.69	0.32	0.80	0.45
Lippy Cr.	0.50	0.46	0.32	0.50	0.48	0.35
Pinch Cr.	0.52	0.33	0.38	0.52	0.78	0.21
Sorenson Cr.	0.33	0.44	0.34	0.33	0.46	0.32
Yootook Cr.	0.34	0.21	0.22	0.34	0.36	0.05

[1] No depth and velocity data was only collected for Howlal Creek riffle and glide. To approximate the proportion of usable habitat in Howlal Creek, Sorenson Creek riffle and glide data was used as Sorenson Creek had a similar discharge.

4.3.5 Maximum salmonid densities (MSD)

Maximum salmonid densities were calculated in 21 habitat units in eight tributaries to the Marble River (Table 21, Appendix F).

Table 21. Summary of alkalinity values and fish weights used in the maximum salmonid density model (Ptolemy *et al*. 1991) and a summary of maximum salmonid densities calculated for 21 habitat units in eight tributaries to the Marble River, August-September, 1996.

Parameter	Average	Stand. dev.	Minimum	Maximum
Alkalinity ($mg \cdot L^{-1}$)	103	43	40	180
Coho fry wt (g)	3.5	1.5	1.2	7.3
Trout-DV fry wt(g)	2.5	1.4	0.7	4.6
Trout-DV parr wt (g)	15.1	3.4	6.3	20.0
Trout-DV adult wt (g)	200	0	200	200
MSD Trout DV fry ($fish \cdot 100m^{-2}$)	235	178	50	627
MSD Trout-DV parr ($fish \cdot 100m^{-2}$)	27	15	12	77
MSD Trout-DV adult ($fish \cdot 100m^{-2}$)	1.8	0.4	1.1	2.4
MSD Coho ($fish \cdot 100m^{-2}$)	226	128	60	504

Corrected maximum salmonid densities (CMSD) for trout and Dolly Varden fry ranged from 15.9 $fish \cdot 100m^{-2}$ in the Link River to 282.7 $fish \cdot 100m^{-2}$ in Lippy Creek (Table 22). CMSD was low at the Link River site due to the relatively low

alkalinity values (40 $mg \cdot L^{-1}$), large fry and habitat that was generally too deep or fast for ideal fry habitat. Lippy Creek had small fry and relatively high alkalinity (180 $mg \cdot L^{-1}$). Parr CMSD values ranged from 4.2 $fish \cdot 100m^{-2}$ in Yootook Creek to 24.6 $fish \cdot 100m^{-2}$ in Malook Creek. Yootook Creek had a low parr CMSD due to the lack of depth as the habitat was mainly shallow riffle (80% riffle). Malook Creek was all deep pool habitat in Reach 1 with a high proportion of the habitat suitable for parr. Adult trout-Dolly Varden CMSD values ranged from 0.4 to1.5 $fish \cdot 100m^{-2}$ and were lowest in Yootook Creek and highest in Malook Creek as with parr. Coho fry CMSDs ranged from 7.8 to 126.0 $fish \cdot 100m^{-1}$. The site in Malook Creek had the highest coho CMSD value (126.0 fish.100 m^{-2}) as the habitat had a high proportion of usable area. Sorenson and Lippy Creek, where the coho fry were small and the alkalinity was relatively high, also had high CMSD values (115.4 and 120.2 $fish \cdot 100m^{-2}$, respectively). Yootook Creek had the lowest coho fry CMSD value (7.8 fish $100m^{-2}$) due to the small proportion of usable habitat (Table 20).

Table 22. Maximum salmonid densities[1] corrected by proportion of usable habitat (CMSD) as predicted by the Ptolemy *et al.* (1991) MSD model in tributaries to the Marble River, August-September 1996.

System	Reach-site	number of habitats	DV-Trout fry	DV-Trout parr	DV-Trout adult	Coho fry
Benson R.	1-1	3	36.3	11.9	0.9	28.4
Howlal C[1]	1-1	3	132.9	7.8	0.5	60.2
Malook C	1-1	1	26.9	24.6	1.5	126.0
Link R	1-1	3	15.9	8.9	0.8	35.6
Lippy C	1-2	2	282.7	34.5	0.8	120.2
Pinch C	1-1	2	86.9	19.2	0.7	32.2
Sorenson C	1-1	3	110.2	16.9	0.8	115.4
Yootook C	1-1	3	48.7	4.2	0.4	7.8

[1]CMSD values were calculated from the CMSD values of different habitat types weighted by reach habitat proportion.

A comparison of actual fish densities to corrected maximum salmonid densities indicates that the habitat in the eight tributaries is under utilized by Dolly Varden and trout and is near or above capacity for coho juveniles at most sites (Table 23). Dolly Varden and trout fry and parr densities were well below predicted maximum salmonid densities in all eight systems. Fry densities were closest to maximum values in Lippy Creek where actual densities were 55% of predicted values. Parr densities were very low at a maximum of 8% of predicted values.

Table 23. Ratio of actual fish densities to maximum salmonid densities predicted by the Ptolemy *et al*. (1991) MSD model in tributaries to the Marble River, August-September 1996.

System	Reach -site	number of habitat	DV-Trout fry	DV-Trout parr	DV-Trout adult	Coho fry
Benson R	1-1	3	0.17	0.00	0.00	0.06
Howlal C	1-1	3	0.09	0.03	0.00	2.28
Malook C	1-1	1	0.00	0.00	0.00	0.13
Link R	1-1	3	0.01	0.01	0.00	0.47
Lippy C	1-2	2	0.55	0.03	0.00	3.23
Pinch C	1-1	3	0.18	0.08	0.00	1.98
Sorenson C	1-1	3	0.05	0.00	0.00	0.66
Yootook C	1-1	3	0.23	0.00	0.00	0.04

Coho fry densities were much closer to corrected maximum salmonid densities. Coho fry densities were above predicted densities in Howlal Creek (2.28x), Lippy Creek (3.23x) and Pinch Creek(1.98x) and relatively close to predicted values in Link River (0.47x) and Sorenson Creek (0.66x). Benson River (0.06x), Malook Creek (0.13x) and Yootook Creek (0.09x) had coho densities that were well below predicted values. Coho densities could be low in the Benson River due to the lack of cover. Reach 1 of this river is wide with little cover away from the banks. Coho denisities in Yootook Creek could be low due to the lack of spawning habitat as the substrate in Reach 1 was mainly cobble and boulder and habitat was mainly riffle (80%). Reach 1 of Malook Creek flows through marsh habitat and was all deep slow flowing pool habitat which may be less suitable for coho rearing than streams with a series of pools and riffles.

There could be several reasons for the low densities of trout and Dolly Varden fry. One reason is that the suitability of the habitat could be lower for other reasons than depth and velocity. The lack of appropriate substrate and suitable cover could also be two factors. The high densities of coho juveniles in the creeks may have helped to depress the Dolly Varden and trout fry and parr populations. The spawning populations of Dolly Varden and trout fry could be low or egg to fry survivals could be low.

4.3.6 Management comments

The Benson River is a significant coho spawning area (Hamilton 1980). Coho densities at the site surveyed in Reach 1 of this river appeared to be relatively low

(1.9 fish·100m^{-2}, Table 18) as the site had a low coho habitat suitability (0.16, Table 20). Low coho densities throughout the Benson River might indicate that many juveniles migrate downstream to rear in Alice Lake. Many of the coho juveniles from the smaller Alice Lake tributaries possibly rear in Alice Lake as flows can become very low in the summer and as in the case of Lippy Creek some become dry.

Escapement data for summer steelhead and winter steelhead indicate that these populations are small despite extensive spawning and rearing habitat available. The few sites sampled during 1996 indicated that rainbow trout juvenile densities were low. A comparison of steelhead production capability estimates for the Marble River compared to angler catches indicates the run is severely depressed (Lirette *et al*. 1987). Lirette *et al*. (1987) estimated that the lower Marble River, Link River, lower Benson River and upper Benson River have the capability to produce 9,700 to 10,100 smolts (1.9 - 2.2 fish·100 m^{-2}) resulting in a total run size of 1,300. The annual escapement is estimated at 50 winter steelhead and 100 summer steelhead (C. Wightman, MELP, pers. comm.). The reasons for the depressed state of the steelhead stocks is not readily apparent. Factors outside the watershed, such as interceptions by commercial ocean salmon fisheries, could be a problem.

Although logging in the watershed may have decreased the suitability of fish habitat in some reaches, the limited amount of sampling that was done in 1996 indicates that coho populations in late summer were generally at or above capacity.

Dolly Varden and trout populations in the anadromous areas that were sampled appear to be well below capacity. The reasons for the low densities of these fish are not apparent. Alice Lake is a large lake with a resident fish population (MELP 1994) that should occupy the available spawning habitat in significant numbers.

The existing angling regulations are probably adequate to protect steelhead in the system. The fishery is catch and release for all wild fish; there is a bait ban on the Marble River; and the Benson River is a fly fishing only area. The size of the lake resident populations of trout and Dolly Varden and the impact of fishing on these populations is unknown.

Critical fish habitat

Critical spawning habitat for chum and pink salmon is Reach 1 of the lower Marble River and lower Marble unnamed tributary #1 (WSC 930-8652-022). These two species are restricted to a small part of the system by Twin Falls.

Critical spawning habitat for chinook is the lower Marble River and to a lesser extent the Benson River to Kathleen Lake and the Link River. These areas are also important holding and spawning areas for steelhead. Hamilton (1980) indicates the main sockeye spawning areas include a section of the lower Marble River below Alice Lake, the Benson River between Alice Lake and Kathleen Lake and the Link River. The most significant spawning and rearing areas for coho are lower Marble tributary #2 (Section 4.2.2), Alice Lake tributary #7 (Section 4.2.16.7) and Howlal Creek. The Benson River, Link River and lower Marble River are also main coho spawning areas (Hamilton 1980). Reach 1 of the Teihsum River and the upper Marble River are critical spawning and rearing areas for Victoria Lake cutthroat trout, rainbow trout and Dolly Varden. There is very little spawning and rearing habitat in the Victoria Lake watershed other than these two areas due the steep nature of the watershed.

Fisheries sensitive zones

Fisheries sensitive zones (FSZs) are off-channel aquatic habitats lying within the floodplain of a main stream channel that are important fish habitat (BC Environment 1995). The habitats include side channels, flood channels of the mainstem, swamps, sloughs, ephemeral tributaries and beaver ponds. Few of these types of habitats were observed during the 1996 survey. Most of the streams that were surveyed are confined and have little flood plain habitat. Reach 1 of the Link River, Benson River, Teihsum River and Upper Marble have wider flood plains that have the potential to have FSZs. Unfortunately time constraints prevented these areas from being fully investigated.

Victoria Lake tributary 6 (Section 4.2.17.6) a small stream flowing through a swamp on the flood plain along Reach 1 of the Teihsum River. This creek is a FSZ that contained cutthroat trout juveniles.

Victoria Lake tributary 12 and and Upper Marble tributary #1 (Section 4.2.17.12 and 4.2.15.4) flow across the flood plain of Reach 1 of the Upper Marble River. Upper Marble tributary #1 flows through an old channel of the Upper Marble River (Appendix B, photos T8 2 and 3) and Tributary 12 flows through marsh habitat (Appendix B, photos T7 38, T8 1). No fish were captured at sites on either of these creeks but they have potential trout rearing and spawning habitat.

Unstable areas

Several unstable areas were noticed in the Marble River watershed. Approximately 1.5 km upstream on Pinch Creek (UTM 09.616580.5588441) is an area were about 30 m of bank has slid into the creek (Appendix B, Photo T-25).

The area may be a source of sediment during high flows. On Alice Lake tributary 8 (Section 4.2.16.8) is an area 600 m upstream (≈UTM 09.6151.55898) where about 1 ha of side hill has slumped which deposited a large volume of mud into the creek about 20 years ago. The area could still be a source of sediment during high flows. An unnamed tribuary to a tributary of the Teihsum River (WSC 930-8652-725-259-392; UTM 09.6211.55757) has changed course in recent years by a blocked bridge. The tributary has cut a new 400 m long channel down a logging road and down the hillside to the main creek (Appendix B, Photos T7-16 and T7-17). A large volume of woody debris and inoganic material was carried downstream as a result. The area appears to have stabilized. Finally a recent landslide scar was observed in the upper reaches of the upper Marble River. The landslide slid into a small pond at the top of the reach (7.2 km upstream at ≈UTM 09.6202.55658) and deposited woody debris into the pond. The slide scar and debris probably no longer pose a threat to fish habitat.

Enhancement opportunities

Enhancement opportunities available include colonization, natural stream improvement, and artificial propagation.

Several areas in the watershed have potential salmonid rearing habitat but are inaccessible to anadromous fish. The Victoria Lake watershed and the Maynard Lake watershed are two of the largest areas. The Marble River hatchery currently outplants coho into Larry Lake and the upper reaches of Sorenson Creek (Debbie Grant, pers. comm.) both of which are inaccessible to anadromous fish. There can be problems with outplanting fish, however. The outplanted fish can compete with resident species. Outplanted fish have the potential to contaminate the gene pool of wild fish. Increased numbers of coho in the ocean can result in an increase in harvest rates which can negatively impact on wild stocks.

Artificial propagation is currently being done by the Marble River hatchery for chinook and coho and for steelhead to a small extent. The sockeye stocks are low despite extensive rearing and spawning capacity in the system. This stock may be a good target for enhancement to boost the size of this stock. A juvenile tagging program could provide information on ocean migration routes and the susceptibility to interception in various fisheries. Sockeye enhancement through hatchery propagation is common in Alaska using special techniques to avoid disease problems.

Natural stream improvement projects that have been conducted in the past have involved the improvement of fish passage to the system. Fish passage has been

improved at Twin Falls, Bear Falls and the Lake Outlet Falls on the lower Marble River. Falls and cascades on the Link River block anadromous fish to a large proportion of the system. It is doubtful the benefits of making the Victoria Lake watershed accessible to anadromous fish would be worth the costs involved. Spawning habitat in the Victoria Lake watershed is limited to Reach 1 of the Teihsum River and upper Marble River.

There are two points of difficult fish passage located 3.4 km and 3.45 upstream in Reach 2 of the Benson River (Higgins 1970; Section 4.2.7.2). Higgins (1970) notes that fish pass these two points with some difficulty. These two features were not examined during the 1996 survey and would need further study to determine the impact of these features on anadromous fish.

Restoration opportunities

Habitat restoration would involve the mitigation of the impacts of logging. Work could include logging road deactivation and slope stabilization at higher elevations in the watershed. Instream work on some of the tributaries most affected by logging could include bank stabilization, placement of large woody debris and boulder clusters. The main problem with instream work is that many of the areas that have been most impacted by logging have been logged 20 to 50 years ago and no longer have good access. The areas that have been most impacted by logging are Lippy Creek Reach 1, Sorenson Creek Reach 1, Reach 1 of Alice Lake tributaries 4, 5, 7 and 11, Benson River Reach 1, Link River Reach 1, Teihsum River Reach 1, 3 and 4, upper Marble River Reach 1 and Howlal Creek Reaches 1 and 2.

The bridge across the unnamed tributary to the Teihsum River tributary (WSC 930-8652-725-259-392; UTM 09.6211.55757) could be removed and the creek redirected back to its original course to prevent further channel erosion. The slumps on Pinch Creek (UTM 09.616580.5588441) and Alice Lake tributary #8 (≈UTM 09.6151.55898) could be examined during high flows to determine if these areas are still eroding. If so the banks in these areas could be stabilized. All three of these areas have stabilized some what since the slumping and channel diversion first occurred. These areas should be assessed by a terrain specialist to determine if the channel redirection and bank stabilization would be benefical restoration projects.

4.4 Wildlife observations

Wildlife observed in the Marble River watershed during the study included marten, beaver, black bear, blacktail deer, red squirrel, Stellar's jay, widgeon, junco, band tail pigeon, scaup, ruffed grouse and belted king fisher. Signs of a herd of Roosevelt elk were observed in the Teihsum River valley. The rough-skinned newt was observed in Reach 3 of the Marble River and in unnamed Lake L2 on lower Marble River tributary 3 (Fielden 1997b). The red-legged frog and pacific tree frog were two other species of amphibians observed in the watershed. Freshwater mussels were observed in lower Marble tributary 2 and in unnamed Lake L4 (Lower Marble River tributary 3; Fielden 1997d).

4.5 Additional sampling

Time constraints limited the number of areas that could be sampled in the study area during the 1996 survey. Ideally, fish density and maximum salmonid density estimates would have been made in each reach. During the survey little information was obtained on rainbow trout. The sites that were surveyed contained low densities of this species. More wide spread sampling would have determined if densities were low throughout the study area or if juveniles were concentrated in certain reaches. Many of the larger more confined mainstem reaches with coarse substrate that were missed could possibly contain higher densities of rainbow juveniles. These reaches include Reaches 1-6 of the lower Marble River, Reach 2 of the Link River and Reach 2, 3 and 4 of the Benson River (Table 24).

Reach descriptions and fish presence and absence was not done for some reaches. The Benson River was initially divided into two reaches during the habitat pretyping phase but after viewing video tapes of the river at the end of the study the upper portion of the river was broken into three reaches. As a consequence sites were missed for Reach 2 and 3.

Reach descriptions and fish distributions were determined up to a barrier in Reach 2 of Yootook Creek and in the upper part of the system in Reach 5. Fish were found in the system up to the barrier but not at the site in Reach 5. Sites in Reaches 3 and 4 could be surveyed to describe the reaches and to determine the distribution of fish in the system. The lower barrier in Reach 2 is a temporary barrier created by a logjam in the canyon. There are several other barriers above this obstruction that could be documented. Access to Reach 3 would have to be gained on foot.

Table 24. Potential additional sampling sites in the Marble River study area.

System	Location	[1]UTM
Lower Marble River	R1	09.6061.55987
Lower Marble River	R2	09.6075.55990
Lower Marble River	R3	09.6085.55990
Lower Marble River	R4	09.6095.55989
Lower Marble River	R5	09.6105.55989
Lower Marble River	R6	09.6112.55983
Lower Marble River trib 1	R1	09.6058.55982
Lower Marble River trib 1	R2	09.6058.55975
Lower Marble River trib 1	R3	09.6058.55968
Lower Marble River trib 2	R2	09.6090.55600
Lower Marble River trib 2 -trib.	R1	09.6083.55967
Link River	R2	09.6137.55878
Benson River	R2	09.6177.55856
Benson River	R3	09.6191.55846
Benson River	R4	09.6202.55839
Alice Lake trib.7	R1	09.6145.55908
Yootook Creek	R3	09.6177.55846
Yootook Creek	R4	09.6178.55837
Teihsum River	R1	09.6175.55766
Upper Marble River	R1	09.6181.55709

[1]UTM - Coordinates are approximate. Actual site locations will need to be determined in the field.

Lower Marble River tributary 1, which flows into the estuary from the south was not surveyed. This creek appears to have 2.6 km of potential fish habitat in three reaches. Hamilton 1980 indicates that chum spawn in this tributary for 1.5 km.

Lower Marble River tributary 2 appears to be an important coho spawning and rearing area. This system was surveyed to a point 1.4 km upstream. The rest of the system should be surveyed to determine the distribution of fish and to verify reach breaks. The creek has a significant tributary (WSC: 930-8652-070-311) that should also be investigated.

Alice Lake tributary 7 appears to be an important coho stream. Coho densities and MSD estimates should be determined for Reach 1.

Most of the tributaries flowing into Victoria Lake are steep and have little fish habitat. The majority of spawning and rearing habitat for Victoria Lake trout and Dolly Varden is restricted to Reach 1 of the Teihsum and upper Marble Rivers.

Juvenile rearing densities, fish species compositions and size-age distributions could be investigated in these areas. Some of the tributaries that flow across the flood plain of the upper Marble River could be investigated for fish and fish habitat. The flood plains of Reach 1 of the Teihsum River, Benson River, Link River and Upper Marble River could be investigated for Fisheries Sensitive Zones.

5.0 CONCLUSIONS

The biophysical and fisheries assessment of the Marble River took place during August, September and October 1996 during low flows. The Marble River is a large lake fed system covering an area of 518 km^2. The watershed is situated on the west coast of Vancouver Island which is an area of seasonally high rainfall (Mean annual precipitation = 3,346 mm at Port Alice). Stream flows in the Marble River are correlated to precipitation as most of the watershed is low in elevation (<1,420 m) and little precipitation falls as snow in the winter. Minimum precipitation generally occurs in July and maximum precipitation occurs in November while minimum flows in the lower Marble River generally occur in August and maximum flows occur in December. The two large lakes, Alice Lake and Victoria Lake and three smaller lakes on the Benson River help to moderate flows and delay the response of the system to rainfall. Many of the tributaries flowing into the lakes have a steep gradient and are subjected to rapidly changing flows.

Marble River is a significant salmon river and is particularly productive for coho and chinook due to the influence of the lakes on the system. Estimated chinook escapements from 1983 to 1992 averaged 1,700 (DFO SEDS data). The chinook escapement for 1996 was 3,200 (D. Grant, Marble River hatchery, pers. comm.). The majority of chinook spawn in the lower Marble River. For chinook, the lakes in the system likely lead to relatively high egg to fry survivals due to the moderating influence of flows on the spawning grounds.

Estimated coho escapements from 1983 to 1992 averaged 1,400 (DFO, SEDS data). The coho escapements could be much higher as this species is difficult to assess. The Benson River is a significant coho spawning area (Hamilton 1980). Howlal Creek, lower Marble River tributary 2 and Alice Lake tributary 7 are three creeks that appear to have an abundance of good coho spawning and rearing habitat, as well. Lower Marble River tributary 2 has at least 1.4 km of low gradient (0.8%) coho habitat. The area along this portion of the creek has not been logged although it was burnt 90 years ago. Howlal Creek has 3.1 km of habitat with a 1.9% gradient and Alice Lake tributary 7 has 2.5 km of habitat with a 2% gradient.

Alice Lake, Benson Lake and Kathleen Lake may be important nursery areas for coho. Despite being a significant coho spawning area, juvenile densities at the site surveyed in Reach 1 of the Benson River appeared to be relatively low (1.9 fish·100m^{-2}, Table 18) as the site had low coho habitat suitability (0.16, Table 20). Low coho densities throughout the Benson River would indicate that many juveniles migrate downstream to rear in Alice Lake. Many of the coho juveniles from the smaller Alice Lake tributaries possibly rear in Alice Lake as well as flows can become very low in the summer and as in the case of Lippy Creek some become dry.

The chum and pink runs are relatively small as these two species are restricted to the lower part of the river and the tributaries below Twin Falls.

Escapement data for summer steelhead, winter steelhead and sockeye indicates that these populations are small despite the extensive spawning and rearing habitat available. A comparison of steelhead production capability estimates for the Marble River compared to angler catches indicates the run is severely depressed (Lirette *et al*. 1987). Lirette *et al.* (1987) estimated that the lower Marble River, Link River, lower Benson River and upper Benson River have the capability to produce 9,700 to 10,100 smolts (1.9 - 2.2 fish·100 m^{-2}) resulting in a total run size of 1,300. The annual escapement is estimated at 50 winter steelhead and 100 summer steelhead (C. Wightman, MELP, pers. comm.). The reasons for the depressed state of the steelhead and sockeye stocks is not readily apparent. Factors outside the watershed such as interceptions by commercial ocean salmon fisheries could be a problem.

There has been some mining activity in the watershed, particularly in the vicinity of Benson Lake and to a smaller extent near the middle Marble (Link) River. There have been five operating iron and copper mines near Benson Lake. There was a limestone quarry near the Link River and there is an active limestone quarry near Benson Lake. A dam and power plant was built at the outlet to Maynard Lake to provide power and water to a copper mine. This facility probably had little impact on anadromous fish as it was built on a system that is inaccessible. The facility is still there but is not used. The Benson Lake Copper Mine discharged tailings into Benson Lake during its operation that may have had an impact on chinook and coho in the system by elevating levels of heavy metal (Sprout and Fraser 1981). No information was obtained on whether heavy metal concentrations are a problem at the present time.

Fish populations may have been impacted by the removal of water from the system by the WFP pulpmill in Port Alice and the BHP copper mine on Rupert Inlet. The pulpmill and mine withdraw 3.3 - 3.8 $m^{3}\cdot sec^{-1}$ of water. The extraction of water could reduce juvenile rearing habitat during the summer in the Link and lower Marble Rivers when flows can reach a low of 1.9 $m^{3}\cdot sec^{-1}$ (Environment Canada). The copper mine is to be closed down in 1997 which will reduce the removal of water by 0.9 $m^{3}\cdot sec^{-1}$.

Of all the industrial activity in the watershed, logging has probably had the most impact on fish populations, particularly in the tributaries feeding the lakes. The valley bottoms throughout most of the watershed have been logged to the stream banks over the past 50 years. Sprout and Fraser (1981) stated that of a number of streams in Areas 26 and 27, fisheries related problems from logging were most notable in the Marble River. Problems from logging along with mining activity may have caused the dramatic decline in chinook and coho stocks in the Marble River (Sprout and Fraser 1981). Areas examined during 1996 that have been most heavily impacted by logging would be Lippy Creek Reach 1, Sorenson Creek Reach 1, Reach 1 of Alice Lake tributaries 4, 5, 7 and 11, Benson River Reach 1, Link River Reach 1, Teihsum River Reach 1, 3 and 4, upper Marble River Reach 1 and Howlal Creek Reaches 1 and 2. These reaches are the least confined with erodable fine, gravel and cobble banks. Logging has likely contributed to channel instability, increased channel widths, reduced large woody debris in the channel and a loss of habitat complexity. Logging can lead to greater instability of the gravel - cobble banks because there is no longer the root masses of mature timber and large debris armouring the banks to dissipating some of the stream's energy. As the banks destabilize, channel widths increase and channel complexity is lost. The removal of mature timber along the stream leads to a loss of cover sources for fish. The effects of removing old growth forest along a stream channel are well documented in other systems (Hogan 1986; Flebbe and Dolloff 1995; Bisson *et al*. 1987; Bilby 1984).

Although logging in the watershed may have decreased the suitability of fish habitat in some reaches, the limited amount of sampling that was done in 1996 indicates that coho populations in late summer were generally at or above capacity.

Dolly Varden and trout populations in the anadromous areas that were sampled appear to be well below capacity. There could be several reasons why juvenile densities of these fish were low:

1. The number of spawners could be low. Trout and Dolly Varden populations in Alice Lake could be low, although this seems unlikely given the size of the lake compared to the available spawning habitat. There is evidence that the steelhead escapement is small.

2. Spawning could be adequate but egg to fry survivals are low. The high densities of coho suggest that egg to fry survivals are adequate for that species, however.

3. The areas that were sampled may not be highly suitable for rearing or the areas sampled are not near spawning areas. More widespread sampling needs to be conducted to determine if trout and Dolly Varden are more concentrated in other areas. Steelhead probably prefer the larger systems for spawning. Steelhead juvenile densities could be higher in some areas of the mainstems of the lower Marble, Link and Benson Rivers.

4. The high densities of coho juveniles at some of the sample sites may have depressed trout and Dolly Varden juvenile densities.

6.0 RECOMMENDATIONS

1. More extensive sampling should be conducted to determine if rainbow trout and Dolly Varden densities are universally low or if there are more significant rearing areas. Potential steelhead rearing areas to be investigated could include the lower Marble River, Benson River Reaches 2 and 3 and the Link River Reach 2.

2. Lower Marble tributaries 1 and 2 should be more thoroughly investigated to determine fish distributions.

3. The bridge across Jeune Creek should be examined by an engineer. There is only 89 cm between the stream bed and the bottom of the bridge so it could be in danger of washing out during high flows.

4. The Marble River appears to have ample sockeye spawning and rearing habitat but escapement data indicates the population is low. Information on the sockeye stock could be reviewed for factors limiting returns. Perhaps enhancement efforts could be redirected from enhancing coho and chinook stocks to enhancing the sockeye stock.

5. An assessment of the habitat above the canyon in Reach 2 of Yootook Creek needs to be done to determine whether the logjam in the canyon should be removed to allow access to anadromous fish.

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Appendix A. Marble River fish size and age data, August-October, 1996.

System	Date	Reach	Site	Habitat	Capture method	Pass	Fish no.	Species	Fork length (mm)	Weight (g)	Scale no.	Age 1	Age 2	Age final	K	Sex	Maturity	Activity	Comments
Alice L. trib. 7 trib.	Sept 5/96	1	1		EL		1	CT	125	19.5	1	regen	2		1.00		IM	R	
Alice L. trib. 7 trib.	Sept 5/96	1	1		EL		2	CT	117	15.7	2	2+	1	2+	0.98	M	MT	R	
Alice L. trib. 7 trib.	Sept 5/96	1	1		EL		3	CT	96	8.1	3	1+	1	1+	0.92		IM	R	
Alice L. trib. 7 trib.	Sept 5/96	1	1		EL		4	CT	33	0.3	4	0+			0.83		IM	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		1	C0	60		1	0+	0	0+			J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		2	C0	86								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		3	C0	80								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		4	C0	84								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		5	C0	82								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		6	C0	95		2	0+	1	0+			J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		7	C0	89		3	0+	1	0+			J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		8	C0	105								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		9	C0	86								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		10	C0	86								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		11	C0	90								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		12	C0	95								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		13	C0	103								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		14	C0	100								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		15	C0	80		4	0+	1	0+			J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		16	C0	71								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		17	C0	92								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		18	C0	45								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		19	C0	47								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		20	C0	87								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		21	C0	78								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		22	C0	114		5	0+	2	0+			J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		23	C0	104								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		24	C0	93								J	R	

Capture method codes: SN - seine; EL - electroshocker; MT - minnow trap
Species codes: CO - coho; CAS - prickly sculpin; CT - cutthroat trout; RB - rainbow trout; DV - Dolly Varden
Maturity codes: IM - immature; MT - maturing; M - mature; J - juvenile; A - adult
Activity codes: R - rearing

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Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		25	C0	68								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		26	C0	73								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		27	C0	78								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		28	C0	53								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		29	C0	73								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		30	C0	45								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		31	C0	52								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		32	C0	86								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		33	C0	86								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		34	C0	115								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		35	C0	88								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		36	C0	92								J	R	
Alice Lake trib. 7	Sept 4/96	1	1	pool	SN		37	C0	79		6	0+	1	0+			J	R	
Alice Lake trib. 7	Sept 4/96	2	2		EL		1	DV	150		1	2+	4	3+		M	M	R	
Alice Lake trib. 7	Sept 4/96	2	2		EL		2	DV	106										
Alice Lake trib. 7	Sept 4/96	2	2		EL		3	DV	124										
Alice Lake trib. 7	Sept 4/96	2	2		EL		4	DV	120										
Alice Lake trib. 7	Sept 4/96	2	2		EL		5	DV	148		2	2+	3	3+		F	M	R	
Alice Lake trib. 7	Sept 4/96	2	2		EL		6	DV	113		3	1+	3	2+		F	M	R	
Alice Lake trib. 7	Sept 4/96	2	2		EL		7	CT	50										
Alice Lake trib. 7	Sept 4/96	2	2		EL		8	CT	60										
Alice Lake trib. 7	Sept 4/96	2	2		EL		9	CT	51										
Alice Lake trib. 7	Sept 4/96	2	2		EL		10	CT	64										
Alice Lake trib. 7	Sept 4/96	2	2		EL		11	CT	124		1	1+	1	1+					
Alice Lake trib. 7	Sept 4/96	2	2		EL		12	CT	63		2	0+	0	0+					
Benson R	Sept 8/96	1	1	riffle	EL		1	RB	66	3.1	1	0+	1	0+	1.08		J	R	
Benson R	Sept 8/96	1	1	riffle	EL		2	RB	75	4.2					1.00		J	R	
Benson R	Sept 8/96	1	1	riffle	EL		3	RB	77	4.5					0.99		J	R	

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Benson R	Sept 8/96	1	1	riffle	EL		4	RB	63	2.4	2	0+	1	0+	0.96		J	R	
Benson R	Sept 8/96	1	1	riffle	EL		5	CAS	77	4.6					1.01				
Benson R	Sept 8/96	1	1	riffle	EL		6	CAS	60	2.2					1.02				
Benson R	Sept 8/96	1	1	riffle	EL		7	CAS	52	1.7					1.21				
Benson R	Sept 8/96	1	1	riffle	EL		8	CAS	47	1.0					0.96				
Benson R	Sept 8/96	1	1	riffle	EL		9	CAS	48	1.0					0.90				
Benson R	Sept 8/96	1	1	riffle	EL		10	CAS	48	1.0					0.90				
Benson R	Sept 8/96	1	1	pool	SN		11	CO	55	2.1					1.26		J	R	
Benson R	Sept 8/96	1	1	pool	SN		12	CO	66	3.0					1.04		J	R	
Benson R	Sept 8/96	1	1	pool	SN		13	CO	70	3.6					1.05		J	R	
Benson R	Sept 8/96	1	1	glide	SN		14	RB	71	3.5					0.98		J	R	
Benson R	Sept 8/96	1	1	glide	SN		15	CO	75	4.9					1.16		J	R	
Benson R	Sept 8/96	1	1	glide	SN		16	CO	79	5.1					1.03		J	R	
Benson R	Sept 8/96	1	1	glide	SN		17	CO	70	3.8	1	0+	1	0+	1.11		J	R	
Benson R	Sept 8/96	1	1	glide	SN		18	CO	70	3.8					1.11		J	R	
Benson R	Sept 8/96	1	1	glide	SN		19	CO	58	2.3					1.18		J	R	
Benson R	Sept 8/96	1	1	glide	SN		20	CO	67	3.3					1.10		J	R	
Benson R	Sept 8/96	1	1	glide	SN		21	CO	64	2.6					0.99		J	R	
Benson R	Sept 8/96	1	1	glide	SN		22	CO	64	2.8					1.07		J	R	
Benson R	Sept 8/96	1	1	glide	SN		23	CO	72	3.9					1.04		J	R	
Benson R	Sept 8/96	1	1	glide	SN		24	CO	68	3.5					1.11		J	R	
Benson R	Sept 8/96	1	1	glide	SN		25	CO	59	2.1	2	0+	1	0+	1.02		J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	1	CO	52								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	2	CO	77								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	3	CO	81								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	4	CO	46								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	5	CO	64								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	6	CO	68								J	R	

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Howlal Cr.	Sept 2/96	1	1	glide	SN	1	7	CO	54								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	8	CO	52								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	9	CO	44								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	10	CO	51								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	11	CO	52								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	12	CO	53								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	13	CO	53								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	14	CO	43								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	15	CO	49								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	16	CO	47								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	17	CO	44								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	18	CO	43								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	19	CO	43								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	20	CO	43								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	21	CO	79								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	22	CO	74								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	23	CO	79								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	24	CO	48								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	25	CO	78								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	26	CO	49								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	27	CO	55								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	28	CO	49								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	29	CO	46								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	30	CO	41								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	31	RB	47								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	1	32	RB	37								J	R	
Howlal Cr.	Sept 2/96	1	1	glide	SN	2	33	CO	42								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	1	CO	75								J	R	

Capture method codes: SN - seine; EL - electroshocker; MT - minnow trap
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Activity codes: R - rearing

Appendix A. Marble River fish size and age data, August-October, 1996.

System	Date	Reach	Site	Habitat	Capture method	Pass	Fish no.	Species	Fork length (mm)	Weight (g)	Scale no.	Age 1	Age 2	Age final	K	Sex	Maturity	Activity	Comments
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	2	CO	81								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	3	CO	47								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	4	CO	51								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	5	CO	47								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	6	CO	75								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	7	CO	66								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	8	CO	50								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	9	CO	76								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	10	CO	57								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	11	CO	77								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	12	CO	75								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	13	CO	73								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	14	CO	82								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	15	CO	77								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	16	CO	71								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	17	CO	78								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	18	CO	82								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	19	CO	66								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	20	CO	68								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	21	CO	70								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	22	CO	71								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	23	CO	66								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	24	CO	46								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	25	CO	43								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	26	CO	55								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	27	CO	47								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	28	CO	53								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	29	CO	43								J	R	

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System	Date	Reach	Site	Habitat	Capture method	Pass	Fish no.	Species	Fork length (mm)	Weight (g)	Scale no.	Age 1	Age 2	Age final	K	Sex	Maturity	Activity	Comments
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	30	CO	46								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	31	CO	42								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	32	CO	79								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	33	CO	81								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	34	CO	75								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	35	CO	82								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	36	CO	83								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	37	CO	85								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	38	CO	84								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	39	CO	86								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	40	CO	79								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	41	CO	55								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	42	CO	48								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	43	CO	71								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	44	CO	80								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	45	CO	72								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	46	CO	50								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	47	CO	43								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	48	CO	77								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	49	CO	73								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	50	CO	72								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	51	CO	63								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	52	CO	69								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	53	CO	61								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	54	CO	69								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	55	CO	65								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	56	CO	58								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	57	CO	46								J	R	

Capture method codes: SN - seine; EL - electroshocker; MT - minnow trap
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System	Date	Reach	Site	Habitat	Capture method	Pass	Fish no.	Species	Fork length (mm)	Weight (g)	Scale no.	Age 1	Age 2	Age final	K	Sex	Maturity	Activity	Comments
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	58	CO	54								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	59	RB	46								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	60	CO	51								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	61	CO	46								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	62	RB	42								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	63	CO	57								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	64	CO	44								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	65	CO	82								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	66	CO	75								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	67	CO	77								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	68	CO	80								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	69	CO	94								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	70	CO	78								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	71	CO	76								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	72	CO	79								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	73	CO	48								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	74	CO	76								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	75	CO	82								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	76	CO	77								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	77	CO	75								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	78	CO	54								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	79	CO	50								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	80	CO	50								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	81	CO	72								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	82	CO	75								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	83	CO	52								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	84	CO	80								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	85	CO	76								J	R	

Capture method codes: SN - seine; EL - electroshocker; MT - minnow trap
Species codes: CO - coho; CAS - prickly sculpin; CT - cutthroat trout; RB - rainbow trout; DV - Dolly Varden
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Howlal Cr.	Sept 2/96	1	1	pool	SN	1	86	CO	80								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	87	CO	78								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	88	CO	45								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	89	CO	51								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	90	CO	76								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	91	CO	44								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	92	CO	83								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	93	CO	77								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	94	CO	84								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	95	CO	80								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	96	CO	46								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	97	CO	73								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	98	CO	52								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	99	CO	78								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	100	CO	52								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	101	CO	48								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	102	CO	78								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	103	CO	46								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	104	CO	67								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	105	CO	43								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	106	CO	45								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	1	107	RB	42								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	2	108	CO	73								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	2	109	CO	75								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	2	110	CO	82								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	2	111	CO	95								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	2	112	CO	43								J	R	
Howlal Cr.	Sept 2/96	1	1	pool	SN	2	113	CO	49								J	R	

Capture method codes: SN - seine; EL - electroshocker; MT - minnow trap
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Howlal Cr.	Sept 2/96	1	1	riffle	EL	1	1	CAS	95								J	R	
Howlal Cr.	Sept 2/96	1	1	riffle	EL	1	2	CO	55			0+		0+			J	R	
Howlal Cr.	Sept 2/96	1	1	riffle	EL	1	3	CO	52			0+		0+			J	R	
Howlal Cr.	Sept 2/96	1	1	riffle	EL	1	4	CO	55			0+		0+			J	R	
Howlal Cr.	Sept 2/96	1	1	riffle	EL	1	5	CO	52			0+		0+			J	R	
Howlal Cr.	Sept 2/96	1	1	riffle	EL	1	6	CO	53			0+		0+			J	R	
Howlal Cr.	Sept 2/96	1	1	riffle	EL	1	7	CO	59			0+		0+			J	R	
Howlal Cr.	Sept 2/96	1	1	riffle	EL	1	8	CO	43			0+		0+			J	R	
Howlal Cr.	Sept 2/96	1	1	riffle	EL	1	9	CO	49			0+		0+			J	R	
Howlal Cr.	Sept 2/96	1	1	riffle	EL	1	10	CO	42			0+		0+			J	R	
Howlal Cr.	Sept 2/96	1	1	riffle	EL	1	11	CO	44			0+		0+			J	R	
Howlal Cr.	Sept 2/96	1	1	riffle	EL	1	12	RB	50			0+		0+			J	R	
Howlal Cr.	Sept 2/96	1	1	riffle	EL	1	13	RB	44			0+		0+			J	R	
Howlal Cr.	Sept 2/96	1	1	riffle	EL	1	14	RB	43			0+		0+			J	R	
Howlal Cr.	Sept 2/96	1	1	riffle	EL	2	15	CO	43			0+		0+			J	R	
Howlal Cr.	Sept 2/96	1	1	riffle	EL	2	16	CO	45			0+		0+			J	R	
Howlal Cr.	Sept 2/96	1	1	riffle	EL	2	17	RB	44			0+		0+			J	R	
Howlal Cr.	Sept 2/96	1	1	riffle	EL	2	18	RB	41			0+		0+			J	R	
Howlal Cr.	Sept 7/96	1	1		SN		1	CO	65	2.6					0.95		J	R	
Howlal Cr.	Sept 7/96	1	1		SN		2	CO	76	4.3					0.98		J	R	
Howlal Cr.	Sept 7/96	1	1		SN		3	CO	85	5.7					0.93		J	R	
Howlal Cr.	Sept 7/96	1	1		SN		4	CO	71	3.2					0.89		J	R	
Howlal Cr.	Sept 7/96	1	1		SN		5	CO	72	3.4					0.91		J	R	
Howlal Cr.	Sept 7/96	1	1		SN		6	CO	51	1.4					1.06		J	R	
Howlal Cr.	Sept 7/96	1	1		SN		7	CO	51	1.3					0.98		J	R	
Howlal Cr.	Sept 7/96	1	1		SN		8	CO	48	1.3					1.18		J	R	
Howlal Cr.	Sept 7/96	1	1		SN		9	CO	50	1.1					0.88		J	R	
Howlal Cr.	Sept 7/96	1	1		SN		10	CO	49	1.3					1.10		J	R	

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Howlal Cr.	Sept 7/96	1	1		SN		11	CO	77	4.5					0.99		J	R	
Howlal Cr.	Sept 7/96	1	1		SN		12	CO	81	5.2					0.98		J	R	
Howlal Cr.	Sept 7/96	1	1		SN		13	CO	77	4.5					0.99		J	R	
Howlal Cr.	Sept 7/96	1	1		SN		14	CO	76	4.2					0.96		J	R	
Howlal Cr.	Sept 7/96	1	1		SN		15	CO	49	1.1					0.93		J	R	
Howlal Cr.	Sept 7/96	1	1		SN		16	CO	48	1.0					0.90		J	R	
Howlal Cr.	Sept 7/96	1	1		SN		17	CO	71	3.4					0.95		J	R	
Howlal Cr.	Sept 7/96	1	1		SN		18	CO	77	4.8					1.05		J	R	
Howlal Cr.	Sept 7/96	1	1		SN		19	CO	61	2.5					1.10		J	R	
Howlal Cr.	Sept 7/96	1	1		SN		20	CO	73	3.7					0.95		J	R	
Howlal Cr.	Sept 7/96	1	1		SN		21	CO	55	1.7					1.02		J	R	
Howlal Cr.	Sept 7/96	1	1		SN		22	CO	45	0.9					0.99		J	R	
Howlal Cr.	Sept 7/96	1	1		SN		23	CO	50	1.2					0.96		J	R	
ilp 00002	Oct 15/96	1	3		EL		35	CT	78	4.9				0+	1.03		J	R	
ilp 00003	Oct. 96	1	3		EL		37	CT	92	7.3				1+	0.94		J	R	
ilp 00003	Oct. 96	1	3		EL		38	CT	66	3.3				0+	1.15		J	R	
ilp 00005	Oct 13/96	1	2		EL		1	CT	135	25.6				1+	1.04		J	R	
ilp 00005	Oct 13/96	1	2		EL		2	CT	55	1.7				0+	1.02		J	R	
ilp 00005	Oct 13/96	1	2		EL		3	CT	56	1.7				0+	0.97		J	R	
ilp 00005	Oct 13/96	1	2		EL		4	CT	111	13.2				1+	0.97		J	R	
ilp 00005	Oct 13/96	1	2		EL		5	CT	126	20.3				1+	1.01		J	R	
ilp 00005	Oct 13/96	1	2		EL		6	CT	56	1.9				0+	1.08		J	R	
ilp 00005	Oct 13/96	1	2		EL		7	CT	53	1.5				0+	1.01		J	R	
ilp 00005	Oct 13/96	1	2		EL		8	CT	50	1.2				0+	0.96		J	R	
ilp 00005	Oct 13/96	1	2		EL		9	CT	55	1.7				0+	1.02		J	R	
Jeune Cr.	Sept 7/96	1	1		EL		1	RB	109	13.2	1	1+	2	1+	1.02		IM	R	
Jeune Cr.	Sept 7/96	1	1		EL		2	RB	117	21.4	2	1+	2	1+	1.34	M	MT	R	DNA
Jeune Cr.	Sept 7/96	1	1		EL		3	RB	108	14.3	3	1+	2	1+	1.14		IM	R	

Capture method codes: SN - seine; EL - electroshocker; MT - minnow trap
Species codes: CO - coho; CAS - prickly sculpin; CT - cutthroat trout; RB - rainbow trout; DV - Dolly Varden
Maturity codes: IM - immature; MT - maturing; M - mature; J - juvenile; A - adult
Activity codes: R - rearing

Appendix A. Marble River fish size and age data, August-October, 1996.

System	Date	Reach	Site	Habitat	Capture method	Pass	Fish no.	Species	Fork length (mm)	Weight (g)	Scale no.	Age 1	Age 2	Age final	K	Sex	Maturity	Activity	Comments
Jeune Cr.	Sept 7/96	1	1		EL		4	RB	92	9.6	4	1+	2	1+	1.23		IM	R	
Jeune Cr.	Sept 7/96	1	1		EL		5	RB	71	4.6	5	0+	1	0+	1.29		IM	R	
Jeune Cr.	Sept 7/96	1	1		EL		6	RB	109	16.9					1.30		IM	R	
Lake 2 outlet	Oct 11/96	1	7		EL		44	CAS	75	5.0	1	0+		0+	1.19		J	R	
Lake 2 outlet	Oct 11/96	1	7		EL		45	CAS	73	3.9				0+	1.00		J	R	
Lake 2 outlet	Oct 11/96	1	7		EL		46	CT	72	3.6				0+	0.96		J	R	
Lake 5 - Tributary 2	Oct. 9/96	1	4		EL		64	CT	58	1.8	1	0+	0+	0+	0.92		J	R	
Lake 5 - Tributary 2	Oct. 9/96	1	4		EL		65	CT	143	28.1	2	2+	2+	2+	0.96		J	R	
Lake 5 - Tributary 2	Oct. 9/96	1	4		EL		66	CT	62	2.4	3	0+	0+	0+	1.01		J	R	
Lake 5 - Tributary 2	Oct. 9/96	1	4		EL		67	CT	52	1.5				0+	1.07		J	R	
Lake 5 - Tributary 2	Oct. 9/96	1	4		EL		68	CT	61	2.5				0+	1.10		J	R	
Link R.	Sept 6/96	1	1	pool	SN		1	CO	73	4.1					1.05		J	R	
Link R.	Sept 6/96	1	1	pool	SN		2	CO	75	4.4					1.04		J	R	
Link R.	Sept 6/96	1	1	pool	SN		3	CO	88	7.7					1.13		J	R	
Link R.	Sept 6/96	1	1	pool	SN		4	CO	74	4.3					1.06		J	R	
Link R.	Sept 6/96	1	1	pool	SN		5	CO	82	6.1					1.11		J	R	
Link R.	Sept 6/96	1	1	pool	SN		6	CO	82	5.6					1.02		J	R	
Link R.	Sept 6/96	1	1	pool	SN		7	CO	79	5.4					1.10		J	R	
Link R.	Sept 6/96	1	1	pool	SN		8	CO	84	6.4	1	0+	1	0+	1.08		J	R	
Link R.	Sept 6/96	1	1	pool	SN		9	CO	61	2.4	2	0+	0	0+	1.06		J	R	
Link R.	Sept 6/96	1	1	pool	SN		10	RB	75	4.6	1	0+	1	0+	1.09		J	R	
Link R.	Sept 6/96	1	1	pool	SN		11	CO	81	5.3					1.00		J	R	
Link R.	Sept 6/96	1	1	pool	SN		12	CO	94	8.5	3	regen	1		1.02		J	R	
Link R.	Sept 6/96	1	1	pool	SN		13	CO	73	4.6					1.18		J	R	
Link R.	Sept 6/96	1	1	pool	SN		14	CO	84	6.2					1.05		J	R	
Link R.	Sept 6/96	1	1	pool	SN		15	CO	90	7.4					1.02		J	R	
Link R.	Sept 6/96	1	1	pool	SN		16	CO	67	2.0					0.66		J	R	skinny
Link R.	Sept 6/96	1	1	pool	SN		17	CO	86	6.9					1.08		J	R	

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Appendix A. Marble River fish size and age data, August-October, 1996.

System	Date	Reach	Site	Habitat	Capture method	Pass	Fish no.	Species	Fork length (mm)	Weight (g)	Scale no.	Age 1	Age 2	Age final	K	Sex	Maturity	Activity	Comments
Link R.	Sept 6/96	1	1	pool	SN		18	CO	80	5.3					1.04		J	R	
Link R.	Sept 6/96	1	1	pool	SN		19	CO	80	5.2					1.02		J	R	
Link R.	Sept 6/96	1	1	pool	SN		20	CO	77	4.9					1.07		J	R	
Link R.	Sept 6/96	1	1	pool	SN		21	RB	126	20.0	2	1+	2	1+	1.00		J	R	DNA
Link R.	Sept 6/96	1	1	pool	SN		22	CO	83	6.4					1.12		J	R	
Link R.	Sept 6/96	1	1	pool	SN		23	CAS	65										
Link R.	Sept 6/96	1	1	pool	SN		24	CO	63	2.6					1.04		J	R	
Link R.	Sept 6/96	1	1	pool	SN		25	CO	77	4.7	4	0+	1	0+	1.03		J	R	
Link R.	Sept 6/96	1	1	pool	SN		26	CO	77	5.0					1.10		J	R	
Link R.	Sept 6/96	1	1	pool	SN		27	CO	85	5.8					0.94		J	R	
Link R.	Sept 6/96	1	1	pool	SN		28	CO	85	6.8					1.11		J	R	
Link R.	Sept 6/96	1	1	pool	SN		29	CO	79	5.6					1.14		J	R	
Link R.	Sept 6/96	1	1	pool	SN		30	CO	94	8.8					1.06		J	R	
Link R.	Sept 6/96	1	1	pool	SN		31	CO	72	4.1					1.10		J	R	
Link R.	Sept 6/96	1	1	pool	SN		32	CO	76	4.9					1.12		J	R	
Link R.	Sept 6/96	1	1	pool	SN		33	CO	76	4.6					1.05		J	R	
Link R.	Sept 6/96	1	1	pool	SN		34	CO	77	4.7					1.03		J	R	
Link R.	Sept 6/96	1	1	pool	SN		35	CO	100	10.7					1.07		J	R	
Link R.	Sept 6/96	1	1	pool	SN		36	CO	78	4.8	5	1+	2	1+	1.01		J	R	
Link R.	Sept 6/96	1	1	pool	SN		37	CAS	125								J	R	
Link R.	Sept 6/96	1	1	pool	SN		38	CAS	57								J	R	
Link R.	Sept 6/96	1	1	pool	SN		39	CAS	52								J	R	
Link R.	Sept 6/96	1	1	pool	SN		40	CAS	52								J	R	
Link R.	Sept 6/96	1	1	riffle	SN		41	CO	92	7.3					0.94		J	R	
Link R.	Sept 6/96	1	1	riffle	SN		42	CAS	74								J	R	
Link R.	Sept 6/96	1	1	riffle	SN		43	CAS	54								J	R	
Link R.	Sept 6/96	1	1	riffle	SN		44	CAS	74								J	R	
Link R.	Sept 6/96	1	1	riffle	SN		45	CAS	56								J	R	

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System	Date	Reach	Site	Habitat	Capture method	Pass	Fish no.	Species	Fork length (mm)	Weight (g)	Scale no.	Age 1	Age 2	Age final	K	Sex	Maturity	Activity	Comments
Link R.	Sept 6/96	1	1	riffle	SN		46	CAS	48								J	R	
Link R.	Sept 6/96	1	1	riffle	SN		47	CAS	63								J	R	
Link R.	Sept 6/96	1	1	riffle	SN		48	CAS	47								J	R	
Link R.	Sept 6/96	1	1	riffle	SN		49	CAS	32								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	1	CO	63								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	2	CO	83								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	3	CO	75								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	4	CO	83								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	5	CO	80								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	6	CO	69								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	7	CO	79								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	8	CO	56								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	9	CO	60								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	10	CO	48								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	11	CO	88								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	12	CO	62								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	13	CO	56								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	14	CO	55								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	15	CO	53								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	16	CO	58								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	17	CO	57								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	18	CO	80								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	19	CO	66								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	20	CO	82								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	21	CO	78								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	22	CO	71								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	23	CO	43								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	24	CO	60								J	R	

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System	Date	Reach	Site	Habitat	Capture method	Pass	Fish no.	Species	Fork length (mm)	Weight (g)	Scale no.	Age 1	Age 2	Age final	K	Sex	Maturity	Activity	Comments
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	25	CO	57								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	26	CO	53								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	27	CO	51								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	28	CO	83								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	29	CO	80								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	30	CO	52								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	31	CO	47								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	32	CO	57								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	33	CO	67								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	34	CO	90								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	35	CO	78								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	36	CO	86								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	37	CO	77								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	38	CO	82								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	39	CO	55								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	40	CO	47								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	41	CO	79								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	42	CO	47								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	43	CO	81								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	44	CO	53								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	45	CO	56								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	46	CO	66								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	47	CO	60								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	48	CO	61								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	49	CO	64								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	50	CO	48								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	51	CO	52								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	52	CO	54								J	R	

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Lippy Cr.	Sept 2/96	1	2	pool	EL	1	53	CO	46								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	54	CO	58								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	55	CO	52								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	56	CO	74								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	57	CO	49								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	58	CO	88								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	59	CO	86								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	60	CO	50								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	61	CO	60								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	62	CO	81								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	63	CO	76								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	64	CO	86								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	65	CO	80								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	66	CO	57								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	67	CO	55								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	68	CO	55								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	69	CO	55								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	70	CO	51								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	71	CO	45								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	72	CO	52								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	73	CO	45								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	74	CO	44								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	75	CO	46								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	76	DV	87								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	77	DV	55								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	1	78	DV	47								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	2	79	CO	51								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	2	80	CO	67								J	R	

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Lippy Cr.	Sept 2/96	1	2	pool	EL	2	81	CO	53								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	2	82	CO	82								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	2	83	CO	83								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	2	84	CO	74								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	2	85	CO	64								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	2	86	CO	63								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	2	87	CO	89								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	2	88	CO	58								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	2	89	CO	54								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	2	90	CO	50								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	2	91	CO	48								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	2	92	CO	50								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	2	93	CO	51								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	2	94	CO	45								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	2	95	CO	45								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	2	96	CO	50								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	2	97	CO	47								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	2	98	CO	52								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	2	99	CO	50								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	2	100	CO	43								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	2	101	DV	79								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	2	102	DV	53								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	2	103	DV	62								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	2	104	DV	52								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	2	105	CT	39								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	2	106	CT	46								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	3	107	CO	58								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	3	108	CO	71								J	R	

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Lippy Cr.	Sept 2/96	1	2	pool	EL	3	109	CO	47								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	3	110	CO	48								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	3	111	DV	46								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	3	112	DV	48								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	3	113	DV	52								J	R	
Lippy Cr.	Sept 2/96	1	2	pool	EL	3	114	DV	43								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	1	CO	47								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	2	CO	62								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	3	CO	44								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	4	CO	53								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	5	CO	54								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	6	CO	47								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	7	CO	57								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	8	CO	55								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	9	CO	75								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	10	CO	60								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	11	CO	65								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	12	CO	56								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	13	CO	55								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	14	CO	53								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	15	CO	48								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	16	CO	41								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	17	CO	58								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	18	CO	79								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	19	CO	49								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	20	CO	46								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	21	CO	53								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	22	CO	68								J	R	

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Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	23	CO	51								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	24	CO	57								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	25	DV	48								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	26	DV	43								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	27	DV	45								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	28	DV	50								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	29	DV	46								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	30	DV	56								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	31	DV	47								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	32	CT	42								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	33	CT	48								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	34	CT	51								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	35	CT	37								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	36	CT	35								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	37	CT	41								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	38	CT	41								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	39	CT	36								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	40	CT	39								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	41	CT	43								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	42	CT	47								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	43	CT	41								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	44	CT	47								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	45	CT	39								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	46	CT	38								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	47	CT	44								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	48	CT	45								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	49	CT	28								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	50	CT	46								J	R	

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Lippy Cr.	Sept 2/96	1	2	riffle	EL	1	51	CT	40								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	2	52	CO	53								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	2	53	CO	50								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	2	54	DV	52								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	2	55	DV	42								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	2	56	CT	38								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	2	57	CT	58								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	2	58	CT	37								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	2	59	CT	38								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	2	60	CT	45								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	2	61	CT	45								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	2	62	CT	40								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	2	63	CT	46								J	R	
Lippy Cr.	Sept 2/96	1	2	riffle	EL	2	64	CT	36								J	R	
Lippy Cr.	Sept 9/96	1	2	pool	SN		1	CO	76	4.6					1.05		J	R	
Lippy Cr.	Sept 9/96	1	2	pool	SN		2	CO	71	3.4					0.95		J	R	
Lippy Cr.	Sept 9/96	1	2	pool	SN		3	CO	50	1.2					0.96		J	R	
Lippy Cr.	Sept 9/96	1	2	pool	SN		4	CO	58	1.8					0.92		J	R	
Lippy Cr.	Sept 9/96	1	2	pool	SN		5	CO	81	5.6					1.05		J	R	
Lippy Cr.	Sept 9/96	1	2	pool	SN		6	CO	80	5.3					1.04		J	R	
Lippy Cr.	Sept 9/96	1	2	pool	SN		7	CO	47	1.1					1.06		J	R	
Lippy Cr.	Sept 9/96	1	2	pool	SN		8	CO	60	2.2					1.02		J	R	
Lippy Cr.	Sept 9/96	1	2	pool	SN		9	CO	62	3.0					1.26		J	R	
Lippy Cr.	Sept 9/96	1	2	pool	SN		10	CO	52	1.3					0.92		J	R	
Lippy Cr.	Sept 9/96	1	2	pool	SN		11	CO	63	2.5					1.00		J	R	
Lippy Cr.	Sept 9/96	1	2	pool	SN		12	CO	55	1.7					1.02		J	R	
Lippy Cr.	Sept 9/96	1	2	pool	SN		13	CO	44	0.7					0.82		J	R	
Lippy Cr.	Sept 9/96	1	2	pool	SN		14	CO	54	1.6					1.02		J	R	

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Lippy Cr.	Sept 9/96	1	2	pool	SN		15	CO	53	1.6					1.07		J	R	
Lippy Cr.	Sept 9/96	1	2	pool	SN		16	CO	61	2.6					1.15		J	R	
Lippy Cr.	Sept 9/96	1	2	pool	SN		17	CO	50	1.2					0.96		J	R	
Lower Marble trib. 3	Oct 13/96	3	4		EL		27	CT	54	1.7				0+	1.08		J	R	
Lower Marble trib. 3	Oct 13/96	3	4		EL		28	CT	68	3.0				0+	0.95		J	R	
Lower Marble trib. 3	Oct 13/96	3	4		EL		29	CT	53	1.5				0+	1.01		J	R	
Lower Marble trib. 3	Oct 13/96	3	4		EL		30	CT	84	5.3				0+	0.89		J	R	
Lower Marble trib. 3	Oct 13/96	3	4		EL		31	CT	62	2.3				0+	0.97		J	R	
Lower Marble trib. 3	Oct 13/96	3	4		EL		32	CT	78	4.4				0+	0.93		J	R	
Lower Marble trib. 3	Oct 13/96	3	4		EL		33	CT	74	3.8				0+	0.94		J	R	
Lower Marble trib. 3	Oct 13/96	3	4		EL		34	CT	64	3.6				0+	1.37		J	R	
Lower Marble trib. 3	Oct 13/96	3	4		EL		35	CT	37	0.5				0+	0.99		J	R	
Lower Marble trib. 3	Oct 13/96	3	4		EL		36	CAS	89	7.3					1.04		J	R	
Lower Marble trib. 3	Oct 13/96	5	2		EL		39	CT	47	0.8				0+	0.77		J	R	
Lower Marble trib. 3	Oct 13/96	5	2		EL		40	CT	55	1.8				0+	1.08		J	R	
Lower Marble trib. 3	Oct 13/96	5	2		EL		41	CT	63	2.5				0+	1.00		J	R	
Lower Marble trib. 3	Oct 13/96	5	2		EL		42	CT	61	2.4				0+	1.06		J	R	
Lower Marble trib. 3	Oct 13/96	5	2		EL		43	CT	44	1.0				0+	1.17		J	R	
Lower Marble trib. 3	Oct 13/96	5	2		EL		44	CT	54	1.7				0+	1.08		J	R	
Lower Marble trib. 3	Oct 13/96	5	2		EL		45	CT	44	0.9				0+	1.06		J	R	
Lower Marble trib. 3	Oct 13/96	5	2		EL		46	CT	100	9.0				1+	0.90		J	R	
Lower Marble trib. 3	Oct 13/96	5	2		EL		47	CT	104	11.3				1+	1.00		J	R	
Lower Marble trib. 3	Oct 13/96	5	2		EL		48	CT	78	4.7				0+	0.99		J	R	
Lower Marble trib. 3	Oct 13/96	5	2		EL		49	CT	105	14.4				1+	1.24		J	R	
Lower Marble trib. 3	Oct 13/96	5	2		EL		50	CAS	69	3.2					0.97		A	R	
Lower Marble trib. 3	Oct 13/96	5	2		EL		51	CAS	71	3.0					0.84		A	R	
Lower Marble trib. 3	Oct 13/96	5	2		EL		52	CAS	62	2.5					1.05		A	R	
Lower Marble trib. 3	Oct 13/96	5	2		EL		53	CAS	108	14.0					1.11		A	R	

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Lower Marble trib. 3	Oct 11/96	8	5		EL		38	CT	58	1.7	1	0+		0+	0.87		J	R	
Lower Marble trib. 3	Oct 11/96	8	5		EL		39	CT	71	3.0	2	0+		0+	0.84		J	R	
Lower Marble trib. 3	Oct 11/96	8	5		EL		40	CT	57	1.8				0+	0.97		J	R	
Lower Marble trib. 3	Oct 11/96	8	5		EL		41	CT	66	2.7				0+	0.94		J	R	
Lower Marble trib. 3	Oct 11/96	8	5		EL		42	CT	53	1.6				0+	1.07		J	R	
Lower Marble trib. 3	Oct 11/96	8	5		EL		43	CT	53	1.7				0+	1.14		J	R	
Lower Marble trib. 3	Oct 11/96	10	5		EL		12	CT	86		1	0+	0	0+			J	R	
Lower Marble trib. 3	Oct 11/96	10	5		EL		13	CT	111	13.6	2	1+	1	1+	0.99		J	R	
Lower Marble trib. 3	Oct 11/96	10	5		EL		14	CT	89	7.1	3	1+	0	1+	1.01		J	R	
Lower Marble trib. 3	Oct 11/96	10	5		EL		15	CT	62	2.2	4	0+	0	0+	0.92		J	R	
Lower Marble trib. 3	Oct 11/96	10	5		EL		16	CT	64	2.3				0+	0.88		J	R	
Lower Marble trib. 3	Oct 11/96	10	5		EL		17	CT	72	3.9	5	0+	0	0+	1.04		J	R	
Lower Marble trib. 3	Oct 11/96	10	5		EL		18	CT	78	5.6				0+	1.18		J	R	
Lower Marble trib. 3	Oct 11/96	10	5		EL		19	CT	54	1.7	6	0+	0	0+	1.08		J	R	
Lower Marble trib. 3	Oct 11/96	10	5		EL		20	CT	79	4.9	7	1+	0	0+	0.99		J	R	
Lower Marble trib. 3	Oct 11/96	10	5		EL		21	CT	76	3.5	8	0+	0	0+	0.80		J	R	
Lower Marble trib. 5	Oct. 9/96	1	5		EL		69	CAS	49								A	R	
Lower Marble trib. 5	Oct. 9/96	1	5		EL		70	CAS	?								A	R	
Lower Marble trib. 5	Oct. 9/96	1	5		EL		71	CAS	?								A	R	
Lower Marble trib. 5	Oct. 9/96	1	5		EL		72	TSB	68								A	R	
Malook Cr.	Sept 3/96	1	1	pool	MT		1	DV	164		1	3+	3	3+		F	IM	R	
Malook Cr.	Sept 3/96	1	1	pool	MT		2	DV	117		2	1+	1	1+			IM	R	
Malook Cr.	Sept 3/96	1	1	pool	MT		3	DV	96		3	1+	2	1+			IM	R	
Malook Cr.	Sept 3/96	1	1	pool	MT		4	CO	72		1	0+	1	0+			J	R	
Malook Cr.	Sept 3/96	1	1	pool	MT		5	CO	86		2	0+	1	0+			J	R	
Malook Cr.	Sept 3/96	1	1	pool	MT		6	CO	87		3	0+	1	0+			J	R	
Malook Cr.	Sept 3/96	1	1	pool	MT		7	CO	59								J	R	
Malook Cr.	Sept 3/96	1	1	pool	MT		8	CO	80								J	R	

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Malook Cr.	Sept 3/96	1	1	pool	MT		9	CO	62								J	R	
Malook Cr.	Sept 3/96	1	1	pool	MT		10	CO	73								J	R	
Malook Cr.	Sept 3/96	1	1	pool	MT		11	CO	86								J	R	
Malook Cr.	Sept 3/96	1	1	pool	MT		12	CO	62								J	R	
Malook Cr.	Sept 3/96	1	1	pool	MT		13	CO	68								J	R	
Malook Cr.	Sept 3/96	1	1	pool	MT		14	CO	75								J	R	
Malook Cr.	Sept 3/96	1	1	pool	MT		15	CO	67								J	R	
Malook Cr.	Sept 3/96	1	1	pool	MT		16	CAS	118										
Malook Cr.	Sept 3/96	1	1	pool	MT		17	CAS	120										
Malook Cr.	Sept 3/96	1	1	pool	MT		18	CAS	98										
Malook Cr.	Sept 3/96	1	1	pool	MT		19	CAS	120										
Malook Cr.	Sept 3/96	1	1	pool	MT		20	CAS	117										
Malook Cr.	Sept 3/96	1	1	pool	MT		21	CAS	92										
Malook Cr.	Sept 3/96	1	1	pool	MT		22	CAS	113										
Malook Cr.	Sept 3/96	1	1	pool	MT		23	CAS	86										
Malook Cr.	Sept 3/96	1	1	pool	MT		24	CAS	112										
Malook Cr.	Sept 3/96	1	1	pool	MT		25	CAS	120										
Malook Cr.	Sept 3/96	1	1	pool	MT		26	CAS	98										
Marsh 2 - trib. 1	Oct 11/96	1	4		EL		1	CT	52	1.7	1	0+	0	0+	1.21		J	R	
Marsh 2 - trib. 1	Oct 11/96	1	4		EL		2	CT	46	0.9				0+	0.92		J	R	
Marsh 2 - trib. 1	Oct 11/96	1	4		EL		3	CT	48	1.1				0+	0.99		J	R	
Marsh 2 - trib. 1	Oct 11/96	1	4		EL		4	CT	121	18.1	2	1+	1	1+	1.02		J	R	
Marsh 2 - trib. 1	Oct 11/96	1	4		EL		5	CT	78	5.8	3	0+	0	0+	1.22		J	R	
Marsh 2 - trib. 1	Oct 11/96	1	4		EL		6	CT	59	2.2	4	0+	0	0+	1.07		J	R	
Marsh 2 - trib. 1	Oct 11/96	1	4		EL		7	CT	55	2.1				0+	1.26		J	R	
Marsh 2 - trib. 1	Oct 11/96	1	4		EL		8	CT	84	5.9	5	1+	0	0+	1.00		J	R	
Marsh 2 - trib. 1	Oct 11/96	1	4		EL		9	CT	59	1.9				0+	0.93		J	R	
Marsh 2 - trib. 1	Oct 11/96	1	4		EL		10	CT	56	1.6				0+	0.91		J	R	

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Marsh 2 - trib. 1	Oct 11/96	1	4		EL		11	CT	47	1.4				0+	1.35		J	R	
Pinch Cr.	Sept 1/96	1	1	pool	EL	1	1	CO	91		4	0+	1	0+			J	R	
Pinch Cr.	Sept 1/96	1	1	pool	EL	1	2	CO	89								J	R	
Pinch Cr.	Sept 1/96	1	1	pool	EL	1	3	CO	81								J	R	
Pinch Cr.	Sept 1/96	1	1	pool	EL	1	4	CO	70								J	R	
Pinch Cr.	Sept 1/96	1	1	pool	EL	1	5	CO	72								J	R	
Pinch Cr.	Sept 1/96	1	1	pool	EL	1	6	CO	75								J	R	
Pinch Cr.	Sept 1/96	1	1	pool	EL	1	7	CO	68								J	R	
Pinch Cr.	Sept 1/96	1	1	pool	EL	1	8	CO	74								J	R	
Pinch Cr.	Sept 1/96	1	1	pool	EL	1	9	DV	102		1	0+	1	1+			J	R	
Pinch Cr.	Sept 1/96	1	1	pool	EL	2	10	CO	81								J	R	
Pinch Cr.	Sept 1/96	1	1	pool	EL	2	11	CO	98		5	0+	1	0+			J	R	
Pinch Cr.	Sept 1/96	1	1	pool	EL	2	12	CO	62								J	R	
Pinch Cr.	Sept 1/96	1	1	pool	EL	2	13	CO	91								J	R	
Pinch Cr.	Sept 1/96	1	1	pool	EL	2	14	CO	89								J	R	
Pinch Cr.	Sept 1/96	1	1	pool	EL	2	15	CO	62								J	R	
Pinch Cr.	Sept 1/96	1	1	pool	EL	2	16	CO	74								J	R	
Pinch Cr.	Sept 1/96	1	1	pool	EL	2	17	CO	82								J	R	
Pinch Cr.	Sept 1/96	1	1	pool	EL	3	18	CO	92								J	R	
Pinch Cr.	Sept 1/96	1	1	pool	EL	3	19	CO	67								J	R	
Pinch Cr.	Sept 1/96	1	1	pool	EL	3	20	CO	85								J	R	
Pinch Cr.	Sept 1/96	1	1	glide	EL	1	21	CO	75								J	R	
Pinch Cr.	Sept 1/96	1	1	glide	EL	1	22	DV	60								J	R	
Pinch Cr.	Sept 1/96	1	1	glide	EL	2	23	CO	81								J	R	
Pinch Cr.	Sept 1/96	1	1	riffle	EL	1	1	DV	58	2.3							J	R	
Pinch Cr.	Sept 1/96	1	1	riffle	EL	1	2	DV	64	2.9							J	R	
Pinch Cr.	Sept 1/96	1	1	riffle	EL	1	3	DV	62	2.1	2	0+	0	0+			J	R	
Pinch Cr.	Sept 1/96	1	1	riffle	EL	1	4	DV	56	1.9							J	R	

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System	Date	Reach	Site	Habitat	Capture method	Pass	Fish no.	Species	Fork length (mm)	Weight (g)	Scale no.	Age 1	Age 2	Age final	K	Sex	Maturity	Activity	Comments
Pinch Cr.	Sept 1/96	1	1	riffle	EL	1	5	DV	63	2.6							J	R	
Pinch Cr.	Sept 1/96	1	1	riffle	EL	1	6	DV	64	2.9							J	R	
Pinch Cr.	Sept 1/96	1	1	riffle	EL	1	7	DV	64	2.8							J	R	
Pinch Cr.	Sept 1/96	1	1	riffle	EL	1	8	CO	67	3.4	1	0+	0	0+			J	R	
Pinch Cr.	Sept 1/96	1	1	riffle	EL	1	9	CO	56	1.7	2	0+	0	0+			J	R	
Pinch Cr.	Sept 1/96	1	1	riffle	EL	1	10	CO	68	3.3							J	R	
Pinch Cr.	Sept 1/96	1	1	riffle	EL	1	11	RB	56	1.7	1	0+	0	0+	0.97		J	R	
Pinch Cr.	Sept 1/96	1	1	riffle	EL	2	12	CO	75	4.7	2	0+	0	0+			J	R	
Pinch Cr.	Sept 1/96	1	1	riffle	EL	2	13	CO	68	3.6							J	R	
Pinch Cr.	Sept 1/96	1	1	riffle	EL	2	14	DV	62	2.8							J	R	
Sorensen Cr.	Sept 5/96	1	1	glide	SN, EL	1	1	CO	59	2.2					1.07		J	R	
Sorensen Cr.	Sept 5/96	1	1	glide	SN, EL	1	2	CO	58	1.7					0.87		J	R	
Sorensen Cr.	Sept 5/96	1	1	glide	SN, EL	1	3	CO	56	1.8					1.02		J	R	
Sorensen Cr.	Sept 5/96	1	1	glide	SN, EL	1	4	CO	56	2.2					1.25		J	R	
Sorensen Cr.	Sept 5/96	1	1	glide	SN, EL	1	5	CAS	48										
Sorensen Cr.	Sept 5/96	1	1	glide	SN, EL	1	6	CAS	46										
Sorensen Cr.	Sept 5/96	1	1	glide	SN, EL	1	7	CAS	48										
Sorensen Cr.	Sept 5/96	1	1	glide	SN, EL	1	8	CAS	48										
Sorensen Cr.	Sept 5/96	1	1	glide	SN, EL	1	9	CAS	41										
Sorensen Cr.	Sept 5/96	1	1	glide	SN, EL	2	10	CAS	48										
Sorensen Cr.	Sept 5/96	1	1	glide	SN, EL	2	11	CAS	47										
Sorensen Cr.	Sept 5/96	1	1	glide	SN, EL	2	12	CAS	54										
Sorensen Cr.	Sept 5/96	1	1	glide	SN, EL	2	13	CAS	35										
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	1	CO	67	3.2	1	0+	1	0+	1.06		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	2	CO	58	2.0	2	0+	0	0+	1.03		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	3	CO	51	1.2					0.90		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	4	CO	64	2.6					0.99		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	5	CO	48	1.1					0.99		J	R	

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Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	6	CO	57	2.1					1.13		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	7	CO	55	1.9					1.14		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	8	CO	63	2.5					1.00		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	9	CT	56	1.7					0.97		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	10	CO	58	1.9					0.97		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	11	CO	54	1.8					1.14		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	12	CO	51	1.4					1.06		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	13	CO	59	2.1					1.02		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	14	CO	56	2.0					1.14		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	15	CO	45	1.1					1.21		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	16	CO	44	1.1					1.29		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	17	CO	47	1.1					1.06		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	18	CO	54	1.6					1.02		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	19	CO	47	1.1					1.06		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	20	CAS	47	1.1					1.06				
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	21	CO	86	5.1	3	0+	1	0+	0.80		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	22	CO	61	2.2					0.97		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	23	CO	59	2.0					0.97		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	24	CO	65	3.0					1.09		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	25	CO	58	2.1					1.08		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	26	CO	60	2.2					1.02		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	27	CO	53	1.5					1.01		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	28	CO	60	2.2					1.02		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	29	CO	52	1.5					1.07		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	30	CT	52	1.2					0.85		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	31	CO	45	1.0					1.10		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	32	CO	59	2.3					1.12		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	33	CO	59	2.3					1.12		J	R	

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System	Date	Reach	Site	Habitat	Capture method	Pass	Fish no.	Species	Fork length (mm)	Weight (g)	Scale no.	Age 1	Age 2	Age final	K	Sex	Maturity	Activity	Comments
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	34	CO	51	1.2					0.90		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	35	CO	64	2.9					1.11		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	36	CO	47	1.1					1.06		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	37	CO	53	1.5					1.01		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	38	CO	55	1.8					1.08		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	39	CO	54	1.5					0.95		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	40	CO	49	1.2					1.02		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	41	CO	56	1.9					1.08		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	42	CO	63	2.7					1.08		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	43	CO	55	1.7					1.02		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	44	CO	54	1.8					1.14		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	45	CO	59	2.1					1.02		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	46	CO	52	1.7					1.21		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	47	CO	56	1.8					1.02		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	48	CO	62	2.4					1.01		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	49	CO	58	2.4					1.23		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	50	CO	49	1.2					1.02		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	51	CO	59	1.4					0.68		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	52	CO	54	1.7					1.08		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	53	CO	50	1.3					1.04		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	54	CO	54	1.7					1.08		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	55	CO	54	1.6					1.02		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	56	CO	44	1.2					1.41		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	57	CO	44	1.2					1.41		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	58	CO	53	1.9					1.28		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	59	CO	53	1.5					1.01		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	60	CO	59	2.0					0.97		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	61	CO	45	1.0					1.10		J	R	

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Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	62	CO	51	1.4					1.06		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	63	CO	45	0.9					0.99		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	64	CO	56	1.9					1.08		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	65	CO	56	1.7					0.97		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	66	CO	50	1.2					0.96		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	67	CO	49	1.0					0.85		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	68	CO	93	8.8	4	0+	1	0+	1.09		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	69	CO	108	12.8	5	0+	1	0+	1.02		J	R	
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	70	CAS	71						0.00				
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	71	CAS	65										
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	72	CAS	47										
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	73	CAS	58										
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	74	CAS	56										
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	75	CAS	64										
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	76	CAS	50										
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	77	CAS	45										
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	78	CAS	58										
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	79	CAS	55										
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	80	CAS	48	1.1					0.99				
Sorensen Cr.	Sept 5/96	1	1	pool	SN, EL	1&2	81	CAS	46	1.1					1.13				
Sorensen Cr.	Sept 5/96	1	1	riffle	EL	1	1	CT	52	1.1					0.78		J	R	
Sorensen Cr.	Sept 5/96	1	1	riffle	EL	1	2	CT	53	1.5					1.01		J	R	
Sorensen Cr.	Sept 5/96	1	1	riffle	EL	1	3	CO	68	3.2					1.02		J	R	
Sorensen Cr.	Sept 5/96	1	1	riffle	EL	1	4	CAS	51										
Sorensen Cr.	Sept 5/96	1	1	riffle	EL	1	5	CAS	48										
Sorensen Cr.	Sept 5/96	1	1	riffle	EL	1	6	CAS	48										
Sorensen Cr.	Sept 5/96	4	5		SN		1	CO	68								J	R	outplants
Sorensen Cr.	Sept 5/96	4	5		SN		2	CO	75								J	R	outplants

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Sorensen Cr.	Sept 5/96	4	5		SN		3	CO	82								J	R	outplants
Sorensen Cr.	Sept 5/96	4	5		SN		4	CO	77								J	R	outplants
Sorensen Cr.	Sept 5/96	4	5		SN		5	CO	78								J	R	outplants
Sorensen Cr.	Sept 5/96	4	5		SN		6	CO	73								J	R	outplants
Sorensen Cr.	Sept 5/96	4	5		SN		7	CO	69								J	R	outplants
Sorensen Cr.	Sept 5/96	4	5		SN		8	CO	78								J	R	outplants
Sorensen Cr.	Sept 5/96	4	5		SN		9	CO	74								J	R	outplants
Sorensen Cr.	Sept 5/96	4	5		SN		10	CO	74								J	R	outplants
Sorensen Cr.	Sept 5/96	4	5		SN		11	CO	77								J	R	outplants
Sorensen Cr.	Sept 5/96	4	5		SN		12	CO	75								J	R	outplants
Upper Marble R.	Aug31/96	2	3		EL		1	CT	98								J	R	
Upper Marble R.	Aug31/96	2	3		EL		2	CT	109								J	R	
Upper Marble R.	Aug31/96	2	3		EL		3	CT	94								J	R	
Victora L. trib. 6	Oct. 1/96	1	1		EL		1	CT	46	1.6				0+	1.10		J	R	
Victoria L. trib. 6	Sept 7/96	1	1		EL		2	CT	53	1.8				0+	1.10		J	R	
Victoria L. trib. 6	Sept 7/96	1	1		EL		3	CT	69	3.4				0+	1.10		J	R	
Victoria L. trib. 6	Sept 7/96	1	1		EL		4	CT	42	0.9				0+	1.10		J	R	
Victoria L. trib. 6	Sept 7/96	1	1		EL		5	CT	63	2.8				0+	1.10		J	R	
Victoria L. trib. 6	Sept 7/96	1	1		EL		6	CT	51	1.6				0+	1.10		J	R	
Victoria L. trib. 6	Sept 7/96	1	1		EL		7	CT	49	1.7				0+	1.10		J	R	
Victoria L. trib. 6	Sept 7/96	1	1		EL		8	CT	55	1.4				0+	1.10		J	R	
Victoria L. trib. 6	Sept 7/96	1	1		EL		9	CT	49	1.3				0+	1.10		J	R	
Victoria L. trib. 6	Sept 7/96	1	1		EL		10	CT	64	2.8				0+	1.10		J	R	
Yootook Cr.	Sept 1/96	1	1	glide	EL	1	1	DV	54								J	R	
Yootook Cr.	Sept 1/96	1	1	glide	EL	1	2	DV	60								J	R	
Yootook Cr.	Sept 1/96	1	1	glide	EL	1	3	DV	56								J	R	
Yootook Cr.	Sept 1/96	1	1	glide	EL	1	4	DV	62								J	R	
Yootook Cr.	Sept 1/96	1	1	glide	EL	1	5	CO	71								J	R	

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Yootook Cr.	Sept 1/96	1	1	pool	EL	1	1	RB	73		1	0+		0+			J	R	
Yootook Cr.	Sept 1/96	1	1	riffle	EL	1	1	DV	62								J	R	
Yootook Cr.	Sept 1/96	1	1	riffle	EL	1	2	DV	57								J	R	
Yootook Cr.	Sept 1/96	1	1	riffle	EL	1	3	DV	58								J	R	
Yootook Cr.	Sept 1/96	1	1	riffle	EL	1	4	DV	55		1	0+		0+			J	R	
Yootook Cr.	Sept 1/96	1	1	riffle	EL	1	5	DV	58								J	R	
Yootook Cr.	Sept 1/96	1	1	riffle	EL	1	6	DV	60								J	R	

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Gazetted Name	**Alias**	**Watershed Code**	**Date of Fish Collection**	**Lake/ Stream/ Wetland**	**R #**	**S #**	**Agency**	**Time**	**Location**	**Weather**	**Crew**	**UTM**	**Area (m^2)**	**Cond./ Temp Date**	**C**
Benson River		930-8652-426	08/09/96	Stream	1	1	ARL	09:00	approx. 600m u/s of the mouth.	cloudy	RJF/JRF	09.0616444.5586428	27.8	27/18/96	1
Benson River		930-8652-426	08/09/96	Stream	1	1	ARL	11:30	approx. 600m u/s of the mouth.	cloudy	RJF/JRF	09.0616444.5586428	161.5	27/18/96	1
Benson River		930-8652-426	08/09/96	Stream	1	1	ARL	13:00	approx. 600m u/s of the mouth.	cloudy	RJF/JRF	09.0616444.5586428	1242	27/18/96	1
Howlal Creek		930-8652-426-016	02/09/96	Stream	1	1	ARL	13:00	Just above SE Main (200 m from mouth).	cloudy/ showers	RJF/TKH	09.0615680.5586077	32	02/09/96	1
Howlal Creek		930-8652-426-016	02/09/96	Stream	1	1	ARL	15:14	Just above SE Main (200 m from mouth).	cloudy/ showers	RJF/TKH	09.0615680.5586077	54	29/08/96	1
Howlal Creek		930-8652-426-016	02/09/96	Stream	1	1	ARL	13:00	Just above SE Main (200 m from mouth).	cloudy/ showers	RJF/TKH	09.0615680.5586077	32	29/08/96	1
Howlal Creek		930-8652-426-016	07/09/96	Stream	1	1	ARL		Just above SE Main (200 m from mouth).	cloudy	RJF/JRF	09.0615680.5586077		29/08/96	1
Jeune Creek		930-8652-466	07/09/96	Stream	1	1	ARL		Bridge	cloudy	RJF/JRF	09.0613000.5587975			
Lippy Creek		930-8652-372	02/09/96	Stream	1	2	ARL	17:00	Just above SE 4 (400 m from mouth).	rain	RJF/TKH	09.0611600.5591000	24.7	20/08/96	2
Lippy Creek		930-8652-372	02/09/96	Stream	1	2	ARL	17:00	Just above SE 4 (400 m from mouth).	rain	RJF/TKH	09.0611600.5591000	20	20/08/96	2
Lippy Creek		930-8652-372	09/09/96	Stream	1	2	ARL		Just above SE 4 (400 m from mouth).		RJF/TKH	09.0611600.5591000		20/08/96	2
Malook Creek		930-8652-426-045	30/08/96	Stream	1	1	ARL	13:00	approx. 300m u/s of the mouth.	rain	RJF/TKH	09.0616839.5586489	302	30/08/96	1
Malook Creek		930-8652-426-045	03/09/96	Stream	1	1	ARL		approx. 300m u/s of the mouth.	sunny	RJF	09.0616839.5586489		30/08/96	1
Marble River	Upper Marble River	930-8652	31/08/96	Stream	2	3	ARL			cloudy	RJF/TKH	09.0618859.5567858		31/08/96	2
Marble River	Link River	930-8652	06/09/96	Stream	1	1	ARL	13:00	approx. 100m u/s of the mouth.	rain	RJF/JRF	09.0614054.5588280	358	23/08/96	
Marble River	Link River	930-8652	06/09/96	Stream	1	1	ARL	14:00	approx. 100m u/s of the mouth.	rain	RJF/JRF	09.0614054.5588280	55.5	23/08/96	
Marble River	Link River	930-8652	06/09/96	Stream	1	1	ARL	16:00	approx. 100m u/s of the mouth.	rain	RJF/JRF	09.0614054.5588280	118.1	23/08/96	
Pinch Creek		930-8652-423	01/09/96	Stream	1	1	ARL	09:51	Just above Alice Main (300 m from mouth).		RJF/TKH	09.0616102.5587867	26.8	01/09/96	1
Pinch Creek		930-8652-423	01/09/96	Stream	1	1	ARL	14:00	Just above Alice Main (300 m from mouth).		RJF/TKH	09.0616102.5587867	16.6	01/09/96	1
Pinch Creek		930-8652-423	01/09/96	Stream	1	1	ARL	11:45	Just above Alice Main (300 m from mouth).		RJF/TKH	09.0616102.5587867	24.9	01/09/96	1
Sorenson Creek		930-8652-385	05/09/96	Stream	1	1	ARL	13:00	approx. 200m u/s of the mouth.	cloudy	RJF/JRF	09.0613300.5589600	54.7	05/09/96	4
Sorenson Creek		930-8652-385	05/09/96	Stream	1	1	ARL	15:21	approx. 200m u/s of the mouth.	cloudy	RJF/JRF	09.0613300.5589600	22.5	05/09/96	4
Sorenson Creek		930-8652-385	05/09/96	Stream	1	1	ARL	16:13	approx. 200m u/s of the mouth.	cloudy	RJF/JRF	09.0613300.5589600	24.1	05/09/96	4
Sorenson Creek		930-8652-385	05/09/96	Stream	4	5	ARL		2000m from the mouth.	cloudy	RJF/JRF	09.0611344.5589559		20/08/96	2

unnamed creek	Lower Marble trib. 3	930-8652-100	11/10/96	Stream	8	5	ARL		M2 outlet.		RJF/JRF	09.0609400.5601450		11/10/96	4
unnamed creek	Lower Marble trib. 3	930-8652-100	13/10/96	Stream	3	4	ARL		M1 outlet - 100m downstream of M1.		RJF/JRF	09.0608089.5600679		13/10/96	1
unnamed creek	Lower Marble trib. 3	930-8652-100	13/10/96	Stream	5	2	ARL		L3 outlet - 100m from M1.		RJF/JRF	09.0608313.5601094		13/10/96	1
unnamed creek	Lower Marble trib. 3	930-8652-100	11/10/96	Stream	10	5	ARL		Drains L4 into M2 - site near .		RJF/JRF	09.0609579.5602030		11/10/96	5
unnamed creek	Lake 2 outlet.	930-8652-100-587	11/10/96	Stream	1	7	ARL	16:30	L2 outlet reach 1.		RJF/JRF	09.0608900.5601375		11/10/96	4
unnamed creek	Marsh 2 trib. 1	930-8652-100-777	11/10/96	Stream	1	4	ARL		M2 T1 - 50 m u/s.		RJF/JRF	09.0609480.5601810		11/10/96	5
unnamed creek	Lake 4 trib. 1	930-8652-100-ilp 00002	15/10/96	Stream	1	3	ARL	12:39	L4T1 50 m above lake.		RJF/JRF	09.0610390.5602500		15/10/96	6
unnamed creek	Lake 1 trib. 5	930-8652-100-ilp 00005	13/10/96	Stream	1	2	ARL		L1 T5 - V500 crossing ~ 500 m from Lake 1.		RJF/JRF	09.0607730.5600930		13/10/96	1
unnamed creek	Lower Marble trib. 5	930-8652-156	09/10/96	Stream	1	5	ARL		Outlet to L5 - 400 m downstream of lake		RJF/JRF	09.0610761.5600623		09/10/96	3
unnamed creek	Lake 5 trib. 2	930-8652-156-859	09/10/96	Stream	1	4	ARL		L5 T2		RJF/JRF	09.0610030.5601341		09/10/96	3
unnamed creek	Alice Lake trib. 7	930-8652-365	04/09/96	Stream	1	1	ARL			sunny	RJF/JRF	09.0613614.5590712		18/08/96	2
unnamed creek	Alice Lake trib. 7	930-8652-365	04/09/96	Stream	2	2	ARL			sunny	RJF/JRF	09.0615242.5592059		04/09/96	
unnamed creek	Alice Lake trib. 7 trib.	930-8652-365-ilp 00009	05/09/96	Stream	1	1	ARL		At SE Main.	cloudy	RJF/JRF	09.0615431.5590859		05/09/96	7
unnamed creek	Victoria Lake trib. 6	930-8652-717	07/09/96	Stream	1	1	ARL		Victoria Lake Main crossing.	cloudy	RJF/JRF	09.0616946.5577437		07/09/96	1
unnamed creek		ilp 00003	13/10/96	Stream	1	3	ARL		M1 T1		RJF/JRF	09.0608210.5600920		?/10/96	1
Yootook Creek		930-8652-426-068	01/09/96	Stream	1	1	ARL	15:40	Just above SE Main , and approx. 200m u/s of the mouth.		RJF/TKH	09.0616955.5585620	36	01/09/96	
Yootook Creek		930-8652-426-068	01/09/96	Stream	1	1	ARL	16:45	Just above SE Main , and approx. 200m u/s of the mouth.		RJF/TKH	09.0616955.5585620	27	01/09/96	
Yootook Creek		930-8652-426-068	01/09/96	Stream	1	1	ARL	17:30	Just above SE Main , and approx. 200m u/s of the mouth.		RJF/TKH	09.0616955.5585620	27.2	01/09/96	

Sub-appendix A: Marble River fish collection information, August-October, 1996.

Gazetted Name	Alias	Watershed Code	Date of Fish Collection	Lake/ Stream/ Wetland	R #	S #	Agency	Time	SC	Location
Benson River		930-8652-426	08/09/96	Stream	1	1	ARL	09:00	24	approx. 600m u/s of the mouth.
Benson River		930-8652-426	08/09/96	Stream	1	1	ARL	11:30	24	approx. 600m u/s of the mouth.
Benson River		930-8652-426	08/09/96	Stream	1	1	ARL	13:00	24	approx. 600m u/s of the mouth.
Howlal Creek		930-8652-426-016	02/09/96	Stream	1	1	ARL	13:00	36	Just above SE Main (200m from mouth).
Howlal Creek		930-8652-426-016	02/09/96	Stream	1	1	ARL	15:14	36	Just above SE Main (200m from mouth).
Howlal Creek		930-8652-426-016	02/09/96	Stream	1	1	ARL	13:00	36	Just above SE Main (200m from mouth).
Howlal Creek		930-8652-426-016	07/09/96	Stream	1	1	ARL		36	Just above SE Main (200m from mouth).
Jeune Creek		930-8652-466	07/09/96	Stream	1	1	ARL		40	Bridge
Lippy Creek		930-8652-372	02/09/96	Stream	1	2	ARL	17:00	9	Just above SE 4 (400m from mouth).
Lippy Creek		930-8652-372	02/09/96	Stream	1	2	ARL	17:00	9	Just above SE 4 (400m from mouth).
Lippy Creek		930-8652-372	09/09/96	Stream	1	2	ARL		9	Just above SE 4 (400m from mouth).
Malook Creek		930-8652-426-045	30/08/96	Stream	1	1	ARL	13:00	27	approx. 300m u/s of the mouth.
Malook Creek		930-8652-426-045	03/09/96	Stream	1	1	ARL		27	approx. 300m u/s of the mouth.
Marble River	Upper Marble River	930-8652	31/08/96	Stream	2	3	ARL		50	
Marble River	Link River	930-8652	06/09/96	Stream	1	1	ARL	13:00	31	approx. 100m u/s of the mouth.
Marble River	Link River	930-8652	06/09/96	Stream	1	1	ARL	14:00	31	approx. 100m u/s of the mouth.
Marble River	Link River	930-8652	06/09/96	Stream	1	1	ARL	16:00	31	approx. 100m u/s of the mouth.
Pinch Creek		930-8652-423	01/09/96	Stream	1	1	ARL	09:51	22	Just above Alice Main (300m from mouth).
Pinch Creek		930-8652-423	01/09/96	Stream	1	1	ARL	14:00	22	Just above Alice Main (300m from mouth).
Pinch Creek		930-8652-423	01/09/96	Stream	1	1	ARL	11:45	22	Just above Alice Main (300m from mouth).
Sorenson Creek		930-8652-385	05/09/96	Stream	1	1	ARL	13:00	15	approx. 200m u/s of the mouth.
Sorenson Creek		930-8652-385	05/09/96	Stream	1	1	ARL	15:21	15	approx. 200m u/s of the mouth.
Sorenson Creek		930-8652-385	05/09/96	Stream	1	1	ARL	16:13	15	approx. 200m u/s of the mouth.
Sorenson Creek		930-8652-385	05/09/96	Stream	4	5	ARL		19	2000m from the mouth.
unnamed creek	Lower Marble trib. 3	930-8652-100	11/10/96	Stream	8	5	ARL		73	M2 outlet.
unnamed creek	Lower Marble trib. 3	930-8652-100	13/10/96	Stream	3	4	ARL		71	M1 outlet - 100m downstream of M1.
unnamed creek	Lower Marble trib. 3	930-8652-100	13/10/96	Stream	5	2	ARL		70	L3 outlet - 100m from M1.
unnamed creek	Lower Marble trib. 3	930-8652-100	11/10/96	Stream	10	5	ARL		75	Drains L4 into M2 - site near .
unnamed creek	Lake 2 outlet.	930-8652-100-587	11/10/96	Stream	1	7	ARL	16:30	80	L2 outlet reach 1.

Sub-appendix A: Marble River fish collection information, August-October, 1996.

Gazetted Name	Alias	Watershed Code	Date of Fish Collection	Lake/ Stream/ Wetland	R #	S #	Agency	Time	SC	Location
unnamed creek	Marsh 2 trib. 1	930-8652-100-777	11/10/96	Stream	1	4	ARL		83	M2 T1 - 50 m u/s.
unnamed creek	Lake 4 trib. 1	ilp 00002	15/10/96	Stream	1	3	ARL	12:39	74	L4T1 50 m above lake.
unnamed creek	Lake 1 trib. 5	ilp 00005	13/10/96	Stream	1	2	ARL		85	L1 T5 - V500 crossing ~ 500 m from Lake 1.
unnamed creek	Lower Marble trib. 5	930-8652-156	09/10/96	Stream	1	5	ARL		76	Outlet to L5 - 400 m downstream of lake
unnamed creek	Lake 5 trib. 2	930-8652-156-859	09/10/96	Stream	1	4	ARL		79	L5 T2
unnamed creek	Alice Lake trib. 7	930-8652-365	04/09/96	Stream	1	1	ARL		57	
unnamed creek	Alice Lake trib. 7	930-8652-365	04/09/96	Stream	2	2	ARL		59	
unnamed creek	Alice L. trib. 7 trib.	ilp 00009	05/09/96	Stream	1	1	ARL		58	At SE Main.
unnamed creek	Victoria Lake trib. 6	930-8652-717	07/09/96	Stream	1	1	ARL		65	Victoria Lake Main crossing.
unnamed creek		ilp 00003	13/10/96	Stream	1	3	ARL		81	M1 T1
Yootook Creek		930-8652-426-068	01/09/96	Stream	1	1	ARL	15:40	28	Just above SE Main (200m from mouth).
Yootook Creek		930-8652-426-068	01/09/96	Stream	1	1	ARL	16:45	28	Just above SE Main (200m from mouth).
Yootook Creek		930-8652-426-068	01/09/96	Stream	1	1	ARL	17:30	28	Just above SE Main (200m from mouth).

Sub-appendix A2: Marble River fish collection information, August-October, 1996

Gazetted Name	Alias	Watershed Code	Weather	Crew	UTM	Area Sampled (m^2)	Temp/ Cond. Date	Water Temp. (^oC)	Cond.	Habitat	Method
Benson River		930-8652-426	cloudy	RJF/JRF	09.0616444.5586428	27.8	27/18/96	11	150	riffle	EL
Benson River		930-8652-426	cloudy	RJF/JRF	09.0616444.5586428	161.5	27/18/96	11	150	pool	FC
Benson River		930-8652-426	cloudy	RJF/JRF	09.0616444.5586428	1242	27/18/96	11	150	glide	FC
Howlal Creek		930-8652-426-016	cloudy/ showers	RJF/TKH	09.0615680.5586077	32	02/09/96	12	134	riffle	SN, EL
Howlal Creek		930-8652-426-016	cloudy/ showers	RJF/TKH	09.0615680.5586077	54	02/09/96	12	134	pool	SN, FC
Howlal Creek		930-8652-426-016	cloudy/ showers	RJF/TKH	09.0615680.5586077	32	02/09/96	12	134	glide	SN, EL
Howlal Creek		930-8652-426-016	cloudy	RJF/JRF	09.0615680.5586077		02/09/96	12	134		SN
Jeune Creek		930-8652-466	cloudy	RJF/JRF	09.0613000.5587975		23/08/96	13			EL
Lippy Creek		930-8652-372	rain	RJF/TKH	09.0611600.5591000	24.7	20/08/96	12	24	pool	SN, EL
Lippy Creek		930-8652-372	rain	RJF/TKH	09.0611600.5591000	20	20/08/96	12	24	riffle	EL
Lippy Creek		930-8652-372		RJF/TKH	09.0611600.5591000		20/08/96	12	24	pool	SN
Malook Creek		930-8652-426-045	rain	RJF/TKH	09.0616839.5586489	302	30/08/96	10	171	pool	FC
Malook Creek		930-8652-426-045	sunny	RJF	09.0616839.5586489		30/08/96	10	171	pool	MT
Marble River	Upper Marble River	930-8652	cloudy	RJF/TKH	09.0618859.5567858		31/08/96	11	29		EL
Marble River	Link River	930-8652	rain	RJF/JRF	09.0614054.5588280	358	23/08/96	17		pool	SN, FC
Marble River	Link River	930-8652	rain	RJF/JRF	09.0614054.5588280	55.5	23/08/96	17		riffle	EL
Marble River	Link River	930-8652	rain	RJF/JRF	09.0614054.5588280	118.1	23/08/96	17		glide	FC
Pinch Creek		930-8652-423	-	RJF/TKH	09.0616102.5587867	26.8	01/09/96	11	128	riffle	EL
Pinch Creek		930-8652-423	-	RJF/TKH	09.0616102.5587867	16.6	01/09/96	11	128	glide	EL
Pinch Creek		930-8652-423	-	RJF/TKH	09.0616102.5587867	24.9	01/09/96	11	128	pool	EL
Sorenson Creek		930-8652-385	cloudy	RJF/JRF	09.0613300.5589600	54.7	05/09/96	10.5	46	pool	SN, EL
Sorenson Creek		930-8652-385	cloudy	RJF/JRF	09.0613300.5589600	22.5	05/09/96	10.5	46	riffle	EL
Sorenson Creek		930-8652-385	cloudy	RJF/JRF	09.0613300.5589600	24.1	05/09/96	10.5	46	glide	SN
Sorenson Creek		930-8652-385	cloudy	RJF/JRF	09.0611344.5589559	-	20/08/96	9.5	26		SN

Sub-appendix A2: Marble River fish collection information, August-October, 1996

Gazetted Name	Alias	Watershed Code	Weather	Crew	UTM	Area Sampled (m^2)	Temp/ Cond. Date	Water Temp. (^oC)	Cond.	Habitat	Method
unnamed creek	Lower Marble trib. 3	930-8652-100	-	RJF/JRF	09.0609400.5601450	-	11/10/96	12.5	45		EL
unnamed creek	Lower Marble trib. 3	930-8652-100	-	RJF/JRF	09.0608089.5600679	-	13/10/96	12.5	167		EL
unnamed creek	Lower Marble trib. 3	930-8652-100	-	RJF/JRF	09.0608313.5601094	-	13/10/96	11.5	138		EL
unnamed creek	Lower Marble trib. 3	930-8652-100	-	RJF/JRF	09.0609579.5602030	-	11/10/96	11	52		EL
unnamed creek	Lake 2 outlet.	930-8652-100-587	-	RJF/JRF	09.0608900.5601375	-	11/10/96	12.5	45		EL
unnamed creek	Marsh 2 trib. 1	930-8652-100-777	-	RJF/JRF	09.0609480.5601810	-	11/10/96	10	55		EL
unnamed creek	Lake 4 trib. 1	ilp 00002	-	RJF/JRF	09.0610390.5602500	-	15/10/96	9	69		EL
unnamed creek	Lake 1 trib. 5	ilp 00005	-	RJF/JRF	09.0607730.5600930	-	13/10/96	11	136		EL
unnamed creek	Lower Marble trib. 5	930-8652-156	-	RJF/JRF	09.0610761.5600623	-	09/10/96	14	36		EL
unnamed creek	Lake 5 trib. 2	930-8652-156-859	-	RJF/JRF	09.0610030.5601341	-	09/10/96	11	36		EL
unnamed creek	Alice Lake trib. 7	930-8652-365	sunny	RJF/JRF	09.0613614.5590712	-	18/08/96	11	25	pool	SN
unnamed creek	Alice Lake trib. 7	930-8652-365	sunny	RJF/JRF	09.0615242.5592059	-	04/09/96	11			EL
unnamed creek	Alice Lake trib. 7 trib.	-ilp 00009	cloudy	RJF/JRF	09.0615431.5590859	-	05/09/96	11	71		EL
unnamed creek	Victoria Lake trib. 6	930-8652-717	cloudy	RJF/JRF	09.0616946.5577437	-	07/09/96	12	104		EL
unnamed creek		ilp 00003	-	RJF/JRF	09.0608210.5600920	-	13/10/96	9.5	147		EL
Yootook Creek		930-8652-426-068	-	RJF/TKH	09.0616955.5585620	36	01/09/96	11		riffle	EL
Yootook Creek		930-8652-426-068	-	RJF/TKH	09.0616955.5585620	27	01/09/96	11		pool	EL
Yootook Creek		930-8652-426-068	-	RJF/TKH	09.0616955.5585620	27.2	01/09/96	11		glide	EL

Appendix B: Marble River photograph documentation, August-October, 1996.

Survey start date	Stream name (gaz.)	Stream name (loc.)	Watershed code	Agency	Crew (Init 1)	Crew (Init 2)	Reach/ site card (Y/N)	Fish cards (Y/N)	Roll/ batch #	Counter #	Negative #	Date of photo	Reach no.	Site no.	Map # NTS/ TRIM	UTM mtd G/M	Zone	E(field)	N(field)	Stream photo dir.	Picture type	Photo direction	Scale item	Comments
1996/08/16	Lippy Cr.		?	ARL	RJF	TKH	Y	N	R1	18	17	1996/08/18	1	1	92L.043	G	9	611491	5591824	Down	Ch			
1996/10/06	Unnamed L.	L. L1	930-8652-100-299	ARL	RJF	JRF	N	N	1	14	13	1996/09/06			92L.053	G	9	607256	5601006		L	NW		NE shore
1996/10/06	Unnamed L.	L. L1	930-8652-100-299	ARL	RJF	JRF	N	N	1	15	14	1996/09/06			92L.053	G	9	607256	5601006		L	W		looking towards T2
1996/10/06	Unnamed L.	L. L1	930-8652-100-299	ARL	RJF	JRF	N	N	1	16	15	1996/09/06			92L.053	G	9	607168	5600868		L	SE		looking towards outlet
1996/10/06	Unnamed L.	L. L1	930-8652-100-299	ARL	RJF	JRF	N	N	1	17	16	1996/09/06			92L.053	G	9	607168	5600868		L	SE		looking along NE shore
1996/10/06	Unnamed L.	L. L1	930-8652-100-299	ARL	RJF	JRF	N	N	1	18	17	1996/09/06			92L.053	G	9	607168	5600868		L	NE		looking at NE shore
1996/10/06	Unnamed L.	L. L1	930-8652-100-299	ARL	RJF	JRF	N	N	1	19	18	1996/09/06			92L.053	G	9	607168	5600868		L	SW		looking towards SW end
1996/10/06	Unnamed L.	L. L1	930-8652-100-299	ARL	RJF	JRF	N	N	1	20	19	1996/09/06			92L.053	G	9	606882	5600469		O			Benchmark
1996/10/06	Unnamed L.	L. L1	930-8652-100-299	ARL	RJF	JRF	N	N	1	21	20	1996/09/07			92L.053	G	9	607363	5600682		L	NE		Bog along NE shore
1996/10/06	Unnamed L.	L. L1	930-8652-100-299	ARL	RJF	JRF	N	N	1	22	21	1996/09/07			92L.053	G	9	607375	5600829		L	NW		looking towards NW shore
1996/10/06	Unnamed L.	L. L1	930-8652-100-299	ARL	RJF	JRF	N	N	1	23	22	1996/09/07			92L.053	G	9	607375	5600829		L	SW		looking towards SW end
1996/10/06	Unnamed Cr.	Cr. L1-T1	930-8652-100-299-xxx	ARL	RJF	JRF	Y	Y	1	24	23	1996/09/07		3	92L.053	G	9	606851	5601186	Up	CH		person, 1.7 m	L1-T1
1996/10/06	Unnamed Cr.	Cr. L1-T1	930-8652-100-299-xxx	ARL	RJF	JRF	Y	Y	1	25	24	1996/09/07		3	92L.053	G	9	606851	5601186		XS			L1-T1
1996/10/06	Unnamed Cr.	Cr. L1-T2	930-8652-100-299-xxx	ARL	RJF	JRF	N	N	1	26	25	1996/09/07			92L.053	M	9	607100	5600500	Up	CH			L1-T2
1996/10/06	Unnamed Cr.	Cr. L1-T1	930-8652-100-299-xxx	ARL	RJF	JRF	Y	Y	2	1	1	1996/09/07		3	92L.053	G	9	606973	5601093	Up	CH			L1-T1 mouth
1996/10/06	Unnamed L.	L. L1	930-8652-100-299	ARL	RJF	JRF	N	N	2	2	2	1996/09/07			92L.053	G	9	607168	5600868		L			L1 SE end looking towards outlet
1996/10/06	Unnamed L.	L. L1	930-8652-100-299	ARL	RJF	JRF	N	N	2	3	3	1996/09/07			92L.053	G	9	607168	5600868		L			NE side of lake
1996/10/06	Unnamed Cr.	Cr. L1-T3	930-8652-100-299-xxx	ARL	RJF	JRF	N	N	2	4	4	1996/09/07			92L.053	G	9	606849	5600597	Up	CH			T3
1996/10/06	Unnamed Cr.	L. L1 outlet	930-8652-100-299	ARL	RJF	JRF	Y	Y	2	5	5	1996/09/07		2	92L.053	G	9	607472	5600664	Down	CH			outlet
1996/10/06	Unnamed Cr.	L. L1 outlet	930-8652-100-299	ARL	RJF	JRF	Y	Y	2	6	6	1996/09/07		2	92L.053	G	9	607736	5600520	Down	CH			outlet 300 m below lake
1996/10/06	Unnamed Cr.	L. L1 outlet	930-8652-100-299	ARL	RJF	JRF	Y	Y	2	7	7	1996/09/07		2	92L.053	G	9	607736	5600520	Up	CH			outlet 300 m below lake
1996/10/06	Marble R.	Upper Marble R.	930-8652	ARL	RJF	JRF	N	N	2	8	8	1996/09/08			92L.053	G	9	604000	5601000		WS			Marble River mouth and Varney Bay
1996/10/06	Unnamed Marsh	Marsh M1	930-8652-100	ARL	RJF	JRF	N	Y	2	9	9	1996/09/08			92L.053	G	9	608256	5600759		WS	N		M1
1996/10/06	Unnamed Cr.	Cr. T1	930-8652-725-259	ARL	RJF	JRF	Y	Y	2	10	10	1996/09/08	3	1	92L.034	G	9	621879	5575607	Up	CH			Teishum River Tributary T1
1996/10/06	Unnamed Cr.	Cr. T1	930-8652-725-259	ARL	RJF	JRF	Y	Y	2	11	11	1996/09/08	3	1	92L.034	G	9	621879	5575607	Down	CH			Teishum River Tributary T1
1996/10/06	Teishum R.	Green R.	930-8652-725	ARL	RJF	JRF	Y	N	2	11	12	1996/09/08			92L.034	G	9	621900	5575600		WS	WNW		Teishum River valley below T1
1996/10/06	Teishum R.	Green R.	930-8652-725	ARL	RJF	JRF	Y	N	2	12	13	1996/09/08			92L.034	G	9	620000	5576300		WS	N		Teishum River
1996/10/06	Yootook Cr.		930-8652-426-068	ARL	RJF	JRF	Y	Y	2	13	14	1996/09/08	5	2	92L.034	G	9	619000	5581000		WS	NWN		Upper Yootook Creek
1996/10/06	Yootook Cr.		930-8652-426-068	ARL	RJF	JRF	Y	Y	2	14	15	1996/09/08	5	2	92L.034	G	9	619336	5582553	Up	CH			Upper Yootook Creek
1996/10/06	Yootook Cr.		930-8652-426-068	ARL	RJF	JRF	Y	Y	2	15	16	1996/09/08	5	2	92L.034	G	9	619336	5582553	Down	CH			Upper Yootook Creek
1996/10/06	Marble R.	Link R.	930-8652	ARL	RJF	JRF	Y	Y	2	17	17	1996/09/08			92L.043	G	9	613262	5587917	Up	CH			Link River falls
1996/10/06	Jeune Cr.		930-8652-466	ARL	RJF	JRF	Y	Y	2	18	18	1996/09/08			92L.043	G	9	611900	5587850		WS	E		Jeune Creek
1996/10/06	Lippy Cr.		?	ARL	RJF	JRF	Y	N	2	19	19	1996/09/08			92L.043	G	9	611200	5591500		WS	NW		Lippy Creek
1996/10/06	Unnamed L.	L. L5	930-8652-156	ARL	RJF	JRF	N	N	2	20	20	1996/09/08			92L.053	G	9	610044	5501038		L	NW		L5
1996/10/06	Unnamed L.	L. L4	930-852-100	ARL	RJF	JRF	N	Y	2	21	21	1996/09/08			92L.053	G	9	610359	5602088		L	W		L4
1996/10/06	Unnamed L.	L. L3	930-852-100	ARL	RJF	JRF	N	Y	2	22	22	1996/09/08			92L.053	G	9	609600	5601700		L	SW		L3
1996/10/06	Unnamed L.	L. L3 and L. L3 outlet	930-852-100	ARL	RJF	JRF	Y	N	2	23	23	1996/09/08			92L.053	G	9	608400	5601000		L	ENE		L3 and outlet
1996/10/06	Unnamed Marsh	Marsh M2	930-852-100	ARL	RJF	JRF	N	Y	2	24	24	1996/09/08			92L.053	G	9	609300	5601300		L	N		M2
1996/10/06	Unnamed L.	L. L5	930-8652-156	ARL	RJF	JRF	N	N	2	25	25	1996/09/08			92L.053	G	9	610000	5601000		L	SE		L5

Appendix B: Marble River photograph documentation, August-October, 1996.

Survey start date	Stream name (gaz.)	Stream name (loc.)	Watershed code	Agency	Crew (Init 1)	Crew (Init 2)	Reach/ site card (Y/N)	Fish cards (Y/N)	Roll/ batch #	Counter #	Negative #	Date of photo	Reach no.	Site no.	Map # NTS/ TRIM	UTM mtd G/M	Zone	E(field)	N(field)	Stream photo dir.	Picture type	Photo direction	Scale item	Comments
1996/10/06	Unnamed L.	L. L5	930-8652-156	ARL	RJF	JRF	N	N	3	1	1A	1996/09/08			92L.053	G	9	610044	5601038		L	NW		northeast side
1996/10/06	Unnamed L.	L. L5	930-8652-156	ARL	RJF	JRF	N	N	3	2	2A	1996/09/08			92L.053	G	9	640044	5601038		L	SE		view down the lake
1996/10/06	Unnamed L.	L. L5	930-8652-156	ARL	RJF	JRF	N	N	3	3	3A	1996/09/08			92L.053	G	9	610044	5601038		L	NW		southwest side of the lake
1996/10/06	Unnamed L.	L. L5	930-8652-156	ARL	RJF	JRF	N	N	3	4	4A	1996/09/08			92L.053	G	9	610300	5600800		L	NW		northwest end
1996/10/06	Unnamed L.	L. L5	930-8652-156	ARL	RJF	JRF	N	N	3	5	5A	1996/09/09			92L.053	G	9	610300	5600800		L	N		NE side
1996/10/06	Unnamed L.	L. L5	930-8652-156	ARL	RJF	JRF	N	N	3	6	6A	1996/09/09			92L.053	G	9	610300	5600800		L	NW		SW side
1996/10/06	Unnamed Cr.	L. L5 outlet	930-8652-156	ARL	RJF	JRF	Y	Y	3	7	7A	1996/09/09	1		92L.053	G	9	610380	5600800		Ch			outlet
1996/10/06	Unnamed L.	L. L5	930-8652-156	ARL	RJF	JRF	N	N	3	9	8A	1996/09/09			92L.053	G	9	610289	5600851		O			Benchmark
1996/10/06	Unnamed L.	L. L5	930-8652-156	ARL	RJF	JRF	N	N	3	10	9A	1996/09/09			92L.053	G	9	610289	5600851		O			Benchmark
1996/10/06	Unnamed Cr.	Cr. L5-T1	930-8652-156	ARL	RJF	JRF	Y	Y	3	11	10A	1996/09/09	2	2	92L.053	G	9	610030	5601341	Up	Ch			Tributary L5-T1
1996/10/06	Unnamed Cr.	Cr. L5-T1	930-8652-156	ARL	RJF	JRF	Y	Y	3	12	11A	1996/09/09	2	2	92L.053	G	9	610030	5601341	Down	Ch			Tributary L5-T1
1996/10/06	Unnamed Cr.	Cr. L5-T2	930-8652-156-xxx	ARL	RJF	JRF	Y	Y	3	13	12A	1996/09/09	1	3	92L.053	G	9	610030	5601332	Up	Ch			Tributary L5-T2
1996/10/06	Unnamed Cr.	Cr. L5-T2	930-8652-156-xxx	ARL	RJF	JRF	Y	Y	3	14	13A	1996/09/09	1	3	92L.053	G	9	610030	5601332	Down	Ch			Tributary L5-T2
1996/10/06	Unnamed Cr.	L. L5 outlet	930-8652-156	ARL	RJF	JRF	Y	Y	3	15	14A	1996/09/09	1	1	92L.053	G	9	610761	5600623	Up	Ch			Lake outlet 300 m downstream of the lake
1996/10/06	Unnamed Cr.	L. L5 outlet	930-8652-156	ARL	RJF	JRF	Y	Y	3	16	15A	1996/09/09	1	1	92L.053	G	9	610761	5600323	Down	Ch			Lake outlet 300 m downstream of the lake
1996/10/06	Unnamed L.	L. L5	930-8652-156	ARL	RJF	JRF	N	N	3	17	16A	1996/09/09			92L.053						Fi			Lake L5 coho juveniles
1996/10/06	Unnamed L.	L. L3	930-852-100	ARL	RJF	JRF	N	Y	3	18	17A	1996/09/11			92L.053	G	9	610289	5600750		L	NE		North shore
1996/10/06	Unnamed L.	L. L3	930-852-100	ARL	RJF	JRF	N	Y	3	19	18A	1996/09/11			92L.053	G	9	610289	5600750		L	NE		North shore
1996/10/06	Unnamed L.	L. L3	930-852-100	ARL	RJF	JRF	N	Y	3	21	20A	1996/09/11			92L.053	G	9	610289	5600750		L	E		south shore east end
1996/10/06	Unnamed L.	L. L3	930-852-100	ARL	RJF	JRF	N	Y	3	22	21A	1996/09/11			92L.053	G	9	610289	5600851		O			Bench mark
1996/10/06	Unnamed L.	L. L3	930-852-100	ARL	RJF	JRF	N	Y	3	23	22A	1996/09/11			92L.053	G	9	609400	5601350		L	W		west end of lake
1996/10/06	Unnamed L.	L. L3	930-852-100	ARL	RJF	JRF	N	Y	3	23	23A	1996/09/11			92L.053	G	9	608947	5601378		L	NW		north side of lake near inlet
1996/10/06	Unnamed L.	L. L3	930-852-100	ARL	RJF	JRF	N	Y	3	24	24A	1996/09/11			92L.053	G	9	608947	5601378		L	W		west end of lake
1996/10/06	Unnamed Cr.	Cr. L3-T2	930-852-100-xxx	ARL	RJF	JRF	N	N	3	25	25A	1996/09/11			92L.053	M	9	609231	5601275	Up	Ch	S		Tributary L3-T2 50 m upstream
1996/10/06	Unnamed Cr.	M2 outlet	930-852-100	ARL	RJF	JRF	Y	Y	4	1	1	1996/09/11	6	11	92L.053	M	9	609425	5601500	Up	Ch			M2 outlet 200 m upstream
1996/10/06	Unnamed Cr.	M2 outlet	930-852-100	ARL	RJF	JRF	Y	Y	4	2	2	1996/09/11	6	11	92L.053	M	9	609425	5601500	Down	Ch			M2 outlet 200 m upstream
1996/10/06	Unnamed Cr.	Cr. L3-T1	930-852-100-xxx	ARL	RJF	JRF	N	Y	4	3	3	1996/09/11	1	10	92L.053	M	9	609425	5601350	Up	Ch			L3-T1 100 m upstream
1996/10/06	Unnamed Cr.	Cr. L3-T1	930-852-100-xxx	ARL	RJF	JRF	N	Y	4	4	4	1996/09/11	1	10	92L.053	M	9	609425	5601350	Down	Ch			L3-T1 100 m upstream
1996/10/06	Unnamed L.	L. L3	930-852-100	ARL	RJF	JRF	N	Y	4	5	5	1996/09/11			92L.053	G	9	610290	5600850		L	E		View of the lake form the outlet
1996/10/06	Unnamed Cr.	L2 outlet	930-852-100-299	ARL	RJF	JRF	Y	Y	4	6	6	1996/09/11	1	7	92L.053	G	9	610140	5600850	Down	Ch			L2 outlet below falls
1996/10/06	Unnamed Cr.	L2 outlet	930-852-100-299	ARL	RJF	JRF	Y	Y	4	7	7	1996/09/11	1	7	92L.053	G	9	610140	5600850	Up	Ch			L2 outlet below falls
1996/10/06	Unnamed Cr.	L3 outlet	930-852-100	ARL	RJF	JRF	Y	N	4	8	8	1996/09/11	5		92L.053	G	9	608860	5601283	Up	Ch			L3 outlet 200 m downstream
1996/10/06	Unnamed Marsh	Marsh M2	930-852-100	ARL	RJF	JRF	N	Y	4	9	9	1996/09/12			92L.053	G	9	609597	5601716		L	N		M2
1996/10/06	Unnamed Marsh	Marsh M2	930-852-100	ARL	RJF	JRF	N	Y	4	10	10	1996/09/12			92L.053	G	9	609597	5605716		L	N		M2 eastside and north end
1996/10/06	Unnamed Marsh	Marsh M2	930-852-100	ARL	RJF	JRF	N	Y	4	11	11	1996/09/12			92L.053	G	9	609597	5605716		L	W		M2 west side
1996/10/06	Unnamed Marsh	Marsh M2	930-852-100	ARL	RJF	JRF	N	Y	4	12	12	1996/09/12			92L.053	G	9	609597	5605713		L	S		M2 south end
1996/10/06	Unnamed Cr.	Cr. M2-T1	930-852-100-xxx	ARL	RJF	JRF	Y	Y	4	13	13	1996/09/12		12	92L.053	G	9	609650	5605600	Up	Ch			M2-T1
1996/10/06	Unnamed Cr.	Cr. M2-T1	930-852-100-xxx	ARL	RJF	JRF	Y	Y	4	14	14	1996/09/12		12	92L.053	G	9	609650	5605600	Down	Ch			M2-T1
1996/10/06	Unnamed Cr.	Cr. L4 outlet, Cr. M2 inlet	930-852-100	ARL	RJF	JRF	Y	Y	4	15	15	1996/09/12	8	13	92L.053	G	9	609579	5602036	Down	Ch			V200 bridge across L4 outlet

Appendix B: Marble River photograph documentation, August-October, 1996.

Survey start date	Stream name (gaz.)	Stream name (loc.)	Watershed code	Agency	Crew (Init 1)	Crew (Init 2)	Reach/ site card (Y/N)	Fish cards (Y/N)	Roll/ batch #	Counter #	Negative #	Date of photo	Reach no.	Site no.	Map # NTS/ TRIM	UTM mtd G/M	Zone	E(field)	N(field)	Stream photo dir.	Picture type	Photo direction	Scale item	Comments
1996/10/06	Unnamed Cr.	Cr. L4 outlet, Cr. M2 inlet	930-852-100	ARL	RJF	JRF	Y	Y	4	16	16	1996/09/12	8	13	92L.053	G	9	609579	5302036	Up	Ch			L4 outlet - M2-T2 inlet
1996/10/06	Unnamed Marsh	Marsh M1	930-852-100	ARL	RJF	JRF	N	Y	4	17	17	1996/09/13			92L.053	G	9	608256	5600750		L	S		M1 looking towards outlet
1996/10/06	Unnamed Marsh	Marsh M1	930-852-100	ARL	RJF	JRF	N	Y	4	18	18	1996/09/13			92L.053	G	9	908256	5600750		L	S		south shore
1996/10/06	Unnamed Marsh	Marsh M1	930-852-100	ARL	RJF	JRF	N	Y	4	19	19	1996/09/13			92L.053	G	9	908256	5600750		L	E		east shore
1996/10/06	Unnamed Marsh	Marsh M1	930-852-100	ARL	RJF	JRF	N	Y	4	20	20	1996/09/13			92L.053	G	9	608256	5600750		L	E		east shore
1996/10/06	Unnamed Marsh	Marsh M1	930-852-100	ARL	RJF	JRF	N	Y	4	21	21	1996/09/13			92L.053	G	9	608256	5600750		L	N		morth shore
1996/10/06	Unnamed Cr.	Cr. L1-T5	930-8652-100-299-xxx	ARL	RJF	JRF	Y	Y	4	22	22	1996/09/13		2	92L.053	G	9	607730	5600930	Up	Ch			L1-T5 500 m from lake
1996/10/06	Unnamed Cr.	Cr. L1-T5	930-8652-100-299-xxx	ARL	RJF	JRF	Y	Y	4	23	23	1996/09/13		2	92L.053	G	9	607730	5600930	Down	Ch			L1-T5 500 m from lake
1996/10/06	Unnamed Cr.	Cr. M1 inlet; Cr. L3 outlet	930-852-100	ARL	RJF	JRF	Y	Y	4	24	24	1996/09/13	6	4	92L.053	G	9	608313	5601094	Up	Ch			M1 inlet - L3 outlet 100 m up from M1
1996/10/06	Unnamed Cr.	Cr. M1-T1	930-852-100-xxx	ARL	RJF	JRF	Y	Y	4	25	25	1996/09/13	1	5	92L.053	G	9	608460	5600750	Up	Ch			M1-T1 100 m upstream from marsh
1996/10/06	Unnamed Cr.	Cr. M1 outlet	930-852-100	ARL	RJF	JRF	Y	Y	4	26	26	1996/09/13	3	4	92L.053	G	9	608089	5600679	Up	Ch			M1 outlet 100 m downstream
1996/10/06	Unnamed L.	L. L4	930-852-100	ARL	RJF	JRF	N	Y	5	1	1	1996/09/14			92L.053	G	9	609993	5601933		L	NE		south shore on left
1996/10/06	Unnamed L.	L. L4	930-852-100	ARL	RJF	JRF	N	Y	5	2	2	1996/09/14			92L.053	G	9	609993	5601933		L	E		east end
1996/10/06	Unnamed L.	L. L4	930-852-100	ARL	RJF	JRF	N	Y	5	3	3	1996/09/14			92L.053	G	9	609993	5601933		L	NE		north shore
1996/10/06	Unnamed L.	L. L4	930-852-100	ARL	RJF	JRF	N	Y	5	4	4	1996/09/14			92L.053	G	9	610359	5602088		L	E		east end
1996/10/06	Unnamed L.	L. L4	930-852-100	ARL	RJF	JRF	N	Y	5	5	5	1996/09/14			92L.053	G	9	610359	5602088		L	S		south shore
1996/10/06	Unnamed L.	L. L4	930-852-100	ARL	RJF	JRF	N	Y	5	6	6	1996/09/14			92L.053	G	9	610359	5602088		L	N		west end
1996/10/06	Unnamed L.	L. L4	930-852-100	ARL	RJF	JRF	N	Y	5	7	7	1996/09/14			92L.053	G	9	610359	5602088		L	N		north shore
1996/10/06	Unnamed L.	L. L4	930-852-100	ARL	RJF	JRF	N	Y	5	8	8	1996/09/14			92L.053						O			Rick with fish
1996/10/06	Unnamed L.	L. L4	930-852-100	ARL	RJF	JRF	N	Y	5	9	9	1996/09/14			92L.053	G	9	610153	5602118		O	S		L4 bench mark
1996/10/06	Unnamed Cr.	Cr. L4-T1	930-852-100-xxx	ARL	RJF	JRF	Y	Y	5	10	10	1996/09/15	1	14	92L.053	M	9	610400	5602200	Up	Ch			50 m upstream of lake
1996/10/06	Unnamed Cr.	Cr. L4-T1	930-852-100-xxx	ARL	RJF	JRF	Y	Y	5	11	11	1996/09/15	1	14	92L.053	M	9	610400	5602200	Down	Ch			50 m upstream of lake
1996/10/06	Unnamed Cr.	Cr. L4-T3	930-852-100-xxx	ARL	RJF	JRF	Y	Y	5	12	12	1996/09/15	1	14	92L.053	G	9	610309	5601936	Up	Ch			100 m upstream of lake
1996/10/06	Unnamed Cr.	Cr. L4-T3	930-852-100-xxx	ARL	RJF	JRF	Y	Y	5	13	13	1996/09/15	1	14	92L.053	G	9	610309	5601936	Down	Ch			100 m upstream of lake
1996/10/06	Unnamed Cr.	Cr. L4 outlet	930-852-100-999	ARL	RJF	JRF	N	N	5	14	14	1996/09/15	8		92L.053	M	9	609850	5602100	Down	Ch			outlet 20 m below lake
1996/10/06	Unnamed Cr.	Cr. L4 outlet	930-852-100	ARL	RJF	JRF	N	N	5	15	15	1996/09/15	8		92L.053	M	9	609850	5602100	Up	Ch			outlet 20 m below lake
1996/10/06	Unnamed L.	L. L2	930-852-100-299	ARL	RJF	JRF	N	Y	5	16	16	1996/09/16			92L.053	G	9	608181	5601817		L	E		L2 toward outlet
1996/10/06	Unnamed L.	L. L2	930-852-100-299	ARL	RJF	JRF	N	Y	5	17	17	1996/09/16			92L.053	G	9	608181	5601817		L	SE		SE shore
1996/10/06	Unnamed L.	L. L2	930-852-100-299	ARL	RJF	JRF	N	Y	5	18	18	1996/09/16			92L.053	G	9	608181	5601817		L	SES		South shore
1996/10/06	Unnamed L.	L. L2	930-852-100-299	ARL	RJF	JRF	N	Y	5	19	19	1996/09/16			92L.053	G	9	608181	5601817		L	S		South shore
1996/10/06	Unnamed L.	L. L2	930-852-100-299	ARL	RJF	JRF	N	Y	5	20	20	1996/09/16			92L.053	G	9	608181	5601817		L	WSW		west shore
1996/10/06	Unnamed L.	L. L2	930-852-100-299	ARL	RJF	JRF	N	Y	5	21	21	1996/09/16			92L.053	G	9	608181	5601817		L	W		west shore
1996/10/06	Unnamed L.	L. L2	930-852-100-299	ARL	RJF	JRF	N	Y	5	22	22	1996/09/16			92L.053	G	9	608181	5601817		L	NWN		northwest shore
1996/10/06	Unnamed L.	L. L2	930-852-100-299	ARL	RJF	JRF	N	Y	5	23	23	1996/09/16			92L.053	G	9	608181	5601817		L	N		north shore
1996/10/06	Unnamed L.	L. L2	930-852-100-299	ARL	RJF	JRF	N	Y	5	24	24	1996/09/16			92L.053	G	9	608181	5601817		L	NEN		northeast side
1996/10/06	Unnamed L.	L. L2	930-852-100-299	ARL	RJF	JRF	N	Y	5	25	25	1996/09/16			92L.053	G	9	608181	5601817		L	ENE		north of outlet
1996/10/06	Unnamed L.	L. L2	930-852-100-299	ARL	RJF	JRF	N	Y	5	26	26	1996/09/16			92L.053	M	9	608560	5601875		L	S		south shore
1996/10/06	Unnamed L.	L. L2	930-852-100-299	ARL	RJF	JRF	N	Y	5	27	27	1996/09/16			92L.053	M	9	608560	5601875		L	E		looking towards outlet
1996/10/06	Unnamed L.	L. L2	930-852-100-299	ARL	RJF	JRF	N	Y	5	28	28	1996/09/16			92L.053	G	9	608249	5602043		O			bench mark

Appendix B: Marble River photograph documentation, August-October, 1996.

Survey start date	Stream name (gaz.)	Stream name (loc.)	Watershed code	Agency	Crew (Init 1)	Crew (Init 2)	Reach/ site card (Y/N)	Fish cards (Y/N)	Roll/ batch #	Counter #	Negative #	Date of photo	Reach no.	Site no.	Map # NTS/ TRIM	UTM mtd G/M	Zone	E(field)	N(field)	Stream photo dir.	Picture type	Photo direction	Scale item	Comments
1996/10/06	Unnamed Cr.	Cr. L2-T1	930-852-100-299-yyy	ARL	RJF	JRF	N	N	6	1	0A	1996/09/17			92L.053	M	9	608240	5602200	Up	Ch			50 m upstream
1996/10/06	Unnamed Cr.	Cr. L2 outlet	930-852-100-299	ARL	RJF	JRF	Y	Y	6	2	1A	1996/09/17	4	9	92L.053	G	9	608614	5601845	Up	Ch	W		20 m downstream from lake
1996/10/06	Unnamed Cr.	Cr. L2 outlet	930-852-100-299	ARL	RJF	JRF	Y	Y	6	3	2A	1996/09/17	4	9	92L.053	G	9	608614	5601845	Up	Ch	E		20 m downstream from lake
1996/10/06	Unnamed Marsh	L. L2 marsh	930-852-100-299	ARL	RJF	JRF	N	Y	6	4	3A	1996/09/17			92L.053	M	9	608800	5601775		L	SE		marsh downsteam of lake L2
1996/10/06	Unnamed Marsh	L. L2 marsh	930-852-100-299	ARL	RJF	JRF	N	Y	6	5	4A	1996/09/17			92L.053	M	9	608800	5601775		L	N		marsh downsteam of lake L2
1996/10/06	Unnamed Cr.	Cr. L2 outlet	930-852-100-299	ARL	RJF	JRF	Y	Y	6	6	5A	1996/09/17	3	8	92L.053	M	9	608850	5601650	Down	Ch	S		100 m downstream of marsh
1996/10/06	Unnamed Cr.	Cr. L2 outlet	930-852-100-299	ARL	RJF	JRF	Y	Y	6	7	6A	1996/09/17	3	8	92L.053	M	9	608850	5601650	Up	Ch	N		100 m downstream of marsh
1996/10/06	Unnamed Cr.	Cr. L2 outlet	930-852-100-299	ARL	RJF	JRF	Y	Y	6	8	7A	1996/09/17	3	8	92L.053	M	9	608850	5601650	Down	Ch	S		100 m downstream of marsh
1996/08/16	Unnamed Cr.		930-8652-365-???	ARL	RJF	JRF	Y	Y	J1	1		1996/09/04	1	1	92L.044	G	9	615431	5590859	Down	Ch			Alice Lake Tributary #7 tributary
1996/08/16	Unnamed Cr.		930-8652-365-???	ARL	RJF	JRF	Y	Y	J1	2		1996/09/04	1	1	92L.044	G	9	615431	5591859	Up	Ch			Alice Lake Tributary #7 tributary
1996/08/16	Malook Cr.		930-8652-426-045	ARL	RJF	JRF	N	N	J1	3		1996/09/04			92L.044	Map	9	617900	5587250		O			Eternal Fountain
1996/08/16	Malook Cr.		930-8652-426-045	ARL	RJF	JRF	N	N	J1	4		1996/09/04			92L.044	Map	9	617900	5587250		O			Eternal Fountain
1996/08/16	Teihsum R.	Green R.	930-8652-725	ARL	RJF	JRF	Y	N	J1	5		1996/09/07	1	1	92L.034	G	9	617313	5576800	Down	Ch			Spawning Dolly Varden?
1996/08/16	Marble R.	Amazon R.	930-8652	ARL	RJF	TKH	N	N	R1	1	0	1996/08/17	6		92L.053	M	9	611200	5598350	Down	Ch	N		Downstream from highway bridge
1996/08/16	Marble R.	Amazon R.	930-8652	ARL	RJF	TKH	N	N	R1	2	1	1996/08/17			92L.053	M	9	611200	5598350	Up	Ch	S		Alice Lake outlet
1996/08/16	Marble R.	Amazon R.	930-8652	ARL	RJF	TKH	N	N	R1	3	2	1996/08/17			92L.053	M	9	611200	5598350	Up	Ch	S		Alice Lake outlet
1996/08/16	Marble R.	Amazon R.	930-8652	ARL	RJF	TKH	Y	N	R1	4	3	1996/08/17	6	6	92L.053	M	9	611200	5598550	Down	Ch	N		Downstream of Lake Outlet falls
1996/08/16	Marble R.	Amazon R.	930-8652	ARL	RJF	TKH	Y	N	R1	5	4	1996/08/17	6	6	92L.053	M	9	611200	5598550	Up	Ch	S		Lake Outlet falls
1996/08/16	Marble R.	Amazon R.	930-8652	ARL	RJF	TKH	Y	N	R1	6	5	1996/08/17	6	6	92L.053	M	9	611200	5598550	UP	Ch	S		Side channel around Lake Outlet Falls
1996/08/16	Marble R.	Amazon R.	930-8652	ARL	RJF	TKH	Y	N	R1	7	6	1996/08/17	5	3	92L.053	M	9	610540	5599075	Down	Ch	W		Marble River
1996/08/16	Marble R.	Amazon R.	930-8652	ARL	RJF	TKH	Y	N	R1	8	7	1996/08/17	5	3	92L.053	M	9	610540	5599075	Up	Ch	E		Marble River
1996/08/16	Unnamed Cr.	Alice Lake Tributary #1		ARL	RJF	TKH	Y	N	R1	9	8	1996/08/18	5	3	92L.053	G	9	610571	5597492	Up	Ch			Alice Lake Tributary #1
1996/08/16	Unnamed Cr.	Alice Lake Tributary #1		ARL	RJF	TKH	Y	N	R1	10	9	1996/08/18	1	1	92L.053	G	9	610571	5597492	Down	Ch			Alice Lake Tributary #1
1996/08/16	Unnamed Cr.	Alice Lake Tributary #5	930-8652-313	ARL	RJF	TKH	Y	N	R1	11	10	1996/08/18	1	1	92L.043	G	9	612790	5593433	Down	Ch			Alice Lake Tributary #5
1996/08/16	Unnamed Cr.	Alice Lake Tributary #5	930-8652-313	ARL	RJF	TKH	Y	N	R1	12	11	1996/08/18	1	1	92L.043	G	9	612790	5593433	Up	Ch			Alice Lake Tributary #5
1996/08/16	Unnamed Cr.	Alice Lake Trbiuatry #7	930-8652-365	ARL	RJF	TKH	Y	Y	R1	13	12	1996/08/18	1	1	92L.043	G	9	613614	5590712	Up	Ch			Alice Lake Tributary #7
1996/08/16	Unnamed Cr.	Alice Lake Tribuary #7	930-8652-365	ARL	RJF	TKH	Y	Y	R1	14	13	1996/08/18	1	1	92L.043	G	9	613614	5590712	Down	Ch			Alice Lake Tributary #7
1996/08/16	Sorenson Cr.		930-8652-372	ARL	RJF	TKH	Y	Y	R1	15	14	1996/08/18	1	1	92L.043	M	9	612550	5590275	Down	Ch			
1996/08/16	Sorenson Cr.		930-8652-372	ARL	RJF	TKH	Y	Y	R1	16	15	1996/08/18	1	1	92L.043	M	9	612550	5591275	Up	Ch			
1996/08/16	Unnamed Cr.	Lower Marble Tributary #4	930-8652-106	ARL	RJF	TKH	Y	N	R1	19	18	1996/08/19	1	1	92L.053	M	9	608750	5599225	Up	Ch	S		Lower Marble River Tributary #4
1996/08/16	Lippy Cr.		?	ARL	RJF	TKH	Y	N	R1	20	19	1996/08/20	2	4	92L.043	M	9	610500	5591850	Up	Ch		person, 1.8 m	
1996/08/16	Lippy Cr.		?	ARL	RJF	TKH	Y	N	R1	21	20	1996/08/20	2	4	92L.043	M	9	610500	5591850	Down	Ch			
1996/08/16	Lippy Cr.		?	ARL	RJF	TKH	Y	N	R1	22	21	1996/08/20	3	5	92L.043	M	9	610200	5592050	Up	Ch			
1996/08/16	Sorenson Cr.		930-8652-372	ARL	RJF	TKH	Y	Y	R1	23	22	1996/08/20	4	5	92L.043	G	9	611344	5589559	Up	Ch			
1996/08/16	Sorenson Cr.		930-8652-372	ARL	RJF	TKH	Y	Y	R1	24	23	1996/08/20	4	5	92L.043	G	9	611344	5589559	Up	Ch			
1996/08/16	Lippy Cr.		?	ARL	RJF	TKH	Y	N	R1	25	24	1996/08/20	2	3	92L.043	G	9	611269	5591543	Up	Ch			
1996/08/16	Lippy Cr.		?	ARL	RJF	TKH	Y	N	R1	26	25	1996/08/20	2	3	92L.043	G	9	611269	5591543	Down	Ch			
1996/08/16	Sorenson Cr.		930-8652-372	ARL	RJF	TKH	Y	N	R2	1	00	1996/08/20	1	2	92L.043	Map	9	612000	5590550	Up	Ch			
1996/08/16	Sorenson Cr.		930-8652-372	ARL	RJF	TKH	Y	N	R2	2	0	1996/08/20	1	2	92L.043	Map	9	612000	5590550	Down	Ch			

Appendix B: Marble River photograph documentation, August-October, 1996.

Survey start date	Stream name (gaz.)	Stream name (loc.)	Watershed code	Agency	Crew (Init 1)	Crew (Init 2)	Reach/ site card (Y/N)	Fish cards (Y/N)	Roll/ batch #	Counter #	Negative #	Date of photo	Reach no.	Site no.	Map # NTS/ TRIM	UTM mtd G/M	Zone	E(field)	N(field)	Stream photo dir.	Picture type	Photo direction	Scale item	Comments
1996/08/16	Unnamed Cr.	Victoria Lake Tributary #17	930-8652-664	ARL	RJF	TKH	Y	N	R2	3	1	1996/08/21	1	1	92L.034	G	9	614501	5578914	Up	Ch			Victoria Lake Tributary #17
1996/08/16	Unnamed Cr.	Victoria Lake Tributary #17	930-8652-664	ARL	RJF	TKH	Y	N	R2	4	2	1996/08/21	1	1	92L.034	G	9	614501	5578914	Down	Ch			Victoria Lake Tributary #17
1996/08/16	Unnamed Cr.		930-8652-664-???	ARL	RJF	TKH	Y	N	R2	5	3	1996/08/21	1	1	92L.034	G	9	614501	5578914	Up	Ch			Victoria Lake Tributary #17 tributary
1996/08/16	Unnamed Cr.		930-8652-664-???	ARL	RJF	TKH	Y	N	R2	6	4	1996/08/21	1	1	92L.034	G	9	614501	5578914	Down	Ch			Victoria Lake Tributary #17 tributary
1996/08/16	Unnamed Cr.	Victoria Lake Tributary #21	930-8652-544	ARL	RJF	TKH	N	N	R2	7	5	1996/08/21	1		92L.043	Map	9	612800	5585300	Up	Ch			Victoria Lake Tributary #21
1996/08/16	Unnamed Cr.	Victoria Lake Tributary #22	930-8652-510	ARL	RJF	TKH	N	N	R2	8	6	1996/08/21	1		92L.043	Map	9	612900	5585800	Down	Ch			Victoria Lake Tributary #22
1996/08/16	Unnamed Cr.	Victoria Lake Tributary #20	930-8652-557	ARL	RJF	TKH	N	N	R2	9	7	1996/08/21	1		92L.033	Map	9	612925	5583900	Down	Ch			Victoria Lake Tributary #20
1996/08/16	Sorenson Cr.		930-8652-372	ARL	RJF	TKH	N	N	R2	10	8	1996/08/22	6		92L.043	Map	9	609850	5589400	Down	Ch			200 m below SE main
1996/08/16	Sorenson Cr.		930-8652-372	ARL	RJF	TKH	Y	N	R2	11	9	1996/08/22	6		92L.043	G	9	610322	5589414	Down	Ch			
1996/08/16	Sorenson Cr.		930-8652-372	ARL	RJF	TKH	Y	N	R2	12	10	1996/08/22	6		92L.043	G	9	610322	5589414	Down	Ch			
1996/08/16	Sorenson Cr.		930-8652-372	ARL	RJF	TKH	Y	N	R2	13	11	1996/08/22	6		92L.043	G	9	610322	5589414	Up	Ch			
1996/08/16	Jeune Cr.		930-8652-466	ARL	RJF	TKH	Y	Y	R2	14	12	1996/08/23	1	1	92L.043	Map	9	613000	5587750	Up	Ch			
1996/08/16	Marble R.	Link R.	930-8652	ARL	RJF	TKH	Y	Y	R2	15	13	1996/08/23	1	1	92L.043	G	9	616580	5588441	Down	Ch			
1996/08/16	Marble R.	Link R.	930-8652	ARL	RJF	TKH	Y	Y	R2	16	14	1996/08/23	1	1	92L.043	G	9	616580	5588441	Down	Ch			
1996/08/16	Marble R.	Link R.	930-8652	ARL	RJF	TKH	Y	Y	R2	17	15	1996/08/23	1	1	92L.043	G	9	616580	5588441	Up	Ch			
1996/08/16	Pinch Cr.		930-8652-423	ARL	RJF	TKH	N	N	R3	1	1	1996/08/27	1		92L.044	G	9	616239	5587921	Up	Ch			View of mainstem on left and spring on right
1996/08/16	Pinch Cr.		930-8652-423	ARL	RJF	TKH	Y	Y	R3	3	2	1996/08/27	1	1	92L.044	G	9	616102	5587867	Down	Ch			
1996/08/16	Yootook Cr.		930-8652-426-068	ARL	RJF	TKH	N	N	R3	4	3	1996/08/28	2		92L.044	Map	9	616925	5585125	Up	Ch		person, 1.8 m	logjam which is creating a fish barrier
1996/08/16	Yootook Cr.		930-8652-426-068	ARL	RJF	TKH	Y	Y	R3	5	4	1996/08/28	1	1	92L.044	Map	9	616900	5585650	Down	Ch			
1996/08/16	Howlal Cr.		930-8652-426-016	ARL	RJF	TKH	Y	Y	R3	6	5	1996/08/29	1	1	92L.044	G	9	615680	5586077	Up	Ch			
1996/08/16	Howlal Cr.		930-8652-426-016	ARL	RJF	TKH	Y	Y	R3	7	6	1996/08/29	1	1	92L.044	G	9	615680	5586077	Down	Ch			
1996/08/16	Howlal Cr.		930-8652-426-016	ARL	RJF	TKH	Y	N	R3	8	7	1996/08/29	1	2	92L.044	G	9	615630	5585172	Up	Ch			
1996/08/16	Howlal Cr.		930-8652-426-016	ARL	RJF	TKH	N	N	R3	9	8	1996/08/29	1	2	92L.044	Map	9	615650	5584600	Up	Ch			1.5 high m x 2 m long cascades
1996/08/16	Howlal Cr.		930-8652-426-016	ARL	RJF	TKH	Y	N	R3	10	9	1996/08/29	2	3	92L.034	G	9	616063	5583633	Up	Ch			
1996/08/16	Howlal Cr.		930-8652-426-016	ARL	RJF	TKH	Y	N	R3	11	10	1996/08/29	2	3	92L.034	G	9	616063	5583633	Down	Ch			
1996/08/16	Howlal Cr.		930-8652-426-016	ARL	RJF	TKH	Y	N	R3	12	11	1996/08/29	2	3	92L.034	G	9	616289	5582415	Up	Ch			
1996/08/16	Howlal Cr.		930-8652-426-016	ARL	RJF	TKH	Y	N	R3	13	12	1996/08/29	2	3	92L.034	G	9	616289	5582415	Down	Ch			
1996/08/16	Malook Cr.		930-8652-426-045	ARL	RJF	TKH	Y	N	R3	14	13	1996/08/30	2	2	92L.044	Map	9	617175	5586925	Up	Ch		person, 1.8 m	
1996/08/16	Malook Cr.		930-8652-426-045	ARL	RJF	TKH	Y	N	R3	15	14	1996/08/30	2	2	92L.044	Map	9	617175	5586925	Down	Ch		person, 1.8 m	
1996/08/16	Malook Cr.		930-8652-426-045	ARL	RJF	TKH	N	N	R3	16	15	1996/08/30	4		92L.044	G	9	617176	5586967	Down	Ch			Site where creek disappears undergound
1996/08/16	Malook Cr.		930-8652-426-045	ARL	RJF	TKH	N	N	R3	17	16	1996/08/30	3		92L.044	Map	9	617000	5587100	Down	Ch			Channel reappears in spots
1996/08/16	Malook Cr.		930-8652-426-045	ARL	RJF	TKH	N	N	R3	18	17	1996/08/30	3		92L.044	Map	9	617000	5587100	Down	Ch			Channel reappears in spots
1996/08/16	Malook Cr.		930-8652-426-045	ARL	RJF	TKH	N	N	R3	19	18	1996/08/30	3		92L.044	Map	9	617000	5587100	Down	Ch			Channel reappears in spots
1996/08/16	Pinch Cr.		930-8652-423	ARL	RJF	TKH	Y	Y	R3	19	20	1996/09/01	1	1	92L.044	Map	9	616000	5587750	Up	Ch			Riffle population estimation site
1996/08/16	Malook Cr.		930-8652-426-045	ARL	RJF	TKH	N	N	R3	20	19	1996/08/30	4		92L.044	Map	9	617376	5586967	Down	Ch			Just downstream of Port Hardy Main
1996/08/16	Pinch Cr.		930-8652-423	ARL	RJF	TKH	Y	Y	R3	20	21	1996/09/01	1	1	92L.044	Map	9	616000	5587750	Down	Ch			Pool population estimation site
1996/08/16	Howlal Cr.		930-8652-426-016	ARL	RJF	TKH	Y	Y	R3	22	22	1996/09/02	1	1	92L.044	G	9	615680	5586077	Up	Ch			Riffle population estimation site
1996/08/16	Howlal Cr.		930-8652-426-016	ARL	RJF	TKH	Y	Y	R3	24	23	1996/09/02	1	1	92L.044	G	9	615680	5586077	Up	Ch			Pool population estimation site
1996/08/16	Unnamed Cr.	Alice Lake Tributary #7	930-8652-365	ARL	RJF			Y	R3	25	24	1996/09/04	1		92L.043	Map	9	613939	5590914	Down	Ch			fish sample site just downstream of road PH25

Appendix B: Marble River photograph documentation, August-October, 1996.

Survey start date	Stream name (gaz.)	Stream name (loc.)	Watershed code	Agency	Crew (Init 1)	Crew (Init 2)	Reach/ site card (Y/N)	Fish cards (Y/N)	Roll/ batch #	Counter #	Negative #	Date of photo	Reach no.	Site no.	Map # NTS/ TRIM	UTM mtd G/M	Zone	E(field)	N(field)	Stream photo dir.	Picture type	Photo direction	Scale item	Comments
1996/08/16	Marble R.	Amazon R.	930-8652	ARL	RJF	TKH	N	N	T1	16	16	1996/08/17	4		92L.053	M	9	61000	5599150	Down	Ch	W		
1996/08/16	Marble R.	Amazon R.	930-8652	ARL	RJF	TKH	N	N	T1	17	17	1996/08/17	5		92L.053	M	9	61000	5599150	Up	Ch	E		
1996/08/16	Marble R.	Amazon R.	930-8652	ARL	RJF	TKH	N	N	T1	18	18	1996/08/17	3		92L.053	M	9	90863	5599225	Up	Ch	E		Bear Falls fishway
1996/08/16	Marble R.	Amazon R.	930-8652	ARL	RJF	TKH	Y	N	T1	19	19	1996/08/17	3	3	92L.053	M	9	60863	5599225	Down	Ch	W		Channel below Bear Falls
1996/08/16	Marble R.	Amazon R.	930-8652	ARL	RJF	TKH	N	N	T1	20	20	1996/08/17	3		92L.053	M	9	60863	5599225	Up	Ch	E		Channel Above Bear Falls
1996/08/16	Marble R.	Amazon R.	930-8652	ARL	RJF	TKH	N	N	T1	21	21	1996/08/17	3		92L.053	M	9	60850	5599275	Up	Ch	E		Bear Falls and fishway
1996/08/16	Marble R.	Amazon R.	930-8652	ARL	RJF	TKH	Y	N	T1	22	22	1996/08/17	1	1	92L.053	M	9	60664	5598950	Up	Ch	E		
1996/08/16	Marble R.	Amazon R.	930-8652	ARL	RJF	TKH	Y	N	T1	23	23	1996/08/17	1	1	92L.053	M	9	60664	5598950	Down	Ch	W		
1996/08/16	Marble R.	Amazon R.	930-8652	ARL	RJF	TKH	Y	N	T1	24	24	1996/08/17	1	1	92L.053	M	9	60664	5598950	Up	Ch	E		
1996/08/16	Marble R.	Amazon R.	930-8652	ARL	RJF	TKH	N	N	T1	25	25	1996/08/17	1		92L.053	M	9	60699	5599275		Xs			Twin Falls
1996/08/16	Marble R.	Amazon R.	930-8652	ARL	RJF	TKH	Y	N	T2	1	0	1996/08/17	2	2	92L.043	M	9	60715	5599275	Down	Ch	E		
1996/08/16	Marble R.	Amazon R.	930-8652	ARL	RJF	TKH	Y	N	T2	2	1	1996/08/17	2	2	92L.053	M	9	60715	5599275	Up	Ch	W	person, 1.8 m	
1996/08/16	Unnamed Cr.	Alice La ke Tribuary #1		ARL	RJF	TKH	N	N	T2	3	2	1996/08/18			92L.053	G	9	61060	5597450			N		Alice Lake Tributary #1
1996/08/16	Unnamed Cr.	Alice Lake Tributary #4	930-8652-298	ARL	RJF	TKH	Y	N	T2	4	3	1996/08/18	1	1	92L.043	G	9	61250	5593792	Down	Ch			Alice Lake Tributary #4
1996/08/16	Unnamed Cr.	Alice Lake Tributary #4	930-8652-298	ARL	RJF	TKH	Y	N	T2	5	4	1996/08/18	1	1	92L.043	G	9	61250	5593792	Up	Ch			Alice Lake Tributary #4
1996/08/16	Unnamed Cr.	Alice Lake Tributary #4	930-8652-298	ARL	RJF	TKH	N	N	T2	6	5	1996/08/18	1	1	92L.043	G	9	61250	5593792		Xs			Alice Lake Tributary #4
1996/08/16	Unnamed Cr.	Alice Lake Tributary #5	930-8652-313	ARL	RJF	TKH	N	N	T2	7	6	1996/08/18			92L.043	G	9	61279	5593433	Up	Ch			Alice Lake Tributary #5
1996/08/16	Unnamed Cr.	Alice Lake Tributary #7	930-8652-365	ARL	RJF	TKH	N	Y	T2	8	7	1996/08/18			92L.043	G	9	61361	5590712	Up	Ch			Alice Lake Tributary #7
1996/08/16	Sorenson Cr.		930-8652-372	ARL	RJF	TKH	N	N	T2	9	8	1996/08/18			92L.043	M	9	61330	5589600					Mouth of Sorenson Creek
1996/08/16	Lippy Cr.		?	ARL	RJF	TKH	N	N	T2	10	9	1996/08/18			92L.043	G	9	61147	5591818					Mouth of Lippy Creek
1996/08/16	Unnamed Cr.	Alice Lake Tributary #12		ARL	RJF	TKH	Y	N	T2	11	10	1996/08/18	1	1	92L.043	M	9	61130	5592700	Up	Ch			Alice Lake Tributary #12
1996/08/16	Unnamed Cr.	Alice Lake Tributary #12		ARL	RJF	TKH	Y	N	T2	12	11	1996/08/18	1	1	92L.043	M	9	61130	5592700	Down	Ch			Alice Lake Tributary #12
1996/08/16	Marble R.	Amazon R.	930-8652	ARL	RJF	TKH	Y	N	T2	13	12	1996/08/19	4	4	92L.053	G	9	60926	5598928	Up	Ch			
1996/08/16	Marble R.	Amazon R.	930-8652	ARL	RJF	TKH	Y	N	T3	1	0a	1996/08/19	3	3	92L.053	G	9	60808	5599273	Up	Ch			
1996/08/16	Marble R.	Amazon R.	930-8652	ARL	RJF	TKH	Y	N	T3	2	1a	1996/08/19	3	3	92L.053	G	9	60808	5599273	Down	Ch			
1996/08/16	Unnamed Cr.		930-8652-070	ARL	RJF	TKH	N	N	T3	3	2a	1996/08/19			92L.053	G	9	60757	5598993	Up	Ch			Lower Marble Tributary #2 + 150 m
1996/08/16	Unnamed Cr.		930-8652-070	ARL	RJF	TKH	N	N	T3	4	3a	1996/08/19			92L.053	G	9	60801	5598067	Down	Ch			Lower Marble Tributary #2 + 700 m
1996/08/16	Unnamed Cr.		930-8652-070	ARL	RJF	TKH	Y	N	T3	5	4a	1996/08/19	1	1	92L.053	G	9	60814	5597921	Down	Ch			Lower Marble Tributary #2 + 1.3 km
1996/08/16	Unnamed Cr.		930-8652-070	ARL	RJF	TKH	Y	N	T3	6	5a	1996/08/19	1	1	92L.053	G	9	60814	5597921	Up	Ch			Lower Marble Tributary #2 + 1.3 km
1996/08/16	Unnamed Cr.		930-8652-070	ARL	RJF	TKH	Y	N	T3	7	6a	1996/08/19	1	2	92L.053	M	9	60780	5998400	Down	Ch			Lower Marble Tributary #2 + 800 m
1996/08/16	Unnamed Cr.		930-8652-070	ARL	RJF	TKH	Y	N	T3	8	7a	1996/08/19	1	2	92L.053	M	9	60780	5998400	Up	Ch			Lower Marble Tributary #2 + 800 m
1996/08/16	Unnamed Cr.		930-8652-070	ARL	RJF	TKH	N	N	T3	9	8a	1996/08/19			92L.053	M	9	60765	5598800	Up	Ch			Lower Marble Tributary #2 + 300 m
1996/08/16	Lippy Cr.		?	ARL	RJF	TKH	N	N	T3	10	9a	1996/08/20	2		92L.043	M	9	61045	5592000	Up	Ch			Lippy Creek culvert @ Port Alice Hwy.
1996/08/16	Lippy Cr.		?	ARL	RJF	TKH	Y	N	T3	11	10a	1996/08/20	3	6	92L.043	M	9	60935	5592300	Up	Ch			Just below branch 50
1996/08/16	Lippy Cr.		?	ARL	RJF	TKH	Y	N	T3	12	11a	1996/08/20	3	6	92L.043	M	9	60935	5592300	Up	Ch			Just below branch 50
1996/08/16	Unnamed Cr.	Alice Lake Tributary #12		ARL	RJF	TKH	Y	N	T3	13	12a	1996/08/20	1	2	92L.043	G	9	61098	5592688	Up	Ch		metrestick	Alice Lake Tributary #12 @ SE4 crossing
1996/08/16	Unnamed Cr.	Alice Lake Tributary #12		ARL	RJF	TKH	Y	N	T3	14	13a	1996/08/20	1	2	92L.043	G	9	61098	5592688	Up	Ch			Alice Lake Tributary #12 @ SEM4 crossing
1996/08/16	Lippy Cr.		?	ARL	RJF	TKH	N	N	T3	15	14a	1996/08/20	2		92L.043	G	9	61126	5591543	Down	Ch		person, 1.8 m	Falls on Lippy Creek 300 m above SEM4 road
1996/08/16	Lippy Cr.		?	ARL	RJF	TKH	Y	Y	T3	16	15a	1996/08/20	1	2	92L.043	M	9	61160	5591000	Up	Ch		person, 1.8 m	200 m below SEM4 road

Appendix B: Marble River photograph documentation, August-October, 1996.

Survey start date	Stream name (gaz.)	Stream name (loc.)	Watershed code	Agency	Crew (Init 1)	Crew (Init 2)	Reach/ site card (Y/N)	Fish cards (Y/N)	Roll/ batch #	Counter #	Negative #	Date of photo	Reach no.	Site no.	Map # NTS/ TRIM	UTM mtd G/M	Zone	E(field)	N(field)	Stream photo dir.	Picture type	Photo direction	Scale item	Comments
1996/08/16	Lippy Cr.		?	ARL	RJF	TKH	Y	Y	T3	17	16a	1996/08/20	1	2	92L.043	M	9	611600	5591000	Up	Ch			200 m below SEM4 road
1996/08/16	Sorenson Cr.		930-8652-372	ARL	RJF	TKH	N	N	T3	18	17a	1996/08/20	2		92L.043	M	9	611925	5590150	Up	Ch		person, 1.8 m	100 m below SEM4 road
1996/08/16	Sorenson Cr.		930-8652-372	ARL	RJF	TKH	N	N	T3	19	18a	1996/08/20	2		92L.043	M	9	611950	5590200	Down	Ch		person, 1.8 m	150 m below SEM4 road
1996/08/16	Sorenson Cr.		930-8652-372	ARL	RJF	TKH	N	N	T3	20	19a	1996/08/20	2		92L.043	G	9	612002	5590439	Down	Ch		person, 1.8 m	400 m below SEM4 road; Lower falls
1996/08/16	Victoria L.		930-8652	ARL	RJF	TKH	N	N	T3	21	20a	1996/08/21			92L.033	M	9	613200	5581600		Lake	S	person, 1.8 m	Victoria Lake boat ramp
1996/08/16	Teihsum R.	Green R.	930-8652-725	ARL	RJF	TKH	N	N	T3	22	21a	1996/08/21			92L.034	M	9	616000	5576800		WS	ENE		Teihsum River valley from lake
1996/08/16	Victoria L.		930-8652	ARL	RJF	TKH	N	N	T3	23	22a	1996/08/21			92L.034	M	9	616300	5575800		Lake	S		South end of Victoria Lake
1996/08/16	Marble R.	Upper Marble R.	930-8652	ARL	RJF	TKH	N	N	T3	24	23a	1996/08/21			92L.034	M	9	617700	5573000		WS	S		Upper Marble River mouth
1996/08/16	Victoria L.		930-8652	ARL	RJF	TKH	N	N	T3	25	24a	1996/08/21			92L.033	M	9	616700	5376400		WS	W		Victoria Lake Tributaries #13-16
1996/08/16	Sorenson Cr.		930-8652-372	ARL	RJF	TKH	N	N	T4	1	0	1996/08/22	6		92L.043	M	9	609700	5589250	Up	Ch	S	person, 1.8 m	SE main crossing
1996/08/16	Sorenson Cr.		930-8652-372	ARL	RJF	TKH	Y	Y	T4	2	1	1996/08/22	5	6	92L.043	G	9	610806	5589659	Down	Ch			
1996/08/16	Sorenson Cr.		930-8652-372	ARL	RJF	TKH	N	N	T4	4	3	1996/08/22	2		92L.043	G	9	611777	5589806	Up	Ch		person, 1.8 m	Falls #4
1996/08/16	Sorenson Cr.		930-8652-372	ARL	RJF	TKH	Y	Y	T4	5	4	1996/08/22	2	3	92L.043	G	9	611922	5590122	Up	Ch			
1996/08/16	Sorenson Cr.		930-8652-372	ARL	RJF	TKH	Y	Y	T4	6	5	1996/08/22	2	3	92L.043	G	9	611922	5590122	Down	Ch		person, 1.8 m	
1996/08/16	Sorenson Cr.		930-8652-372	ARL	RJF	TKH	Y	N	T4	7	6	1996/08/22	3	4	92L.043	G	9	611645	5589724	Up	Ch			
1996/08/16	Sorenson Cr.		930-8652-372	ARL	RJF	TKH	Y	N	T4	8	7	1996/08/22	3	4	92L.043	G	9	611645	5589724	Up	Ch			
1996/08/16	Sorenson Cr.		930-8652-372	ARL	RJF	TKH	Y	N	T4	9	8	1996/08/22	6	7	92L.044	G	9	610021	5589423	Down	Ch			
1996/08/16	Marble R.	Link R.	930-8652	ARL	RJF	TKH	Y	Y	T4	10	9	1996/08/23	1	1	92L.044	G	9	614054	5588280	Down	Ch			
1996/08/16	Marble R.	Link R.	930-8652	ARL	RJF	TKH	Y	Y	T4	11	10	1996/08/23	1	1	92L.044	G	9	614250	5588380	Down	Ch			
1996/08/16	Marble R.	Link R.	930-8652	ARL	RJF	TKH	Y	Y	T4	12	11	1996/08/23	1	1	92L.044	G	9	614054	5588280	Down	Ch			
1996/08/16	Jeune Cr.		930-8652-466	ARL	RJF	TKH	Y	Y	T4	13	12	1996/08/23	1	1	92L.043	M	9	613000	5587750	Down	Ch			
1996/08/16	Jeune Cr.		930-8652-466	ARL	RJF	TKH	N	N	T4	14	13	1996/08/23	1		92L.043	M	9	613100	5587750	Up	Ch			2nd falls
1996/08/16	Jeune Cr.		930-8652-466	ARL	RJF	TKH	N	N	T4	15	14	1996/08/23	1		92L.043	M	9	612900	5587750	Down	Ch		person, 1.8 m	West Main Bridge
1996/08/16	Jeune Cr.		930-8652-466	ARL	RJF	TKH	N	N	T4	16	15	1996/08/23	1		92L.043	M	9	613070	5587750	Up	Ch		person, 1.8 m	lower falls-cascades
1996/08/16	Marble R.	Link R.	930-8652	ARL	RJF	TKH	N	N	T4	17	16	1996/08/23	2		92L.043	G	9	613262	5587917	Up	Ch			Link River falls
1996/08/16	Marble R.	Link R.	930-8652	ARL	RJF	TKH	N	N	T4	18	17	1996/08/23	2		92L.043	G	9	613262	5587917	Down	Ch			Link River just downstream of falls
1996/08/16	Marble R.	Link R.	930-8652	ARL	RJF	TKH	Y	N	T4	19	18	1996/08/23	3	4	92L.043	M	9	613340	5587650	Up	Ch			Link River just below Victoria Lake
1996/08/16	Marble R.	Link R.	930-8652	ARL	RJF	TKH	Y	N	T4	20	19	1996/08/23	3	5	92L.043	M	9	613340	5587400		Xs			Link River dam on Victoria Lake
1996/08/16	Marble R.	Link R.	930-8652	ARL	RJF	TKH	Y	N	T4	21	20	1996/08/23	3	5	92L.043	M	9	613340	5587400	Up	Ch		person, 1.8 m	Victoria Lake outlet
1996/08/16	Marble R.	Link R.	930-8652	ARL	RJF	TKH	Y	N	T4	22	21	1996/08/23	3	4	92L.043	M	9	613340	5587500	Down	Ch			large pool downstream of dam
1996/08/16	Marble R.	Link R.	930-8652	ARL	RJF	TKH	Y	N	T4	23	22	1996/08/23	3	3	92L.043	G	9	613212	5587749	Down	Ch			
1996/08/16	Marble R.	Link R.	930-8652	ARL	RJF	TKH	Y	N	T4	24	23	1996/08/23	2	2	92L.043	M	9	613400	5587900	Up	Ch			
1996/08/16	Marble R.	Link R.	930-8652	ARL	RJF	TKH	Y	N	T4	25	24	1996/08/23	2	2	92L.044	M	9	613400	5587900	Down	Ch			
1996/08/16	Pinch Cr.		930-8652-423	ARL	RJF	TKH	Y	Y	T4	26	25	1996/08/23	1	1	92L.044	G	9	616580	5588441	Down	Ch			
1996/08/16	Pinch Cr.		930-8652-423	ARL	RJF	TKH	N	N	T5	1	0	1996/08/23	1		92L.044	G	9	616493	5588568	Up	Ch		person, 1.8 m	Pinch Creek 1.5 m high falls
1996/08/16	Pinch Cr.		930-8652-423	ARL	RJF	TKH	N	N	T5	2	1	1996/08/23	1		92L.044	G	9	616493	5588568	XS	O		person, 1.8 m	Pinch Creek 1.5 m high falls
1996/08/16	Pinch Cr.		930-8652-423	ARL	RJF	TKH	N	N	T5	3	2	1996/08/23	1		92L.044	G	9	616239	5587921	Bd	O			Pinch Creek spring
1996/08/16	Pinch Cr.		930-8652-423	ARL	RJF	TKH	N	N	T5	4	3	1996/08/23	1		92L.044	G	9	616102	5587867	Up	Ch			
1996/08/16	Pinch Cr.		930-8652-423	ARL	RJF	TKH	Y	N	T5	5	4	1996/08/23	2	2	92L.044	G	9	617266	5589134	Down	Ch			

Appendix B: Marble River photograph documentation, August-October, 1996.

Survey start date	Stream name (gaz.)	Stream name (loc.)	Watershed code	Agency	Crew (Init 1)	Crew (Init 2)	Reach/ site card (Y/N)	Fish cards (Y/N)	Roll/ batch #	Counter #	Negative #	Date of photo	Reach no.	Site no.	Map # NTS/ TRIM	UTM mtd G/M	Zone	E(field)	N(field)	Stream photo dir.	Picture type	Photo direction	Scale item	Comments
1996/08/16	Pinch Cr.		930-8652-423	ARL	RJF	TKH	Y	N	T5	6	5	1996/08/23	2	2	92L.044	G	9	61726	5589134	Up	Ch			
1996/08/16	Pinch Cr.		930-8652-423	ARL	RJF	TKH	Y	N	T5	7	6	1996/08/23	2	2	92L.044	G	9	61726	5589134	Down	Ch			
1996/08/16	Benson R.		930-8652-426	ARL	RJF	TKH	Y	Y	T5	8	7	1996/08/27	1	1	92L.044	G	9	61644	5586424	Down	Ch			
1996/08/16	Benson R.		930-8652-426	ARL	RJF	TKH	Y	Y	T5	9	8	1996/08/27	1	1	92L.044	G	9	61644	5586424	Up	Ch			Benson River, Site 1 from Hardy main
1996/08/16	Benson R.		930-8652-426	ARL	RJF	TKH	Y	N	T5	10	9	1996/08/28	4	2	92L.034	G	9	62002	5583997	Down	Ch			
1996/08/16	Benson R.		930-8652-426	ARL	RJF	TKH	Y	N	T5	11	10	1996/08/28	4	2	92L.034	G	9	62002	5583997	Up	Ch			
1996/08/16	Benson R.		930-8652-426	ARL	RJF	TKH	Y	N	T5	12	11	1996/08/28	4	2	92L.034	G	9	62002	5583997	Up	Ch			
1996/08/16	Benson R.		930-8652-426	ARL	RJF	TKH	N	N	T5	13	12	1996/08/28	5		92L.034	M	9	62332	5584300	Down	Ch			Between Kathleen Lake & Benson Lake
1996/08/16	Benson R.		930-8652-426	ARL	RJF	TKH	N	N	T5	14	13	1996/08/28	5		92L.034	M	9	62332	5584300	Up	Ch			Between Kathleen Lake & Benson Lake
1996/08/16	Yootook Cr.		930-8652-426-068	ARL	RJF	TKH	N	N	T6	3	3	1996/08/28	2		92L.044	M	9	61690	5585200	Up	Ch			Yootook Creek Reach 2 logjam
1996/08/16	Yootook Cr.		930-8652-426-068	ARL	RJF	TKH	Y	Y	T6	4	4	1996/08/28	1	1	92L.044	M	9	61690	5585650	Up	Ch			
1996/08/16	Howlal Cr.		930-8652-426-016	ARL	RJF	TKH	Y	Y	T6	5	5	1996/08/28	1	1	92L.044	G	9	61563	5585172	Down	Ch			
1996/08/16	Malook Cr.		930-8652-426-045	ARL	RJF	TKH	Y	Y	T6	6	6	1996/08/30	1	1	92L.044	G	9	61683	5586489	Down	Ch			
1996/08/16	Malook Cr.		930-8652-426-045	ARL	RJF	TKH	Y	Y	T6	7	7	1996/08/30	1	1	92L.044	G	9	61683	5586489	Up	Ch			
1996/08/16	Malook Cr.		930-8652-426-045	ARL	RJF	TKH	Y	N	T6	8	8	1996/08/30	2	2	92L.044	M	9	61717	5586925	Up	Ch			
1996/08/16	Malook Cr.		930-8652-426-045	ARL	RJF	TKH	N	N	T6	9	9	1996/08/30	2	2	92L.044	M	9	61717	5586925		Xs			
1996/08/16	Malook Cr.		930-8652-426-045	ARL	RJF	TKH	N	N	T6	10	10	1996/08/30	2		92L.034	M	9	61717	5586925	Up	Ch			Reach 2 spring
1996/08/16	Teihsum R.	Green R.	930-8652-725	ARL	RJF	TKH	Y	N	T6	11	11	1996/08/31	1	1	92L.034	G	9	61731	5576800	Down	Ch			
1996/08/16	Teihsum R.	Green R.	930-8652-725	ARL	RJF	TKH	Y	N	T6	12	12	1996/08/31	1	1	92L.034	G	9	61731	5576800	Up	Ch			
1996/08/16	Teihsum R.	Green R.	930-8652-725	ARL	RJF	TKH	Y	N	T6	13	13	1996/08/31	1	1	92L.034	G	9	61731	5576800	Down	Ch			
1996/08/16	Teihsum R.	Green R.	930-8652-725	ARL	RJF	TKH	Y	N	T6	14	14	1996/08/31	2	2	92L.034	M	9	61742	5576700	Up	Ch			
1996/08/16	Teihsum R.	Green R.	930-8652-725	ARL	RJF	TKH	Y	N	T6	15	15	1996/08/31	2	2	92L.034	M	9	61742	5576700	Down	Ch			
1996/08/16	Marble R.	Upper Marble R.	930-8652	ARL	RJF	TKH	Y	N	T6	16	16	1996/08/31	1	2	92L.024	G	9	61838	5568888	Up	Ch			
1996/08/16	Marble R.	Upper Marble R.	930-8652	ARL	RJF	TKH	Y	N	T6	17	17	1996/08/31	1	2	92L.024	G	9	61838	5568888	Down	Ch			
1996/08/16	Marble R.	Upper Marble R.	930-8652	ARL	RJF	TKH	Y	N	T6	18	18	1996/08/31	1	2	92L.024	G	9	61838	5568888	Up	Ch			
1996/08/16	Marble R.	Upper Marble R.	930-8652	ARL	RJF	TKH	Y	Y	T6	19	19	1996/08/31	2	3	92L.024	G	9	61885	5567858	Up	Ch			
1996/08/16	Marble R.	Upper Marble R.	930-8652	ARL	RJF	TKH	Y	Y	T6	20	20	1996/08/31	2	3	92L.024	G	9	61885	5567858	Down	Ch		person , 1.8 m	
1996/08/16	Marble R.	Upper Marble R.	930-8652	ARL	RJF	TKH	Y	N	T6	21	21	1996/08/31	3	5	92L.024	G	9	61960	5566662	Down	Ch			
1996/08/16	Marble R.	Upper Marble R.	930-8652	ARL	RJF	TKH	Y	N	T6	22	22	1996/08/31	3	5	92L.024	G	9	61960	5566662	Up	Ch			
1996/08/16	Marble R.	Upper Marble R.	930-8652	ARL	RJF	TKH	N	N	T6	23	23	1996/08/31	2		92L.024	M	9	61955	5566962	Down	Ch			
1996/08/16	Marble R.	Upper Marble R.	930-8652	ARL	RJF	TKH	N	N	T6	24	24	1996/08/31	1		92L.024	M	9	61830	5570000		Ws	N		
1996/08/16	Marble R.	Upper Marble R.	930-8652	ARL	RJF	TKH	N	N	T6	25	25	1996/08/31	1		92L.024	M	9	61830	5570000		Ws	S		
1996/08/16	Lippy Cr.		?	ARL	RJF	TKH	Y	Y	T7	6	6	1996/09/02	1	2	92L.043	M	9	61160	5591000	Down	Ch			Riffle population estimation site
1996/08/16	Marble R.	Upper Marble R.	930-8652	ARL	RJF	TKH	Y	N	T7	8	8	1996/09/03	1	1	92L.024	G	9	61800	5570908	Down	Ch			
1996/08/16	Marble R.	Upper Marble R.	930-8652	ARL	RJF	TKH	Y	N	T7	9	9	1996/09/03	1	1	92L.024	G	9	61800	5570908	Up	Ch			
1996/08/16	Teihsum R.	Green R.	930-8652-725	ARL	RJF	TKH	Y	N	T7	10	10	1996/09/03	4	5	92L.024	G	9	61952	5574700	Up	Ch			
1996/08/16	Teihsum R.	Green R.	930-8652-725	ARL	RJF	TKH	Y	N	T7	11	11	1996/09/03	4	5	92L.024	G	9	61952	5574700	Down	Ch			
1996/08/16	Teihsum R.	Green R.	930-8652-725	ARL	RJF	TKH	Y	N	T7	12	12	1996/09/03	4	5	92L.024	G	9	61952	5574700	Up	Ch			
1996/08/16	Unnamed Cr.		930-8652-725-259	ARL	RJF		Y	N	T7	13	13	1996/09/03	1	1	92L.034	G	9	61979	5576116	Down	Ch			Unnamed Teihsum River tributary

Appendix B: Marble River photograph documentation, August-October, 1996.

Survey start date	Stream name (gaz.)	Stream name (loc.)	Watershed code	Agency	Crew (Init 1)	Crew (Init 2)	Reach/ site card (Y/N)	Fish cards (Y/N)	Roll/ batch #	Counter #	Negative #	Date of photo	Reach no.	Site no.	Map # NTS/ TRIM	UTM mtd G/M	Zone	E(field)	N(field)	Stream photo dir.	Picture type	Photo direction	Scale item	Comments
1996/08/16	Unnamed Cr.		930-8652-725-259	ARL	RJF		Y	N	T7	14	14	1996/09/03	1	1	92L.034	G	9	619792	5576116	Up	Ch			Unnamed Teihsum River tributary
1996/08/16	Unnamed Cr.		930-8652-725-259	ARL	RJF		Y	N	T7	15	15	1996/09/03	1	1	92L.034	G	9	619792	5576116	Down	Ch			Unnamed Teihsum River tributary
1996/08/16	Unnamed Cr.		930-8652-725-259-392	ARL	RJF		N	N	T7	16	16	1996/09/03			92L.034	M	9	621000	5575650	Down	Ch			new path of creek
1996/08/16	Unnamed Cr.		930-8652-725-259-392	ARL	RJF		N	N	T7	17	17	1996/09/03			92L.034	M	9	621000	5575650	Up	Ch			Logging road turned into creek bed
1996/08/16	Unnamed Cr.		930-8652-725-259	ARL	RJF		Y	N	T7	18	18	1996/09/03	2	2	92L.034	G	9	620984	5575547	Down	Ch			
1996/08/16	Teihsum R.	Green R.	930-8652-725	ARL	RJF		Y	N	T7	19	19	1996/09/03	3	4	92L.034	G	9	619072	5576571	Up	Ch			
1996/08/16	Teihsum R.	Green R.	930-8652-725	ARL	RJF		Y	N	T7	20	20	1996/09/03	3	4	92L.034	G	9	619072	5576571	Down	Ch			
1996/08/16	Unnamed Cr.	Alice Lake Tribuatry #5	930-8652-313-143	ARL	RJF		Y	Y	T7	21	21	1996/09/04	1	2	92L.043	G	9	613368	5592664	Down	Ch			Mouth of Alice Lake Unnamed Tributary #5
1996/08/16	Unnamed Cr.	Alice Lake Tribuaty #7	930-8652-365	ARL	RJF		Y	Y	T7	22	22	1996/09/04	2	2	92L.044	G	9	615248	5592059	Down	Ch			Alice Lake Unnamed Tributary #7
1996/08/16	Unnamed Cr.	Alice Lake Tributary #8	930-8652-400	ARL	RJF	JRF	Y	N	T7	23	23	1996/09/05			92L.044	G	9	614852	5589757	Up	Ch			Alice Lake Unnamed Tributary #8
1996/08/16	Unnamed Cr.	Alice Lake Tributary #8	930-8652-400	ARL	RJF	JRF		N	T7	24	24	1996/09/05			92L.044	G	9	614856	5589757	Down	Ch			Alice Lake Unnamed Tributary #8
1996/08/16	Sorenson Cr.		930-8652-372	ARL	RJF	JRF	Y	Y	T7	25	25	1996/09/05	1	1	92L.043	M	9	612550	5591275	Up	Ch			Pool population estimation site
1996/08/16	Sorenson Cr.		930-8652-372	ARL	RJF	JRF	Y	Y	T7	26	26	1996/09/05	1	1	92L.043	M	9	612550	5591275	Down	Ch			Riffle population estimation site
1996/08/16	Sorenson Cr.		930-8652-372	ARL	RJF	JRF	Y	Y	T7	27	27	1996/09/05	1	1	92L.043	M	9	612550	5591275	Down	Ch			Glide population estmation site
1996/08/16	Unnamed Cr.	AliceLake Tributary #7	930-8652-365	ARL	RJF	JRF	N	Y	T7	28	28	1996/09/05			92L.044	M	9	612550	5591275		Ws	E		Alice Lake Unnamed Tributary #7
1996/08/16	Unnamed Cr.	Alice Lake Tributary # 11	930-8652-385	ARL	RJF	JRF	Y	Y	T7	29	30	1996/09/06	1	1	92L.043	G	9	612717	5589775	Down	Ch			Alice Lake Unnamed Tributary #11
1996/08/16	Unnamed Cr.	Alice Lake Tributary # 11	930-8652-385	ARL	RJF	JRF	Y	Y	T7	30	31	1996/09/06	1	1	92L.043	G	9	612717	5589775	Up	Ch			Alice Lake Unnamed Tributary #11
1996/08/16	Marble R.	Link R.	930-8652	ARL	RJF	JRF	Y	Y	T7	31	32	1996/09/06	1	1	92L.044	G	9	616587	5588441	Up	Ch			Pool population estimation site
1996/08/16	Marble R.	Link R.	930-8652	ARL	RJF	JRF	Y	Y	T7	32	33	1996/09/06	1	1	92L.044	G	9	616580	5588441	Down	Ch			Pool population estimation site
1996/08/16	Marble R.	Link R.	930-8652	ARL	RJF	JRF	Y	Y	T7	33	34	1996/09/06	1	1	92L.044	G	9	616580	5588441	Up	Ch			riffle population estimation site
1996/08/16	Marble R.	Link R.	930-8652	ARL	RJF	JRF	Y	Y	T7	34	35	1996/09/06	1	1	92L.044	G	9	616580	5588441	Down	Ch			glide population estimation site
1996/08/16	Marble R.	Link R.	930-8652	ARL	RJF	JRF	Y	Y	T7	35	36	1996/09/06	1	1	92L.044	G	9	616580	5588441	Up	Ch			glide population estimation site
1996/08/16	Marble R.	Link R.	930-8652	ARL	RJF	JRF	Y	Y	T7	36	37	1996/09/06	1	1	92L.044	G	9	616580	5588441	Down	Ch			glide population estimation site
1996/08/16	Unnamed Cr.	Victoria Lake Tributary #12	930-8652-868-399	ARL	RJF	JRF	Y	Y	T7	36	38	1996/09/07	1	1	92L.024	G	9	617800	5572694	Down	Ch			Victoria Lake Unnamed Tributary #12
1996/08/16	Unnamed Cr.	Victoria Lake Tributary #12	930-8652-868-399	ARL	RJF	JRF	Y	Y	T8	1	1	1996/09/07	1	1	92L.024	G	9	617800	5572694	Up	Ch			Victoria Lake Unnamed Tributary #12
1996/08/16	Unnamed Cr.	Upper Marble Tributary #1	930-8652-868-400??	ARL	RJF	JRF	Y	N	T8	2	2	1996/09/07	1	1	92L.024	G	9	617590	5572541	Up	Ch			Upper Marble Tributary #1
1996/08/16	Unnamed Cr.	UpperMarble Tributary #1	930-8652-868-400??	ARL	RJF	JRF	Y	N	T8	3	3	1996/09/07	1	1	92L.024	G	9	617591	5572541	Down	Ch			Upper Marble Tributary #1
1996/08/16	Unnamed Cr.	Victoria Lake Tributary #7	930-8652-729	ARL	RJF	JRF	N	N	T8	4	4	1996/09/07			92L.034	G	9	617303	5575926	Down	Ch			Victoria Lake Unnamed Tributary #7
1996/08/16	Unnamed Cr.	Victoria Lake Tributary #7	930-8652-729	ARL	RJF	JRF	N	N	T8	5	5	1996/09/07			92L.034	G	9	617303	5575926	Up	Ch			Victoria Lake Unnamed Tributary #7
1996/08/16	Teihsum R.	Green R.	930-8652-725	ARL	RJF	JRF	Y	N	T8	6	6	1996/09/07	3	3	92L.034	G	9	618403	5576450	Up	Ch			
1996/08/16	Teihsum R.	Green R.	930-8652-725	ARL	RJF	JRF	Y	N	T8	7	7	1996/09/07	3	3	92L.034	G	9	618402	5576450	Down	Ch			
1996/08/16	Unnamed Cr.	Victoria Lake Tributary #7	930-8652-717	ARL	RJF	JRF	Y	Y	T8	8	8	1996/09/07	1	1	92L.034	G	9	616946	5577437	Up	Ch			Victoria Lake Unnamed Tributary #7
1996/08/16	Benson R.		930-8652-426	ARL	RJF	JRF	Y	Y	T8	9	9	1996/09/07	1	1	92L.044	G	9	616446	5586424	Down	Ch		person, 1.8 m	riffle population assessment site
1996/08/16	Benson R.		930-8652-426	ARL	RJF	JRF	Y	Y	T8	10	10	1996/09/07	1	1	92L.044	G	9	616444	5586424		Xs	N		glide population assessment site
1996/08/16	Benson R.		930-8652-426	ARL	RJF	JRF	Y	Y	T8	11	11	1996/09/07	1	1	92L.044	G	9	616444	5586424		Xs	NW		pool population assessment site
1996/08/16	Benson R.		930-8652-426	ARL	RJF	JRF	Y	Y	T8	12	12	1996/09/07	1	1	92L.044	G	9	616444	5586424		Xs	NW		pool population assessment site
1996/08/16	Benson R.		930-8652-426	ARL	RJF	JRF	Y	Y	T8	13	13	1996/09/07	1	1	92L.044	G	9	616444	5586424		Xs	NE		glide population assessment site
1996/08/16	Benson R.		930-8652-426	ARL	RJF	JRF	Y	Y	T8	14	14	1996/09/07	1	1	92L.044	G	9	616444	5586424		Xs	SE		glide population assessment site

Appendix B: Photograph documentation, equipment details, August-October 1996

Survey start date: 17-Aug-96
Survey end date: 14-Oct-96

Camera #1
Make & Model: Pentax PC-700
Format: 135 mm film

Camera #2
Make & Model: Pentax Spotmatic
Format: 135 mm film
Lens: 1:1.4/50

Roll #	Camera	Output medium	Film type	ISO
T1	1	neg	colour	400
T2	1	neg	colour	400
T3	1	neg	colour	400
T4	1	neg	colour	400
T5	1	neg	colour	400
T6	1	neg	colour	400
T7	1	neg	colour	400
T8	1	neg	colour	400
R1	2	neg	colour	400
R2	2	neg	colour	400
R3	2	neg	colour	400
R4	2	neg	colour	400
R5	2	neg	colour	400
1	1	neg	colour	400
2	1	neg	colour	400
3	1	neg	colour	400
4	1	neg	colour	400
5	1	neg	colour	400
6	1	neg	colour	400

Appendix D. Marble River depth and velocity transect data and fish probability of use values, August-September, 1996.

System	Reach	Site	Habitat	Distance (m)	Transect (m)	Cell length (m)	Depth (m)	Velocity (m/sec)	substrate	Discharge (m^3/sec^{-1})	Pop. est y/n?	Rainbow trout fry			Rainbow trout parr			Rainbow trout adults			Cutthroat trout fry			Cutthroat trout parr			Coho fry		
												P(d)	P(v)	P(b)	P(d)	P(v)	P(b)	P(d)	P(v)	P(b)	P(d)	P(v)	P(b)	P(d)	P(v)	P(b)	P(d)	P(v)	P(b)
Pinch C	1	1	riffle	0.50	0.00	0.25	0.00	0.00	f	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Pinch C	1	1	riffle	1.00	0.50	0.50	0.10	0.01	f	0.00	y	1.00	1.00	1.00	0.25	1.00	0.25	0.20	0.82	0.16	1.00	1.00	1.00	0.27	1.00	0.27	0.05	0.80	0.04
Pinch C	1	1	riffle	1.50	1.00	0.50	0.17	0.01	sc	0.00	y	1.00	1.00	1.00	0.55	1.00	0.55	0.34	0.82	0.28	1.00	1.00	1.00	0.71	1.00	0.71	0.33	0.80	0.26
Pinch C	1	1	riffle	2.00	1.50	0.50	0.12	0.10	sc/b	0.01	y	1.00	1.00	1.00	0.35	1.00	0.35	0.24	0.92	0.22	1.00	1.00	1.00	0.36	1.00	0.36	0.17	1.00	0.17
Pinch C	1	1	riffle	2.50	2.00	0.50	0.15	0.90	sc/b	0.07	y	1.00	0.00	0.00	0.45	0.00	0.00	0.30	0.02	0.01	1.00	0.00	0.00	0.50	0.00	0.00	0.25	0.00	0.00
Pinch C	1	1	riffle	3.00	2.50	0.50	0.22	0.10	b/sc	0.01	y	0.98	1.00	0.98	0.77	1.00	0.77	0.44	0.92	0.41	0.98	1.00	0.98	0.98	1.00	0.98	0.54	1.00	0.54
Pinch C	1	1	riffle	3.50	3.00	0.50	0.30	0.36	b/sc	0.05	y	0.98	0.13	0.13	0.93	0.87	0.81	0.60	1.00	0.60	0.98	0.13	0.13	1.00	0.87	0.87	0.87	0.00	0.00
Pinch C	1	1	riffle	4.00	3.50	0.50	0.30	0.59	b	0.09	y	0.98	0.00	0.00	0.93	0.14	0.13	0.60	1.00	0.60	0.98	0.00	0.00	1.00	0.14	0.14	0.87	0.00	0.00
Pinch C	1	1	riffle	4.50	4.00	0.50	0.30	0.61	b	0.09	y	0.98	0.00	0.00	0.93	0.04	0.04	0.60	1.00	0.60	0.98	0.00	0.00	1.00	0.04	0.04	0.87	0.00	0.00
Pinch C	1	1	riffle	5.00	4.50	0.40	0.12	0.00	lc	0.00	y	1.00	1.00	1.00	0.35	1.00	0.35	0.24	0.81	0.19	1.00	1.00	1.00	0.36	1.00	0.36	0.17	0.80	0.14
Pinch C	1	1	riffle	5.30	4.80	0.15	0.00	0.00	lc	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
						4.80				0.32																			
Pinch C	1	1	pool	1.50	0.00	0.25	0.34	0.00	f	0.00	y	0.95	1.00	0.95	0.93	1.00	0.93	0.68	0.81	0.55	0.95	1.00	0.95	1.00	1.00	1.00	1.00	0.80	0.80
Pinch C	1	1	pool	2.00	0.50	0.50	0.54	0.00	f,sc	0.00	y	0.29	1.00	0.29	1.00	1.00	1.00	1.00	0.81	0.81	0.29	1.00	0.29	1.00	1.00	1.00	1.00	0.80	0.80
Pinch C	1	1	pool	2.50	1.00	0.50	0.47	0.00	f,sc	0.00	y	0.40	1.00	0.40	1.00	1.00	1.00	0.94	0.81	0.76	0.40	1.00	0.40	1.00	1.00	1.00	1.00	0.80	0.80
Pinch C	1	1	pool	3.00	1.50	0.50	0.40	0.00	f,sc	0.00	y	0.66	1.00	0.66	1.00	1.00	1.00	0.80	0.81	0.65	0.66	1.00	0.66	1.00	1.00	1.00	1.00	0.80	0.80
Pinch C	1	1	pool	3.50	2.00	0.50	0.52	0.02	f,sc	0.01	y	0.29	1.00	0.29	1.00	1.00	1.00	1.00	0.83	0.83	0.29	1.00	0.29	1.00	1.00	1.00	1.00	0.80	0.80
Pinch C	1	1	pool	4.00	2.50	0.50	0.20	0.12	g,f,b	0.01	y	0.98	1.00	0.98	0.66	1.00	0.66	0.40	0.94	0.38	0.98	1.00	0.98	0.95	1.00	0.95	0.42	0.90	0.38
Pinch C	1	1	pool	4.50	3.00	0.50	0.42	0.19	b,g,sc	0.04	y	0.50	1.00	0.50	1.00	1.00	1.00	0.84	1.00	0.84	0.50	1.00	0.50	1.00	1.00	1.00	1.00	0.40	0.40
Pinch C	1	1	pool	5.00	3.50	0.50	0.35	1.35	b,sc	0.24	y	0.95	0.00	0.00	0.93	0.00	0.00	0.70	0.00	0.00	0.95	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Pinch C	1	1	pool	5.50	4.00	0.50	0.27	0.13	b,sc,f	0.02	y	0.98	1.00	0.98	0.93	1.00	0.93	0.54	0.96	0.52	0.98	1.00	0.98	1.00	1.00	1.00	0.77	0.80	0.62
Pinch C	1	1	pool	6.00	4.50	0.25	0.16	0.00	sc,b,f	0.00	y	1.00	1.00	1.00	0.55	1.00	0.55	0.32	0.81	0.26	1.00	1.00	1.00	0.71	1.00	0.71	0.33	0.80	0.26
						4.50				0.31																			
Pinch C	1	1	glide	3.20	0.00	0.15	0.00	0.00	sg	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Pinch C	1	1	glide	3.50	0.30	0.40	0.05	0.06	lg	0.00	y	1.00	1.00	1.00	0.10	1.00	0.10	0.10	0.88	0.09	1.00	1.00	1.00	0.13	1.00	0.13	0.02	0.80	0.02
Pinch C	1	1	glide	4.00	0.80	0.50	0.08	0.27	sg	0.02	y	1.00	0.55	0.55	0.17	1.00	0.17	0.16	1.00	0.16	1.00	0.55	0.55	0.22	1.00	0.22	0.05	0.10	0.01
Pinch C	1	1	glide	4.50	1.30	0.50	0.15	0.20	sg	0.03	y	1.00	1.00	1.00	0.45	1.00	0.45	0.30	1.00	0.30	1.00	1.00	1.00	0.50	1.00	0.50	0.25	0.30	0.08
Pinch C	1	1	glide	5.00	1.80	0.50	0.17	0.39	lg	0.07	y	1.00	0.05	0.05	0.55	0.80	0.44	0.34	1.00	0.34	1.00	0.05	0.05	0.71	0.80	0.57	0.33	0.00	0.00
Pinch C	1	1	glide	5.50	2.30	0.50	0.20	0.35	lg	0.07	y	0.98	0.13	0.13	0.66	0.92	0.61	0.40	1.00	0.40	0.98	0.13	0.13	0.95	0.92	0.87	0.42	0.00	0.00
Pinch C	1	1	glide	6.00	2.80	0.50	0.20	0.30	lg	0.06	y	0.98	0.35	0.34	0.66	0.99	0.65	0.40	1.00	0.40	0.98	0.35	0.34	0.95	0.99	0.94	0.42	0.06	0.03
Pinch C	1	1	glide	6.50	3.30	0.50	0.25	0.43	lg	0.11	y	0.98	0.01	0.01	0.88	0.60	0.53	0.50	1.00	0.50	0.98	0.01	0.01	1.00	0.60	0.60	0.64	0.00	0.00
Pinch C	1	1	glide	7.00	3.80	0.50	0.15	0.38	sc	0.06	y	1.00	0.08	0.08	0.45	0.87	0.39	0.30	1.00	0.30	1.00	0.08	0.08	0.50	0.87	0.44	0.25	0.00	0.00
Pinch C	1	1	glide	7.50	4.30	0.50	0.10	0.24	sg	0.02	y	1.00	0.90	0.90	0.25	1.00	0.25	0.20	1.00	0.20	1.00	0.90	0.90	0.27	1.00	0.27	0.05	0.20	0.01
Pinch C	1	1	glide	8.00	4.80	0.50	0.12	0.08	sg	0.01	y	1.00	1.00	1.00	0.35	1.00	0.35	0.24	0.90	0.22	1.00	1.00	1.00	0.36	1.00	0.36	0.17	1.00	0.17
Pinch C	1	1	glide	8.50	5.30	0.35	0.03	0.00	sg	0.00	y	1.00	1.00	1.00	0.03	1.00	0.03	0.06	0.81	0.05	1.00	1.00	1.00	0.03	1.00	0.03	0.02	0.80	0.02
Pinch C	1	1	glide	8.70	5.50	0.10	0.00	0.00	lg	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
						5.50				0.45																			
Yootook C	1	1	pool	0.50	0.00	0.25	0.44	0.08	f,sc	0.01	y	0.50	1.00	0.50	1.00	1.00	1.00	0.88	0.90	0.79	0.50	1.00	0.50	1.00	1.00	1.00	1.00	1.00	1.00
Yootook C	1	1	pool	1.00	0.50	0.50	0.45	0.15	sc,b	0.03	y	0.50	1.00	0.50	1.00	1.00	1.00	0.90	0.98	0.88	0.50	1.00	0.50	1.00	1.00	1.00	1.00	0.60	0.60
Yootook C	1	1	pool	1.50	1.00	0.50	0.44	0.30	b,sc	0.07	y	0.50	0.35	0.18	1.00	0.99	0.99	0.88	1.00	0.88	0.50	0.35	0.18	1.00	0.99	0.99	1.00	0.06	0.06
Yootook C	1	1	pool	2.00	1.50	0.50	0.33	0.99	b,sc	0.16	y	0.95	0.00	0.00	0.93	0.00	0.00	0.66	0.02	0.01	0.95	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Yootook C	1	1	pool	2.50	2.00	0.50	0.17	0.48	b	0.04	y	1.00	0.01	0.01	0.55	0.50	0.28	0.34	1.00	0.34	1.00	0.01	0.01	0.71	0.50	0.36	0.33	0.00	0.00
Yootook C	1	1	pool	3.00	2.50	0.50	0.00	0.00	b	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Yootook C	1	1	pool	3.50	3.00	0.50	0.00	0.00	b,sc,f	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Yootook C	1	1	pool	4.00	3.50	0.25	0.00	0.00	sc,f,b	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
						3.50				0.31																			
Yootook C	1	1	glide	1.60	0.00	0.20	0.11	0.00	sg	0.00	y	1.00	1.00	1.00	0.25	1.00	0.25	0.22	0.81	0.18	1.00	1.00	1.00	0.27	1.00	0.27	0.17	0.80	0.14
Yootook C	1	1	glide	2.00	0.40	0.45	0.27	0.07	sc	0.01	y	0.98	1.00	0.98	0.93	1.00	0.93	0.54	0.89	0.48	0.98	1.00	0.98	1.00	1.00	1.00	0.77	0.80	0.62
Yootook C	1	1	glide	2.50	0.90	0.50	0.26	0.06	lc	0.01	y	0.98	1.00	0.98	0.88	1.00	0.88	0.52	0.88	0.46	0.98	1.00	0.98	1.00	1.00	1.00	0.77	0.80	0.62
Yootook C	1	1	glide	3.00	1.40	0.50	0.06	0.16	b	0.00	y	1.00	1.00	1.00	0.10	1.00	0.10	0.12	0.99	0.12	1.00	1.00	1.00	0.13	1.00	0.13	0.05	0.60	0.03
Yootook C	1	1	glide	3.50	1.90	0.50	0.32	0.09	b	0.01	y	0.95	1.00	0.95	0.93	1.00	0.93	0.64	0.91	0.58	0.95	1.00	0.95	1.00	1.00	1.00	0.94	1.00	0.94
Yootook C	1	1	glide	4.00	2.40	0.50	0.20	0.25	b	0.03	y	0.98	0.75	0.74	0.66	1.00	0.66	0.40	1.00	0.40	0.98	0.75	0.74	0.95	1.00	0.95	0.42	0.10	0.04
Yootook C	1	1	glide	4.50	2.90	0.50	0.21	0.21	lc	0.02	y	0.98	0.90	0.88	0.77	1.00	0.77	0.42	1.00	0.42	0.98	0.90	0.88	0.98	1.00	0.98	0.54	0.30	0.16
Yootook C	1	1	glide	5.00	3.40	0.50	0.27	0.28	b	0.04	y	0.98	0.55	0.54	0.93	1.00	0.93	0.54	1.00	0.54	0.98	0.55	0.54	1.00	1.00	1.00	0.77	0.10	0.08
Yootook C	1	1	glide	5.50	3.90	0.50	0.11	0.10	b	0.01	y	1.00	1.00	1.00	0.25	1.00	0.25	0.22	0.92	0.20	1.00	1.00	1.00	0.27	1.00	0.27	0.17	1.00	0.17
Yootook C	1	1	glide	6.00	4.40	0.50	0.00	0.00	b	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Yootook C	1	1	glide	6.50	4.90	0.50	0.21	0.20	sc	0.02	y	0.98	1.00	0.98	0.77	1.00	0.77	0.42	1.00	0.42	0.98	1.00	0.98	0.98	1.00	0.98	0.54	0.30	0.16
Yootook C	1	1	glide	7.00	5.40	0.50	0.18	0.30	lc	0.03	y	1.00	0.35	0.35	0.66	0.99	0.65	0.36	1.00	0.36	1.00	0.35	0.35	0.95	0.99	0.94	0.42	0.06	0.03
Yootook C	1	1	glide	7.50	5.90	0.50	0.13	0.02	sc	0.00	y	1.00	1.00	1.00	0.35	1.00	0.35	0.26	0.83	0.22	1.00	1.00	1.00	0.36	1.00	0.36	0.25	0.80	0.20
Yootook C	1	1	glide	8.00	6.40	0.45	0.08	0.04	lg	0.00	y	1.00	1.00	1.00	0.17	1.00	0.17	0.16	0.85	0.14	1.00	1.00	1.00	0.22	1.00	0.22	0.05	0.80	0.04
Yootook C	1	1	glide	8.40	6.80	0.20	0.00	0.00	lg	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
						6.80				0.18																			
Yootook C	1	1	riffle	2.50	0.00	0.25	0.00	0.00	lg	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Yootook C	1	1	riffle	3.00	0.50	0.50	0.13	0.51	lg	0.03	y	1.00	0.00	0.00	0.35	0.23	0.08	0.26	1.00	0.26	1.00	0.00	0.00	0.36	0.23	0.08	0.25	0.00	0.00
Yootook C	1	1	riffle	3.50	1.00	0.50	0.15	0.49	lc	0.04	y	1.00	0.01	0.01	0.45	0.40	0.18	0.30	1.00	0.30	1.00	0.01	0.01	0.50	0.40	0.20	0.25	0.00	0.00
Yootook C	1	1	riffle	4.00	1.50	0.50	0.06	0.59	b	0.02	y	1.00	0.00	0.00	0.10	0.14	0.01	0.12	1.00	0.12	1.00	0.00	0.00	0.13	0.14	0.02	0.05	0.00	0.00
Yootook C	1	1	riffle	4.50	2.00	0.50	0.10	0.55	b	0.03	y	1.00	0.00	0.00	0.25	0.23	0.06	0.20	1.00	0.20	1.00	0.00	0.00	0.27	0.23	0.06	0.05	0.00	0.00
Yootook C	1	1	riffle	5.00	2.50	0.50	0.10	0.85	b	0.04	y	1.00	0.00	0.00	0.25	0.00	0.00	0.20	0.02	0.00	1.00	0.00	0.00	0.27	0.02	0.00	0.05	0.00	0.00
Yootook C	1	1	riffle	5.50	3.00	0.50	0.10	0.18	lc	0.01	y	1.00	1.00	1.00	0.25	1.00	0.25	0.20	1.00	0.20	1.00	1.00	1.00	0.27	1.00	0.27	0.05	0.40	0.02
Yootook C	1	1	riffle	6.00	3.50	0.50	0.17	0.21	sc	0.02	y	1.00	0.90	0.90	0.55	1.00	0.55	0.34	1.00	0.34	1.00	0.90	0.90	0.71	1.00	0.71	0.33	0.30	0.10
Yootook C	1	1	riffle	6.50	4.00	0.50	0.10	0.13	lc	0.01	y	1.00	1.00	1.00	0.25	1.00	0.25	0.20	0.96	0.19	1.00	1.00	1.00	0.27	1.00	0.27	0.05	0.80	0.04
Yootook C	1	1	riffle	7.00	4.50	0.50	0.10	0.00	b	0.00	y	1.00	1.00	1.00	0.25	1.00	0.25	0.20	0.81	0.16	1.00	1.00	1.00	0.27	1.00	0.27	0.05	0.80	0.04
Yootook C	1	1	riffle	7.50	5.00	0.25	0.00	0.00	b	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
						5.00				0.19																			

Appendix D. Marble River depth and velocity transect data and fish probability of use values, August-September, 1996.

System	Reach	Site	Habitat	Distance (m)	Transect (m)	Cell length (m)	Depth (m)	Velocity (m/sec)	substrate	Discharge (m^3/sec^{-1})	Pop. est y/n?	Rainbow trout fry			Rainbow trout parr			Rainbow trout adults			Cutthroat trout fry			Cutthroat trout parr			Coho fry		
												P(d)	P(v)	P(b)	P(d)	P(v)	P(b)	P(d)	P(v)	P(b)	P(d)	P(v)	P(b)	P(d)	P(v)	P(b)	P(d)	P(v)	P(b)
Teihsum R	1	1	glide	6.30	0.00	0.10	0.00	0.00		0.00	n	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Teihsum R	1	1	glide	6.50	0.20	0.35	0.06	0.00		0.00	n	1.00	1.00	1.00	0.10	1.00	0.10	0.12	0.81	0.10	1.00	1.00	1.00	0.13	1.00	0.13	0.05	0.80	0.04
Teihsum R	1	1	glide	7.00	0.70	0.50	0.06	0.00		0.00	n	1.00	1.00	1.00	0.10	1.00	0.10	0.12	0.81	0.10	1.00	1.00	1.00	0.13	1.00	0.13	0.05	0.80	0.04
Teihsum R	1	1	glide	7.50	1.20	0.50	0.02	0.08		0.00	n	1.00	1.00	1.00	0.03	1.00	0.03	0.04	0.90	0.04	1.00	1.00	1.00	0.03	1.00	0.03	0.00	1.00	0.00
Teihsum R	1	1	glide	8.00	1.70	0.50	0.06	0.03		0.00	n	1.00	1.00	1.00	0.10	1.00	0.10	0.12	0.84	0.10	1.00	1.00	1.00	0.13	1.00	0.13	0.05	0.80	0.04
Teihsum R	1	1	glide	8.50	2.20	0.50	0.30	0.30		0.05	n	0.98	0.35	0.34	0.93	0.99	0.92	0.60	1.00	0.60	0.98	0.35	0.34	1.00	0.99	0.99	0.87	0.06	0.05
Teihsum R	1	1	glide	9.00	2.70	0.50	0.28	0.34		0.05	n	0.98	0.18	0.18	0.93	0.95	0.88	0.56	1.00	0.56	0.98	0.18	0.18	1.00	0.95	0.95	0.87	0.06	0.05
Teihsum R	1	1	glide	9.50	3.20	0.50	0.29	0.39		0.06	n	0.98	0.05	0.05	0.93	0.80	0.74	0.58	1.00	0.58	0.98	0.05	0.05	1.00	0.80	0.80	0.87	0.00	0.00
Teihsum R	1	1	glide	10.00	3.70	0.50	0.27	0.40		0.05	n	0.98	0.05	0.05	0.93	0.80	0.74	0.54	1.00	0.54	0.98	0.05	0.05	1.00	0.80	0.80	0.77	0.00	0.00
Teihsum R	1	1	glide	10.50	4.20	0.50	0.26	0.54		0.07	n	0.98	0.00	0.00	0.88	0.23	0.20	0.52	1.00	0.52	0.98	0.00	0.00	1.00	0.23	0.23	0.77	0.00	0.00
Teihsum R	1	1	glide	11.00	4.70	0.50	0.26	0.37		0.05	n	0.98	0.08	0.08	0.88	0.87	0.77	0.52	1.00	0.52	0.98	0.08	0.08	1.00	0.87	0.87	0.77	0.00	0.00
Teihsum R	1	1	glide	11.50	5.20	0.50	0.25	0.44		0.06	n	0.98	0.01	0.01	0.88	0.60	0.53	0.50	1.00	0.50	0.98	0.01	0.01	1.00	0.60	0.60	0.64	0.00	0.00
Teihsum R	1	1	glide	12.00	5.70	0.50	0.26	0.35		0.05	n	0.98	0.13	0.13	0.88	0.92	0.81	0.52	1.00	0.52	0.98	0.13	0.13	1.00	0.92	0.92	0.77	0.00	0.00
Teihsum R	1	1	glide	12.50	6.20	0.50	0.29	0.37		0.05	n	0.98	0.08	0.08	0.93	0.87	0.81	0.58	1.00	0.58	0.98	0.08	0.08	1.00	0.87	0.87	0.87	0.00	0.00
Teihsum R	1	1	glide	13.00	6.70	0.50	0.34	0.43		0.07	n	0.95	0.01	0.01	0.93	0.60	0.56	0.68	1.00	0.68	0.95	0.01	0.01	1.00	0.60	0.60	1.00	0.00	0.00
Teihsum R	1	1	glide	13.50	7.20	0.50	0.27	0.37		0.05	n	0.98	0.08	0.08	0.93	0.87	0.81	0.54	1.00	0.54	0.98	0.08	0.08	1.00	0.87	0.87	0.77	0.00	0.00
Teihsum R	1	1	glide	14.00	7.70	0.50	0.26	0.22		0.03	n	0.98	0.90	0.88	0.88	1.00	0.88	0.52	1.00	0.52	0.98	0.90	0.88	1.00	1.00	1.00	0.77	0.30	0.23
Teihsum R	1	1	glide	14.50	8.20	0.50	0.14	0.18		0.01	n	1.00	1.00	1.00	0.45	1.00	0.45	0.28	1.00	0.28	1.00	1.00	1.00	0.50	1.00	0.50	0.25	0.40	0.10
Teihsum R	1	1	glide	15.00	8.70	0.25	0.00	0.00		0.00	n	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
						8.70				0.64																			
L. Marble R	1	4	glide	3.80	0.00	0.10	0.27	0.37		0.01	n	0.98	0.08	0.08	0.93	0.87	0.81	0.54	1.00	0.54	0.98	0.08	0.08	1.00	0.87	0.87	0.77	0.00	0.00
L. Marble R	1	4	glide	4.00	0.20	0.60	0.23	0.27		0.04	n	0.98	0.55	0.54	0.77	1.00	0.77	0.46	1.00	0.46	0.98	0.55	0.54	0.98	1.00	0.98	0.64	0.10	0.06
L. Marble R	1	4	glide	5.00	1.20	1.00	0.30	0.27		0.08	n	0.98	0.55	0.54	0.93	1.00	0.93	0.60	1.00	0.60	0.98	0.55	0.54	1.00	1.00	1.00	0.87	0.10	0.09
L. Marble R	1	4	glide	6.00	2.20	1.00	0.30	0.21		0.06	n	0.98	0.90	0.88	0.93	1.00	0.93	0.60	1.00	0.60	0.98	0.90	0.88	1.00	1.00	1.00	0.87	0.30	0.26
L. Marble R	1	4	glide	7.00	3.20	1.00	0.29	0.45		0.13	n	0.98	0.01	0.01	0.93	0.50	0.47	0.58	1.00	0.58	0.98	0.01	0.01	1.00	0.50	0.50	0.87	0.00	0.00
L. Marble R	1	4	glide	8.00	4.20	1.00	0.60	0.30		0.18	n	0.21	0.35	0.07	1.00	0.99	0.99	1.00	1.00	1.00	0.21	0.35	0.07	1.00	0.99	0.99	1.00	0.06	0.06
L. Marble R	1	4	glide	9.00	5.20	1.00	0.26	0.38		0.10	n	0.98	0.08	0.08	0.88	0.87	0.77	0.52	1.00	0.52	0.98	0.08	0.08	1.00	0.87	0.87	0.77	0.00	0.00
L. Marble R	1	4	glide	10.00	6.20	1.00	0.57	0.24		0.14	n	0.21	0.90	0.19	1.00	1.00	1.00	1.00	1.00	1.00	0.21	0.90	0.19	1.00	1.00	1.00	1.00	0.20	0.20
L. Marble R	1	4	glide	11.00	7.20	1.00	0.40	0.23		0.09	n	0.66	0.90	0.59	1.00	1.00	1.00	0.80	1.00	0.80	0.66	0.90	0.59	1.00	1.00	1.00	1.00	0.20	0.20
L. Marble R	1	4	glide	12.00	8.20	1.00	0.62	0.37		0.23	n	0.15	0.08	0.01	1.00	0.87	0.87	1.00	1.00	1.00	0.15	0.08	0.01	1.00	0.87	0.87	1.00	0.00	0.00
L. Marble R	1	4	glide	13.00	9.20	1.00	0.50	0.13		0.07	n	0.40	1.00	0.40	1.00	1.00	1.00	1.00	0.96	0.96	0.40	1.00	0.40	1.00	1.00	1.00	1.00	0.80	0.80
L. Marble R	1	4	glide	14.00	10.20	1.00	0.62	0.35		0.22	n	0.15	0.13	0.02	1.00	0.92	0.92	1.00	1.00	1.00	0.15	0.13	0.02	1.00	0.92	0.92	1.00	0.00	0.00
L. Marble R	1	4	glide	15.00	11.20	1.00	0.80	0.24		0.19	n	0.04	0.90	0.04	1.00	1.00	1.00	1.00	1.00	1.00	0.04	0.90	0.04	1.00	1.00	1.00	1.00	0.20	0.20
L. Marble R	1	4	glide	16.00	12.20	1.00	0.81	0.09		0.07	n	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.91	0.91	0.02	1.00	0.02	1.00	1.00	1.00	1.00	1.00	1.00
L. Marble R	1	4	glide	17.00	13.20	1.00	0.75	0.28		0.21	n	0.06	0.55	0.03	1.00	1.00	1.00	1.00	1.00	1.00	0.06	0.55	0.03	1.00	1.00	1.00	1.00	0.10	0.10
L. Marble R	1	4	glide	18.00	14.20	1.00	0.34	0.36		0.12	n	0.95	0.13	0.12	0.93	0.87	0.81	0.68	1.00	0.68	0.95	0.13	0.12	1.00	0.87	0.87	1.00	0.00	0.00
L. Marble R	1	4	glide	19.00	15.20	1.00	0.55	0.05		0.03	n	0.29	1.00	0.29	1.00	1.00	1.00	1.00	0.87	0.87	0.29	1.00	0.29	1.00	1.00	1.00	1.00	0.80	0.80
L. Marble R	1	4	glide	20.00	16.20	1.00	0.44	0.22		0.09	n	0.50	0.90	0.45	1.00	1.00	1.00	0.88	1.00	0.88	0.50	0.90	0.45	1.00	1.00	1.00	1.00	0.30	0.30
L. Marble R	1	4	glide	21.00	17.20	1.00	0.27	0.05		0.01	n	0.98	1.00	0.98	0.93	1.00	0.93	0.54	0.87	0.47	0.98	1.00	0.98	1.00	1.00	1.00	0.77	0.80	0.62
L. Marble R	1	4	glide	22.00	18.20	0.50	0.27	0.05		0.01	n	0.98	1.00	0.98	0.93	1.00	0.93	0.54	0.87	0.47	0.98	1.00	0.98	1.00	1.00	1.00	0.77	0.80	0.62
						18.20				2.08																			
Malook C	1	1	pool	1.30	0.00	0.10	0.00	0.00		0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Malook C	1	1	pool	1.50	0.20	0.35	0.20	0.00		0.00	y	0.98	1.00	0.98	0.66	1.00	0.66	0.40	0.81	0.32	0.98	1.00	0.98	0.95	1.00	0.95	0.42	0.80	0.34
Malook C	1	1	pool	2.00	0.70	0.50	0.57	0.00		0.00	y	0.21	1.00	0.21	1.00	1.00	1.00	1.00	0.81	0.81	0.21	1.00	0.21	1.00	1.00	1.00	1.00	0.80	0.80
Malook C	1	1	pool	2.50	1.20	0.50	0.83	0.00		0.00	y	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.81	0.81	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.80	0.80
Malook C	1	1	pool	3.00	1.70	0.50	1.17	0.00		0.00	y	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.81	0.81	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.80	0.80
Malook C	1	1	pool	3.50	2.20	0.50	1.39	0.00		0.00	y	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.81	0.81	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.80	0.80
Malook C	1	1	pool	4.00	2.70	0.50	1.70	0.00		0.00	y	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.81	0.81	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.80	0.80
Malook C	1	1	pool	4.50	3.20	0.50	1.83	0.00		0.00	y	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.81	0.81	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.80	0.80
Malook C	1	1	pool	5.00	3.70	0.50	2.10	0.00		0.00	y	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.81	0.81	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.80	0.80
Malook C	1	1	pool	5.50	4.20	0.50	2.30	0.00		0.00	y	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.81	0.81	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.80	0.80
Malook C	1	1	pool	6.00	4.70	0.50	3.00	0.00		0.00	y	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.81	0.81	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.80	0.80
Malook C	1	1	pool	6.50	5.20	0.50	2.20	0.00		0.00	y	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.81	0.81	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.80	0.80
Malook C	1	1	pool	7.00	5.70	0.50	2.10	0.00		0.00	y	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.81	0.81	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.80	0.80
Malook C	1	1	pool	7.50	6.20	0.50	2.00	0.00		0.00	y	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.81	0.81	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.80	0.80
Malook C	1	1	pool	8.00	6.70	0.50	0.43	0.00		0.00	y	0.50	1.00	0.50	1.00	1.00	1.00	0.86	0.81	0.70	0.50	1.00	0.50	1.00	1.00	1.00	1.00	0.80	0.80
Malook C	1	1	pool	8.50	7.20	0.25	0.18	0.00		0.00	y	1.00	1.00	1.00	0.66	1.00	0.66	0.36	0.81	0.29	1.00	1.00	1.00	0.95	1.00	0.95	0.42	0.80	0.34
						7.20				0.00																			
Howlal C	1	1	pool	1.00	0.00	0.25	0.00	0.00	lc	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Howlal C	1	1	pool	1.50	0.50	0.50	0.41	0.00	lc	0.00	y	0.50	1.00	0.50	1.00	1.00	1.00	0.82	0.81	0.66	0.50	1.00	0.50	1.00	1.00	1.00	1.00	0.80	0.80
Howlal C	1	1	pool	2.00	1.00	0.50	0.67	0.00	lg	0.00	y	0.10	1.00	0.10	1.00	1.00	1.00	1.00	0.81	0.81	0.10	1.00	0.10	1.00	1.00	1.00	1.00	0.80	0.80
Howlal C	1	1	pool	2.50	1.50	0.50	0.76	0.00	lg	0.00	y	0.04	1.00	0.04	1.00	1.00	1.00	1.00	0.81	0.81	0.04	1.00	0.04	1.00	1.00	1.00	1.00	0.80	0.80
Howlal C	1	1	pool	3.00	2.00	0.50	0.76	0.00	lg	0.00	y	0.04	1.00	0.04	1.00	1.00	1.00	1.00	0.81	0.81	0.04	1.00	0.04	1.00	1.00	1.00	1.00	0.80	0.80
Howlal C	1	1	pool	3.50	2.50	0.50	0.78	0.00	lg	0.00	y	0.04	1.00	0.04	1.00	1.00	1.00	1.00	0.81	0.81	0.04	1.00	0.04	1.00	1.00	1.00	1.00	0.80	0.80
Howlal C	1	1	pool	4.00	3.00	0.50	0.88	0.00	lc	0.00	y	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.81	0.81	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.80	0.80
Howlal C	1	1	pool	4.50	3.50	0.50	0.93	0.03	lc	0.01	y	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.84	0.84	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.80	0.80
Howlal C	1	1	pool	5.00	4.00	0.50	0.80	0.03	sc	0.01	y	0.04	1.00	0.04	1.00	1.00	1.00	1.00	0.84	0.84	0.04	1.00	0.04	1.00	1.00	1.00	1.00	0.80	0.80
Howlal C	1	1	pool	5.50	4.50	0.50	0.68	0.00	lg	0.00	y	0.10	1.00	0.10	1.00	1.00	1.00	1.00	0.81	0.81	0.10	1.00	0.10	1.00	1.00	1.00	1.00	0.80	0.80
Howlal C	1	1	pool	6.00	5.00	0.50	0.60	0.00	lg	0.00	y	0.21	1.00	0.21	1.00	1.00	1.00	1.00	0.81	0.81	0.21	1.00	0.21	1.00	1.00	1.00	1.00	0.80	0.80
Howlal C	1	1	pool	6.50	5.50	0.50	0.45	0.00	lg	0.00	y	0.50	1.00	0.50	1.00	1.00	1.00	0.89	0.81	0.72	0.50	1.00	0.50	1.00	1.00	1.00	1.00	0.80	0.80
Howlal C	1	1	pool	7.00	6.00	0.50	0.35	0.00	lg	0.00	y	0.95	1.00	0.95	0.93	1.00	0.93	0.70	0.81	0.57	0.95	1.00	0.95	1.00	1.00	1.00	1.00	0.80	0.80
Howlal C	1	1	pool	7.50	6.50	0.50	0.17	0.00	sg	0.00	y	1.00	1.00	1.00	0.55	1.00	0.55	0.34	0.81	0.28	1.00	1.00	1.00	0.71	1.00	0.71	0.33	0.80	0.26
Howlal C	1	1	pool	8.00	7.00	0.25	0.00	0.00	lg	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
						7.00				0.03																			

Appendix D. Marble River depth and velocity transect data and fish probability of use values, August-September, 1996.

System	Reach	Site	Habitat	Distance (m)	Transect (m)	Cell length (m)	Depth (m)	Velocity (m/sec)	substrate	Discharge (m^3/sec^{-1})	Pop. est y/n?	Rainbow trout fry			Rainbow trout parr			Rainbow trout adults			Cutthroat trout fry			Cutthroat trout parr			Coho fry		
												P(d)	P(v)	P(b)	P(d)	P(v)	P(b)	P(d)	P(v)	P(b)	P(d)	P(v)	P(b)	P(d)	P(v)	P(b)	P(d)	P(v)	P(b)
Lippy C	1	6	riffle	1.80	0.00	0.10	0.00	0.00	f	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Lippy C	1	6	riffle	2.00	0.20	0.23	0.10	0.00	sg	0.00	y	1.00	1.00	1.00	0.25	1.00	0.25	0.20	0.81	0.16	1.00	1.00	1.00	0.27	1.00	0.27	0.05	0.80	0.04
Lippy C	1	6	riffle	2.25	0.45	0.25	0.00	0.00	sg	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Lippy C	1	6	riffle	2.50	0.70	0.25	0.00	0.00	sg	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Lippy C	1	6	riffle	2.75	0.95	0.25	0.00	0.00	b	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Lippy C	1	6	riffle	3.00	1.20	0.25	0.00	0.00	sg	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Lippy C	1	6	riffle	3.25	1.45	0.25	0.00	0.00	lg	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Lippy C	1	6	riffle	3.50	1.70	0.25	0.02	0.11	lg	0.00	y	1.00	1.00	1.00	0.03	1.00	0.03	0.04	0.93	0.04	1.00	1.00	1.00	0.03	1.00	0.03	0.00	0.90	0.00
Lippy C	1	6	riffle	3.75	1.95	0.25	0.00	0.00	b	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Lippy C	1	6	riffle	4.00	2.20	0.25	0.00	0.00	b	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Lippy C	1	6	riffle	4.25	2.45	0.25	0.00	0.00	lc	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Lippy C	1	6	riffle	4.50	2.70	0.25	0.40	0.09	sc	0.01	y	0.66	1.00	0.66	1.00	1.00	1.00	0.80	0.91	0.73	0.66	1.00	0.66	1.00	1.00	1.00	1.00	1.00	1.00
Lippy C	1	6	riffle	4.75	2.95	0.25	0.07	0.22	sc	0.00	y	1.00	0.90	0.90	0.17	1.00	0.17	0.14	1.00	0.14	1.00	0.90	0.90	0.22	1.00	0.22	0.05	0.30	0.02
Lippy C	1	6	riffle	5.00	3.20	0.25	0.08	0.16	;c	0.00	y	1.00	1.00	1.00	0.17	1.00	0.17	0.16	0.99	0.16	1.00	1.00	1.00	0.22	1.00	0.22	0.05	0.60	0.03
Lippy C	1	6	riffle	5.25	3.45	0.25	0.03	0.00	lc	0.00	y	1.00	1.00	1.00	0.03	1.00	0.03	0.06	0.81	0.05	1.00	1.00	1.00	0.03	1.00	0.03	0.02	0.80	0.02
Lippy C	1	6	riffle	5.50	3.70	0.25	0.00	0.00	lg	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Lippy C	1	6	riffle	5.75	3.95	0.25	0.00	0.00	lg	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Lippy C	1	6	riffle	6.00	4.20	0.23	0.04	0.00	lg	0.00	y	1.00	1.00	1.00	0.03	1.00	0.03	0.08	0.81	0.06	1.00	1.00	1.00	0.03	1.00	0.03	0.02	0.80	0.02
Lippy C	1	6	riffle	6.20	4.40	0.10	0.00	0.00	b	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
						4.40				0.02																			
Lippy C	1	6	pool	1.50	0.00	0.13	0.00	0.00	bedrock	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Lippy C	1	6	pool	1.75	0.25	0.25	0.35	0.00	bedrock	0.00	y	0.95	1.00	0.95	0.93	1.00	0.93	0.70	0.81	0.57	0.95	1.00	0.95	1.00	1.00	1.00	1.00	0.80	0.80
Lippy C	1	6	pool	2.00	0.50	0.25	0.40	0.00	bedrock	0.00	y	0.66	1.00	0.66	1.00	1.00	1.00	0.80	0.81	0.65	0.66	1.00	0.66	1.00	1.00	1.00	1.00	0.80	0.80
Lippy C	1	6	pool	2.25	0.75	0.25	0.44	0.00	bedrock	0.00	y	0.50	1.00	0.50	1.00	1.00	1.00	0.88	0.81	0.71	0.50	1.00	0.50	1.00	1.00	1.00	1.00	0.80	0.80
Lippy C	1	6	pool	2.50	1.00	0.25	0.54	0.00	bedrock	0.00	y	0.29	1.00	0.29	1.00	1.00	1.00	1.00	0.81	0.81	0.29	1.00	0.29	1.00	1.00	1.00	1.00	0.80	0.80
Lippy C	1	6	pool	2.75	1.25	0.25	0.60	0.00	lc	0.00	y	0.21	1.00	0.21	1.00	1.00	1.00	1.00	0.81	0.81	0.21	1.00	0.21	1.00	1.00	1.00	1.00	0.80	0.80
Lippy C	1	6	pool	3.00	1.50	0.25	0.55	0.00	lc	0.00	y	0.29	1.00	0.29	1.00	1.00	1.00	1.00	0.81	0.81	0.29	1.00	0.29	1.00	1.00	1.00	1.00	0.80	0.80
Lippy C	1	6	pool	3.25	1.75	0.25	0.48	0.00	lc	0.00	y	0.40	1.00	0.40	1.00	1.00	1.00	0.96	0.81	0.78	0.40	1.00	0.40	1.00	1.00	1.00	1.00	0.80	0.80
Lippy C	1	6	pool	3.50	2.00	0.25	0.40	0.00	b	0.00	y	0.66	1.00	0.66	1.00	1.00	1.00	0.80	0.81	0.65	0.66	1.00	0.66	1.00	1.00	1.00	1.00	0.80	0.80
Lippy C	1	6	pool	3.75	2.25	0.25	0.35	0.00	b	0.00	y	0.95	1.00	0.95	0.93	1.00	0.93	0.70	0.81	0.57	0.95	1.00	0.95	1.00	1.00	1.00	1.00	0.80	0.80
Lippy C	1	6	pool	4.00	2.50	0.25	0.30	0.00	lg	0.00	y	0.98	1.00	0.98	0.93	1.00	0.93	0.60	0.81	0.49	0.98	1.00	0.98	1.00	1.00	1.00	0.87	0.80	0.70
Lippy C	1	6	pool	4.25	2.75	0.25	0.26	0.00	lc	0.00	y	0.98	1.00	0.98	0.88	1.00	0.88	0.52	0.81	0.42	0.98	1.00	0.98	1.00	1.00	1.00	0.77	0.80	0.62
Lippy C	1	6	pool	4.50	3.00	0.25	0.15	0.00		0.00	y	1.00	1.00	1.00	0.45	1.00	0.45	0.30	0.81	0.24	1.00	1.00	1.00	0.50	1.00	0.50	0.25	0.80	0.20
Lippy C	1	6	pool	4.75	3.25	0.20	0.08	0.00	lg	0.00	y	1.00	1.00	1.00	0.17	1.00	0.17	0.16	0.81	0.13	1.00	1.00	1.00	0.22	1.00	0.22	0.05	0.80	0.04
Lippy C	1	6	pool	4.90	3.40	0.08	0.00	0.00		0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
						3.40				0.00																			
U. Marble R	1		glide	8.00	0.00	0.25	0.00	0.00	lg	0.00	n	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
U. Marble R	1		glide	8.50	0.50	0.50	0.18	0.99	lg	0.09	n	1.00	0.00	0.00	0.66	0.00	0.00	0.36	0.02	0.01	1.00	0.00	0.00	0.95	0.00	0.00	0.42	0.00	0.00
U. Marble R	1		glide	9.00	1.00	0.50	0.20	0.96	lg	0.10	n	0.98	0.00	0.00	0.66	0.00	0.00	0.40	0.02	0.01	0.98	0.00	0.00	0.95	0.00	0.00	0.42	0.00	0.00
U. Marble R	1		glide	9.50	1.50	0.50	0.27	0.95	lg	0.13	n	0.98	0.00	0.00	0.93	0.00	0.00	0.54	0.02	0.01	0.98	0.00	0.00	1.00	0.00	0.00	0.77	0.00	0.00
U. Marble R	1		glide	10.00	2.00	0.50	0.27	0.98	lg	0.13	n	0.98	0.00	0.00	0.93	0.00	0.00	0.54	0.02	0.01	0.98	0.00	0.00	1.00	0.00	0.00	0.77	0.00	0.00
U. Marble R	1		glide	10.50	2.50	0.50	0.29	0.95	lg	0.14	n	0.98	0.00	0.00	0.93	0.00	0.00	0.58	0.02	0.01	0.98	0.00	0.00	1.00	0.00	0.00	0.87	0.00	0.00
U. Marble R	1		glide	11.00	3.00	0.50	0.28	1.05	lg	0.15	n	0.98	0.00	0.00	0.93	0.00	0.00	0.56	0.01	0.01	0.98	0.00	0.00	1.00	0.00	0.00	0.87	0.00	0.00
U. Marble R	1		glide	11.50	3.50	0.50	0.30	1.06	lg	0.16	n	0.98	0.00	0.00	0.93	0.00	0.00	0.60	0.01	0.01	0.98	0.00	0.00	1.00	0.00	0.00	0.87	0.00	0.00
U. Marble R	1		glide	12.00	4.00	0.50	0.28	1.11	lg	0.16	n	0.98	0.00	0.00	0.93	0.00	0.00	0.56	0.01	0.01	0.98	0.00	0.00	1.00	0.00	0.00	0.87	0.00	0.00
U. Marble R	1		glide	12.50	4.50	0.50	0.15	1.18	lg	0.09	n	1.00	0.00	0.00	0.45	0.00	0.00	0.30	0.01	0.00	1.00	0.00	0.00	0.50	0.00	0.00	0.25	0.00	0.00
U. Marble R	1		glide	13.00	5.00	0.25	0.10	0.90	lg	0.02	n	1.00	0.00	0.00	0.25	0.00	0.00	0.20	0.02	0.00	1.00	0.00	0.00	0.27	0.00	0.00	0.05	0.00	0.00
						5.00	0.00			1.16																			
Sorenson C	1	1	pool	0.40	0.00	0.30	0.00	0.00	f	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Sorenson C	1	1	pool	1.00	0.60	0.55	0.15	0.00	lg	0.00	y	1.00	1.00	1.00	0.45	1.00	0.45	0.30	0.81	0.24	1.00	1.00	1.00	0.50	1.00	0.50	0.25	0.80	0.20
Sorenson C	1	1	pool	1.50	1.10	0.50	0.23	0.00	lg	0.00	y	0.98	1.00	0.98	0.77	1.00	0.77	0.46	0.81	0.37	0.98	1.00	0.98	0.98	1.00	0.98	0.64	0.80	0.51
Sorenson C	1	1	pool	2.00	1.60	0.50	0.42	0.00	lg	0.00	y	0.50	1.00	0.50	1.00	1.00	1.00	0.84	0.81	0.68	0.50	1.00	0.50	1.00	1.00	1.00	1.00	0.80	0.80
Sorenson C	1	1	pool	2.50	2.10	0.50	0.67	0.05	sc	0.02	y	0.10	1.00	0.10	1.00	1.00	1.00	1.00	0.87	0.87	0.10	1.00	0.10	1.00	1.00	1.00	1.00	0.80	0.80
Sorenson C	1	1	pool	3.00	2.60	0.50	0.79	0.00	sc	0.00	y	0.04	1.00	0.04	1.00	1.00	1.00	1.00	0.81	0.81	0.04	1.00	0.04	1.00	1.00	1.00	1.00	0.80	0.80
Sorenson C	1	1	pool	3.50	3.10	0.50	0.82	0.03	sc	0.01	y	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.84	0.84	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.80	0.80
Sorenson C	1	1	pool	4.00	3.60	0.50	0.74	0.00	lg	0.00	y	0.06	1.00	0.06	1.00	1.00	1.00	1.00	0.81	0.81	0.06	1.00	0.06	1.00	1.00	1.00	1.00	0.80	0.80
Sorenson C	1	1	pool	4.50	4.10	0.50	0.59	0.00	lg	0.00	y	0.21	1.00	0.21	1.00	1.00	1.00	1.00	0.81	0.81	0.21	1.00	0.21	1.00	1.00	1.00	1.00	0.80	0.80
Sorenson C	1	1	pool	5.00	4.60	0.50	0.47	0.00	sg	0.00	y	0.40	1.00	0.40	1.00	1.00	1.00	0.94	0.81	0.76	0.40	1.00	0.40	1.00	1.00	1.00	1.00	0.80	0.80
Sorenson C	1	1	pool	5.50	5.10	0.50	0.33	0.00	lg	0.00	y	0.95	1.00	0.95	0.93	1.00	0.93	0.66	0.81	0.53	0.95	1.00	0.95	1.00	1.00	1.00	1.00	0.80	0.80
Sorenson C	1	1	pool	6.00	5.60	0.35	0.07	0.00	lg	0.00	y	1.00	1.00	1.00	0.17	1.00	0.17	0.14	0.81	0.11	1.00	1.00	1.00	0.22	1.00	0.22	0.05	0.80	0.04
Sorenson C	1	1	pool	6.20	5.80	0.10	0.00	0.00	lg	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
						5.80				0.03																			
Sorenson C	1	1	riffle	0.70	0.00	0.15	0.00	0.00	lg	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Sorenson C	1	1	riffle	1.00	0.30	0.28	0.10	0.02	lg	0.00	y	1.00	1.00	1.00	0.25	1.00	0.25	0.20	0.83	0.17	1.00	1.00	1.00	0.27	1.00	0.27	0.05	0.80	0.04
Sorenson C	1	1	riffle	1.25	0.55	0.25	0.12	0.15	lg	0.00	y	1.00	1.00	1.00	0.35	1.00	0.35	0.24	0.98	0.23	1.00	1.00	1.00	0.36	1.00	0.36	0.17	0.60	0.10
Sorenson C	1	1	riffle	1.50	0.80	0.25	0.12	0.60	lg	0.02	y	1.00	0.00	0.00	0.35	0.14	0.05	0.24	1.00	0.24	1.00	0.00	0.00	0.36	0.14	0.05	0.17	0.00	0.00
Sorenson C	1	1	riffle	1.75	1.05	0.25	0.08	0.79	lg	0.02	y	1.00	0.00	0.00	0.17	0.00	0.00	0.16	0.41	0.07	1.00	0.00	0.00	0.22	0.00	0.00	0.05	0.00	0.00
Sorenson C	1	1	riffle	2.00	1.30	0.25	0.08	0.93	lg	0.02	y	1.00	0.00	0.00	0.17	0.00	0.00	0.16	0.02	0.00	1.00	0.00	0.00	0.22	0.00	0.00	0.05	0.00	0.00
Sorenson C	1	1	riffle	2.25	1.55	0.25	0.05	0.68	lg	0.01	y	1.00	0.00	0.00	0.10	0.04	0.00	0.10	1.00	0.10	1.00	0.00	0.00	0.13	0.04	0.01	0.02	0.00	0.00
Sorenson C	1	1	riffle	2.50	1.80	0.25	0.00	0.00	lg	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Sorenson C	1	1	riffle	2.75	2.05	0.25	0.05	0.42	lg	0.01	y	1.00	0.04	0.04	0.10	0.70	0.07	0.10	1.00	0.10	1.00	0.04	0.04	0.13	0.70	0.09	0.02	0.00	0.00
Sorenson C	1	1	riffle	3.00	2.30	0.13	0.00	0.00	lg	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
						2.30				0.07																			
Sorenson C	1	1	glide	1.80	0.00	0.10	0.00	0.00	lg	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00

Appendix D. Marble River depth and velocity transect data and fish probability of use values, August-September, 1996.

System	Reach	Site	Habitat	Distance (m)	Transect (m)	Cell length (m)	Depth (m)	Velocity (m/sec)	substrate	Discharge (m^3/sec^{-1})	Pop. est y/n?	Rainbow trout fry			Rainbow trout parr			Rainbow trout adults			Cutthroat trout fry			Cutthroat trout parr			Coho fry		
												P(d)	P(v)	P(b)	P(d)	P(v)	P(b)	P(d)	P(v)	P(b)	P(d)	P(v)	P(b)	P(d)	P(v)	P(b)	P(d)	P(v)	P(b)
Sorenson C	1	1	glide	2.00	0.20	0.23	0.03	0.08	lg	0.00	y	1.00	1.00	1.00	0.03	1.00	0.03	0.06	0.90	0.05	1.00	1.00	1.00	0.03	1.00	0.03	0.02	1.00	0.02
Sorenson C	1	1	glide	2.25	0.45	0.25	0.11	0.11	lg	0.00	y	1.00	1.00	1.00	0.25	1.00	0.25	0.22	0.93	0.21	1.00	1.00	1.00	0.27	1.00	0.27	0.17	0.90	0.15
Sorenson C	1	1	glide	2.50	0.70	0.25	0.20	0.11	lg	0.01	y	0.98	1.00	0.98	0.66	1.00	0.66	0.40	0.93	0.37	0.98	1.00	0.98	0.95	1.00	0.95	0.42	0.90	0.38
Sorenson C	1	1	glide	2.75	0.95	0.25	0.23	0.16	lg	0.01	y	0.98	1.00	0.98	0.77	1.00	0.77	0.46	0.99	0.46	0.98	1.00	0.98	0.98	1.00	0.98	0.64	0.60	0.38
Sorenson C	1	1	glide	3.00	1.20	0.25	0.25	0.13	lg	0.01	y	0.98	1.00	0.98	0.88	1.00	0.88	0.50	0.96	0.48	0.98	1.00	0.98	1.00	1.00	1.00	0.64	0.80	0.51
Sorenson C	1	1	glide	3.25	1.45	0.25	0.24	0.13	lg	0.01	y	0.98	1.00	0.98	0.88	1.00	0.88	0.48	0.96	0.46	0.98	1.00	0.98	1.00	1.00	1.00	0.64	0.80	0.51
Sorenson C	1	1	glide	3.50	1.70	0.25	0.23	0.14	lg	0.01	y	0.98	1.00	0.98	0.77	1.00	0.77	0.46	0.97	0.44	0.98	1.00	0.98	0.98	1.00	0.98	0.64	0.70	0.45
Sorenson C	1	1	glide	3.75	1.95	0.25	0.19	0.15	lg	0.01	y	0.98	1.00	0.98	0.66	1.00	0.66	0.38	0.98	0.37	0.98	1.00	0.98	0.95	1.00	0.95	0.42	0.60	0.25
Sorenson C	1	1	glide	4.00	2.20	0.25	0.11	0.15	lg	0.00	y	1.00	1.00	1.00	0.25	1.00	0.25	0.22	0.98	0.22	1.00	1.00	1.00	0.27	1.00	0.27	0.17	0.60	0.10
Sorenson C	1	1	glide	4.25	2.45	0.25	0.10	0.12	lg	0.00	y	1.00	1.00	1.00	0.25	1.00	0.25	0.20	0.94	0.19	1.00	1.00	1.00	0.27	1.00	0.27	0.05	0.90	0.05
Sorenson C	1	1	glide	4.50	2.70	0.25	0.05	0.05	lg	0.00	y	1.00	1.00	1.00	0.10	1.00	0.10	0.10	0.87	0.09	1.00	1.00	1.00	0.13	1.00	0.13	0.02	0.80	0.02
Sorenson C	1	1	glide	4.75	2.95	0.13	0.00	0.00	lg	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
						2.95				0.06																			
Link R	1	5	riffle	1.60	0.00	0.20	0.00	0.00	b	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Link R	1	5	riffle	2.00	0.40	0.70	0.07	0.00	c	0.00	y	1.00	1.00	1.00	0.17	1.00	0.17	0.14	0.81	0.11	1.00	1.00	1.00	0.22	1.00	0.22	0.05	0.80	0.04
Link R	1	5	riffle	3.00	1.40	1.00	0.09	0.18	c	0.02	y	1.00	1.00	1.00	0.25	1.00	0.25	0.18	1.00	0.18	1.00	1.00	1.00	0.27	1.00	0.27	0.05	0.40	0.02
Link R	1	5	riffle	4.00	2.40	1.00	0.00	0.00	b	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Link R	1	5	riffle	5.00	3.40	1.00	0.12	0.32	b	0.04	y	1.00	0.25	0.25	0.35	0.98	0.34	0.24	1.00	0.24	1.00	0.25	0.25	0.36	0.98	0.35	0.17	0.06	0.01
Link R	1	5	riffle	6.00	4.40	1.00	0.00	0.00	lc	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Link R	1	5	riffle	7.00	5.40	1.00	0.14	0.08	lc	0.01	y	1.00	1.00	1.00	0.45	1.00	0.45	0.28	0.90	0.25	1.00	1.00	1.00	0.50	1.00	0.50	0.25	1.00	0.25
Link R	1	5	riffle	8.00	6.40	1.00	0.12	0.24	b	0.03	y	1.00	0.90	0.90	0.35	1.00	0.35	0.24	1.00	0.24	1.00	0.90	0.90	0.36	1.00	0.36	0.17	0.20	0.03
Link R	1	5	riffle	9.00	7.40	1.00	0.04	0.30	b	0.01	y	1.00	0.35	0.35	0.03	0.99	0.03	0.08	1.00	0.08	1.00	0.35	0.35	0.03	0.99	0.03	0.02	0.06	0.00
Link R	1	5	riffle	10.00	8.40	1.00	0.12	0.11	b	0.01	y	1.00	1.00	1.00	0.35	1.00	0.35	0.24	0.93	0.22	1.00	1.00	1.00	0.36	1.00	0.36	0.17	0.90	0.15
Link R	1	5	riffle	11.00	9.40	1.00	0.15	0.27	lc	0.04	y	1.00	0.55	0.55	0.45	1.00	0.45	0.30	1.00	0.30	1.00	0.55	0.55	0.50	1.00	0.50	0.25	0.10	0.03
Link R	1	5	riffle	12.00	10.40	1.00	0.24	0.31	lc	0.07	y	0.98	0.25	0.25	0.88	0.98	0.86	0.48	1.00	0.48	0.98	0.25	0.25	1.00	0.98	0.98	0.64	0.06	0.04
Link R	1	5	riffle	13.00	11.40	1.00	0.23	0.37	lc	0.09	y	0.98	0.08	0.08	0.77	0.87	0.67	0.46	1.00	0.46	0.98	0.08	0.08	0.98	0.87	0.85	0.64	0.00	0.00
Link R	1	5	riffle	14.00	12.40	1.00	0.34	0.45	lc	0.15	y	0.95	0.01	0.01	0.93	0.50	0.47	0.68	1.00	0.68	0.95	0.01	0.01	1.00	0.50	0.50	1.00	0.00	0.00
Link R	1	5	riffle	15.00	13.40	1.00	0.34	0.96	b	0.33	y	0.95	0.00	0.00	0.93	0.00	0.00	0.68	0.02	0.01	0.95	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Link R	1	5	riffle	16.00	14.40	1.00	0.22	0.19	b	0.04	y	0.98	1.00	0.98	0.77	1.00	0.77	0.44	1.00	0.44	0.98	1.00	0.98	0.98	1.00	0.98	0.54	0.40	0.22
Link R	1	5	riffle	17.00	15.40	1.00	0.31	0.66	lc	0.20	y	0.95	0.00	0.00	0.93	0.04	0.04	0.62	1.00	0.62	0.95	0.00	0.00	1.00	0.04	0.04	0.94	0.00	0.00
Link R	1	5	riffle	18.00	16.40	1.00	0.27	0.63	lc	0.17	y	0.98	0.00	0.00	0.93	0.04	0.04	0.54	1.00	0.54	0.98	0.00	0.00	1.00	0.04	0.04	0.77	0.00	0.00
Link R	1	5	riffle	19.00	17.40	1.00	0.30	0.59	sc	0.18	y	0.98	0.00	0.00	0.93	0.14	0.13	0.60	1.00	0.60	0.98	0.00	0.00	1.00	0.14	0.14	0.87	0.00	0.00
Link R	1	5	riffle	20.00	18.40	1.00	0.23	1.10	sc	0.25	y	0.98	0.00	0.00	0.77	0.00	0.00	0.46	0.01	0.00	0.98	0.00	0.00	0.98	0.00	0.00	0.64	0.00	0.00
Link R	1	5	riffle	21.00	19.40	0.75	0.14	0.30	sc	0.03	y	1.00	0.35	0.35	0.45	0.99	0.45	0.28	1.00	0.28	1.00	0.35	0.35	0.50	0.99	0.50	0.25	0.06	0.02
Link R	1	5	riffle	21.50	19.90	0.25	0.00	0.00	lg	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
						19.90				1.68																			
Link R	1	5	pool	2.50	0.00	0.25	0.00	0.00	lg	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Link R	1	5	pool	3.00	0.50	0.75	0.79	0.17		0.10	y	0.04	1.00	0.04	1.00	1.00	1.00	1.00	1.00	1.00	0.04	1.00	0.04	1.00	1.00	1.00	1.00	0.60	0.60
Link R	1	5	pool	4.00	1.50	1.00	1.50	0.29		0.44	y	0.02	0.35	0.01	1.00	0.99	0.99	1.00	1.00	1.00	0.02	0.35	0.01	1.00	0.99	0.99	1.00	0.06	0.06
Link R	1	5	pool	5.00	2.50	1.00	1.50	0.25	b	0.38	y	0.02	0.75	0.02	1.00	1.00	1.00	1.00	1.00	1.00	0.02	0.75	0.02	1.00	1.00	1.00	1.00	0.10	0.10
Link R	1	5	pool	6.00	3.50	1.00	1.50	0.16	b	0.24	y	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.99	0.99	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.60	0.60
Link R	1	5	pool	7.00	4.50	1.00	1.34	0.30	b	0.40	y	0.02	0.35	0.01	1.00	0.99	0.99	1.00	1.00	1.00	0.02	0.35	0.01	1.00	0.99	0.99	1.00	0.06	0.06
Link R	1	5	pool	8.00	5.50	1.00	1.33	0.23	lc	0.31	y	0.02	0.90	0.02	1.00	1.00	1.00	1.00	1.00	1.00	0.02	0.90	0.02	1.00	1.00	1.00	1.00	0.20	0.20
Link R	1	5	pool	9.00	6.50	1.00	1.21	0.07	lc	0.08	y	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.89	0.89	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.80	0.80
Link R	1	5	pool	10.00	7.50	1.00	1.00	0.01	b	0.01	y	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.82	0.82	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.80	0.80
Link R	1	5	pool	11.00	8.50	1.00	0.74	0.03	b	0.02	y	0.06	1.00	0.06	1.00	1.00	1.00	1.00	0.84	0.84	0.06	1.00	0.06	1.00	1.00	1.00	1.00	0.80	0.80
Link R	1	5	pool	12.00	9.50	1.00	0.49	0.00	lc	0.00	y	0.40	1.00	0.40	1.00	1.00	1.00	0.98	0.81	0.79	0.40	1.00	0.40	1.00	1.00	1.00	1.00	0.80	0.80
Link R	1	5	pool	13.00	10.50	1.00	0.36	0.00	lg	0.00	y	0.95	1.00	0.95	0.93	1.00	0.93	0.72	0.81	0.58	0.95	1.00	0.95	1.00	1.00	1.00	1.00	0.80	0.80
Link R	1	5	pool	14.00	11.50	1.00	0.21	0.00	lg	0.00	y	0.98	1.00	0.98	0.77	1.00	0.77	0.42	0.81	0.34	0.98	1.00	0.98	0.98	1.00	0.98	0.54	0.80	0.43
Link R	1	5	pool	15.00	12.50	0.65	0.05	0.00	lg	0.00	y	1.00	1.00	1.00	0.10	1.00	0.10	0.10	0.81	0.08	1.00	1.00	1.00	0.13	1.00	0.13	0.02	0.80	0.02
Link R	1	5	pool	15.30	12.80	0.15	0.00	0.00	lg	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
						12.80				1.98																			
Link R	1	5	glide	2.70	0.00	0.15	0.00	0.00	lg	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Link R	1	5	glide	3.00	0.30	0.65	0.10	0.00	lg	0.00	y	1.00	1.00	1.00	0.25	1.00	0.25	0.20	0.81	0.16	1.00	1.00	1.00	0.27	1.00	0.27	0.05	0.80	0.04
Link R	1	5	glide	4.00	1.30	1.00	0.15	0.03	lg	0.00	y	1.00	1.00	1.00	0.45	1.00	0.45	0.30	0.84	0.25	1.00	1.00	1.00	0.50	1.00	0.50	0.25	0.80	0.20
Link R	1	5	glide	5.00	2.30	1.00	0.25	0.05	sc	0.01	y	0.98	1.00	0.98	0.88	1.00	0.88	0.50	0.87	0.43	0.98	1.00	0.98	1.00	1.00	1.00	0.64	0.80	0.51
Link R	1	5	glide	6.00	3.30	1.00	0.44	0.06	sc	0.03	y	0.50	1.00	0.50	1.00	1.00	1.00	0.88	0.88	0.77	0.50	1.00	0.50	1.00	1.00	1.00	1.00	0.80	0.80
Link R	1	5	glide	7.00	4.30	1.00	0.50	0.05	sc	0.03	y	0.40	1.00	0.40	1.00	1.00	1.00	1.00	0.87	0.87	0.40	1.00	0.40	1.00	1.00	1.00	1.00	0.80	0.80
Link R	1	5	glide	8.00	5.30	1.00	0.44	0.06	lg	0.03	y	0.50	1.00	0.50	1.00	1.00	1.00	0.88	0.88	0.77	0.50	1.00	0.50	1.00	1.00	1.00	1.00	0.80	0.80
Link R	1	5	glide	9.00	6.30	1.00	0.50	0.06	sc	0.03	y	0.40	1.00	0.40	1.00	1.00	1.00	1.00	0.88	0.88	0.40	1.00	0.40	1.00	1.00	1.00	1.00	0.80	0.80
Link R	1	5	glide	10.00	7.30	1.00	0.45	0.11	sc	0.05	y	0.50	1.00	0.50	1.00	1.00	1.00	0.90	0.93	0.84	0.50	1.00	0.50	1.00	1.00	1.00	1.00	0.90	0.90
Link R	1	5	glide	11.00	8.30	1.00	0.55	0.12	sc	0.07	y	0.29	1.00	0.29	1.00	1.00	1.00	1.00	0.94	0.94	0.29	1.00	0.29	1.00	1.00	1.00	1.00	0.90	0.90
Link R	1	5	glide	12.00	9.30	1.00	0.60	0.12	sc	0.07	y	0.21	1.00	0.21	1.00	1.00	1.00	1.00	0.94	0.94	0.21	1.00	0.21	1.00	1.00	1.00	1.00	0.90	0.90
Link R	1	5	glide	13.00	10.30	1.00	0.46	0.18	b	0.08	y	0.40	1.00	0.40	1.00	1.00	1.00	0.92	1.00	0.92	0.40	1.00	0.40	1.00	1.00	1.00	1.00	0.40	0.40
Link R	1	5	glide	14.00	11.30	1.00	0.80	0.15	lc	0.12	y	0.04	1.00	0.04	1.00	1.00	1.00	1.00	0.98	0.98	0.04	1.00	0.04	1.00	1.00	1.00	1.00	0.60	0.60
Link R	1	5	glide	15.00	12.30	1.00	0.80	0.17	b	0.14	y	0.04	1.00	0.04	1.00	1.00	1.00	1.00	1.00	1.00	0.04	1.00	0.04	1.00	1.00	1.00	1.00	0.60	0.60
Link R	1	5	glide	16.00	13.30	1.00	0.90	0.16	b	0.14	y	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.99	0.99	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.60	0.60
Link R	1	5	glide	17.00	14.30	1.00	0.95	0.20	lc	0.19	y	0.02	1.00	0.02	1.00	1.00	1.00	1.00	1.00	1.00	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.30	0.30
Link R	1	5	glide	18.00	15.30	1.00	0.93	0.23	b	0.21	y	0.02	0.90	0.02	1.00	1.00	1.00	1.00	1.00	1.00	0.02	0.90	0.02	1.00	1.00	1.00	1.00	0.20	0.20
Link R	1	5	glide	19.00	16.30	1.00	0.90	0.12	lc	0.11	y	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.94	0.94	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.90	0.90
Link R	1	5	glide	20.00	17.30	1.00	0.79	0.17	lc	0.13	y	0.04	1.00	0.04	1.00	1.00	1.00	1.00	1.00	1.00	0.04	1.00	0.04	1.00	1.00	1.00	1.00	0.60	0.60
Link R	1	5	glide	21.00	18.30	1.00	0.77	0.11	lc	0.08	y	0.04	1.00	0.04	1.00	1.00	1.00	1.00	0.93	0.93	0.04	1.00	0.04	1.00	1.00	1.00	1.00	0.90	0.90
Link R	1	5	glide	22.00	19.30	1.00	0.55	0.10	b	0.06	y	0.29	1.00	0.29	1.00	1.00	1.00	1.00	0.92	0.92	0.29	1.00	0.29	1.00	1.00	1.00	1.00	1.00	1.00
Link R	1	5	glide	23.00	20.30	0.80	0.17	0.00	lc	0.00	y	1.00	1.00	1.00	0.55	1.00	0.55	0.34	0.81	0.28	1.00	1.00	1.00	0.71	1.00	0.71	0.33	0.80	0.26

Appendix D. Marble River depth and velocity transect data and fish probability of use values, August-September, 1996.

System	Reach	Site	Habitat	Distance (m)	Transect (m)	Cell length (m)	Depth (m)	Velocity (m/sec)	substrate	Discharge (m^3/sec^{-1})	Pop. est y/n?	Rainbow trout fry			Rainbow trout parr			Rainbow trout adults			Cutthroat trout fry			Cutthroat trout parr			Coho fry		
												P(d)	P(v)	P(b)	P(d)	P(v)	P(b)	P(d)	P(v)	P(b)	P(d)	P(v)	P(b)	P(d)	P(v)	P(b)	P(d)	P(v)	P(b)
Link R	1	5	glide	23.60	20.90	0.30	0.00	0.00	lc	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
						20.90				1.58																			
Benson R	1	1	riffle	0.00	0.00	0.25	0.16	0.09	lg	0.00	y	1.00	1.00	1.00	0.55	1.00	0.55	0.32	0.91	0.29	1.00	1.00	1.00	0.71	1.00	0.71	0.33	1.00	0.33
Benson R	1	1	riffle	0.50	0.50	0.50	0.15	0.44	lc	0.03	y	1.00	0.01	0.01	0.45	0.60	0.27	0.30	1.00	0.30	1.00	0.01	0.01	0.50	0.60	0.30	0.25	0.00	0.00
Benson R	1	1	riffle	1.00	1.00	0.50	0.13	0.24	lg	0.02	y	1.00	0.90	0.90	0.35	1.00	0.35	0.26	1.00	0.26	1.00	0.90	0.90	0.36	1.00	0.36	0.25	0.20	0.05
Benson R	1	1	riffle	1.50	1.50	0.50	0.15	0.33	b	0.02	y	1.00	0.18	0.18	0.45	0.95	0.43	0.30	1.00	0.30	1.00	0.18	0.18	0.50	0.95	0.48	0.25	0.06	0.02
Benson R	1	1	riffle	2.00	2.00	0.50	0.17	0.20	lg	0.02	y	1.00	1.00	1.00	0.55	1.00	0.55	0.34	1.00	0.34	1.00	1.00	1.00	0.71	1.00	0.71	0.33	0.30	0.10
Benson R	1	1	riffle	2.50	2.50	0.50	0.17	0.29	lc	0.02	y	1.00	0.35	0.35	0.55	0.99	0.54	0.34	1.00	0.34	1.00	0.35	0.35	0.71	0.99	0.70	0.33	0.06	0.02
Benson R	1	1	riffle	3.00	3.00	0.50	0.22	0.06	sc	0.01	y	0.98	1.00	0.98	0.77	1.00	0.77	0.44	0.88	0.39	0.98	1.00	0.98	0.98	1.00	0.98	0.54	0.80	0.43
Benson R	1	1	riffle	3.50	3.50	0.50	0.16	0.04	sc	0.00	y	1.00	1.00	1.00	0.55	1.00	0.55	0.32	0.85	0.27	1.00	1.00	1.00	0.71	1.00	0.71	0.33	0.80	0.26
Benson R	1	1	riffle	4.00	4.00	0.50	0.12	0.64	sc	0.04	y	1.00	0.00	0.00	0.35	0.04	0.01	0.24	1.00	0.24	1.00	0.00	0.00	0.36	0.04	0.01	0.17	0.00	0.00
Benson R	1	1	riffle	4.50	4.50	0.50	0.18	0.22	b	0.02	y	1.00	0.90	0.90	0.66	1.00	0.66	0.36	1.00	0.36	1.00	0.90	0.90	0.95	1.00	0.95	0.42	0.30	0.13
Benson R	1	1	riffle	5.00	5.00	0.40	0.25	0.39	sc	0.04	y	0.98	0.05	0.05	0.88	0.80	0.70	0.50	1.00	0.50	0.98	0.05	0.05	1.00	0.80	0.80	0.64	0.00	0.00
Benson R	1	1	riffle	5.30	5.30	0.15	0.28	0.21	sc	0.01	y	0.98	0.90	0.88	0.93	1.00	0.93	0.56	1.00	0.56	0.98	0.90	0.88	1.00	1.00	1.00	0.87	0.30	0.26
						5.30				0.23																			
Benson R	1	1	pool	9.00	0.00	0.25	0.68	0.23	lc	0.04	y	0.10	0.90	0.09	1.00	1.00	1.00	1.00	1.00	1.00	0.10	0.90	0.09	1.00	1.00	1.00	1.00	0.20	0.20
Benson R	1	1	pool	8.50	0.50	0.50	0.81	0.46	lc	0.19	y	0.02	0.01	0.00	1.00	0.50	0.50	1.00	1.00	1.00	0.02	0.01	0.00	1.00	0.50	0.50	1.00	0.00	0.00
Benson R	1	1	pool	8.00	1.00	0.50	0.87	0.50	lc	0.22	y	0.02	0.01	0.00	1.00	0.33	0.33	1.00	1.00	1.00	0.02	0.01	0.00	1.00	0.33	0.33	1.00	0.00	0.00
Benson R	1	1	pool	7.50	1.50	0.50	0.97	0.61	lc	0.30	y	0.02	0.00	0.00	1.00	0.04	0.04	1.00	1.00	1.00	0.02	0.00	0.00	1.00	0.04	0.04	1.00	0.00	0.00
Benson R	1	1	pool	7.00	2.00	0.50	1.01	0.51	lc	0.26	y	0.02	0.00	0.00	1.00	0.23	0.23	1.00	1.00	1.00	0.02	0.00	0.00	1.00	0.23	0.23	1.00	0.00	0.00
Benson R	1	1	pool	6.50	2.50	0.50	1.16	0.68	lc	0.39	y	0.02	0.00	0.00	1.00	0.04	0.04	1.00	1.00	1.00	0.02	0.00	0.00	1.00	0.04	0.04	1.00	0.00	0.00
Benson R	1	1	pool	6.00	3.00	0.50	1.20	0.49	lc	0.29	y	0.02	0.01	0.00	1.00	0.40	0.40	1.00	1.00	1.00	0.02	0.01	0.00	1.00	0.40	0.40	1.00	0.00	0.00
Benson R	1	1	pool	5.50	3.50	0.50	1.31	0.42	lc	0.28	y	0.02	0.04	0.00	1.00	0.70	0.70	1.00	1.00	1.00	0.02	0.04	0.00	1.00	0.70	0.70	1.00	0.00	0.00
Benson R	1	1	pool	5.00	4.00	0.50	1.26	0.47	lc	0.30	y	0.02	0.01	0.00	1.00	0.50	0.50	1.00	1.00	1.00	0.02	0.01	0.00	1.00	0.50	0.50	1.00	0.00	0.00
Benson R	1	1	pool	4.50	4.50	0.50	1.50	0.24	lc	0.18	y	0.02	0.90	0.02	1.00	1.00	1.00	1.00	1.00	1.00	0.02	0.90	0.02	1.00	1.00	1.00	1.00	0.20	0.20
Benson R	1	1	pool	4.00	5.00	0.50	1.50	0.11	lc	0.08	y	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.93	0.93	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.90	0.90
Benson R	1	1	pool	3.50	5.50	0.50	1.50	0.12	lc	0.09	y	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.94	0.94	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.90	0.90
Benson R	1	1	pool	3.00	6.00	0.50	1.50	0.05	lc	0.04	y	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.87	0.87	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.80	0.80
Benson R	1	1	pool	2.50	6.50	0.50	1.43	0.12	lc	0.09	y	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.94	0.94	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.90	0.90
Benson R	1	1	pool	2.00	7.00	0.50	1.38	0.07	lc	0.05	y	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.89	0.89	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.80	0.80
Benson R	1	1	pool	1.50	7.50	0.50	1.25	0.16	lc	0.10	y	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.99	0.99	0.02	1.00	0.02	1.00	1.00	1.00	1.00	0.60	0.60
Benson R	1	1	pool	1.00	8.00	0.50	0.30	0.18	lc	0.03	y	0.98	1.00	0.98	0.93	1.00	0.93	0.60	1.00	0.60	0.98	1.00	0.98	1.00	1.00	1.00	0.87	0.40	0.35
Benson R	1	1	pool	0.50	8.50	0.25	0.00	0.00	lc	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
						8.50				2.91																			
Benson R	1	1	glide	2.00	0.00	0.50	0.00	0.00	lg	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00
Benson R	1	1	glide	3.00	1.00	2.00	0.40	0.20	lg	0.16	y	0.66	1.00	0.66	1.00	1.00	1.00	0.80	1.00	0.80	0.66	1.00	0.66	1.00	1.00	1.00	1.00	0.30	0.30
Benson R	1	1	glide	6.00	4.00	3.00	0.11	0.16	b	0.05	y	1.00	1.00	1.00	0.25	1.00	0.25	0.22	0.99	0.22	1.00	1.00	1.00	0.27	1.00	0.27	0.17	0.60	0.10
Benson R	1	1	glide	9.00	7.00	3.00	0.27	0.40	lc	0.32	y	0.98	0.05	0.05	0.93	0.80	0.74	0.54	1.00	0.54	0.98	0.05	0.05	1.00	0.80	0.80	0.77	0.00	0.00
Benson R	1	1	glide	12.00	10.00	3.00	0.17	0.15	lc	0.08	y	1.00	1.00	1.00	0.55	1.00	0.55	0.34	0.98	0.33	1.00	1.00	1.00	0.71	1.00	0.71	0.33	0.60	0.20
Benson R	1	1	glide	15.00	13.00	3.00	0.27	0.41	lc	0.33	y	0.98	0.04	0.04	0.93	0.70	0.65	0.54	1.00	0.54	0.98	0.04	0.04	1.00	0.70	0.70	0.77	0.00	0.00
Benson R	1	1	glide	18.00	16.00	3.00	0.18	0.43	b	0.23	y	1.00	0.01	0.01	0.66	0.60	0.40	0.36	1.00	0.36	1.00	0.01	0.01	0.95	0.60	0.57	0.42	0.00	0.00
Benson R	1	1	glide	21.00	19.00	3.00	0.31	0.47	b	0.44	y	0.95	0.01	0.01	0.93	0.50	0.47	0.62	1.00	0.62	0.95	0.01	0.01	1.00	0.50	0.50	0.94	0.00	0.00
Benson R	1	1	glide	24.00	22.00	3.00	0.20	0.43	lc	0.26	y	0.98	0.01	0.01	0.66	0.60	0.40	0.40	1.00	0.40	0.98	0.01	0.01	0.95	0.60	0.57	0.42	0.00	0.00
Benson R	1	1	glide	27.00	25.00	3.00	0.10	0.46	lc	0.14	y	1.00	0.01	0.01	0.25	0.50	0.13	0.20	1.00	0.20	1.00	0.01	0.01	0.27	0.50	0.14	0.05	0.00	0.00
Benson R	1	1	glide	30.00	28.00	3.00	0.26	0.09	lc	0.07	y	0.98	1.00	0.98	0.88	1.00	0.88	0.52	0.91	0.47	0.98	1.00	0.98	1.00	1.00	1.00	0.77	1.00	0.77
Benson R	1	1	glide	33.00	31.00	3.00	0.09	0.42	lc	0.11	y	1.00	0.04	0.04	0.25	0.70	0.18	0.18	1.00	0.18	1.00	0.04	0.04	0.27	0.70	0.19	0.05	0.00	0.00
Benson R	1	1	glide	36.00	34.00	3.00	0.21	0.28	lc	0.18	y	0.98	0.55	0.54	0.77	1.00	0.77	0.42	1.00	0.42	0.98	0.55	0.54	0.98	1.00	0.98	0.54	0.10	0.05
Benson R	1	1	glide	39.00	37.00	3.00	0.36	0.39	b	0.42	y	0.95	0.05	0.05	0.93	0.80	0.74	0.72	1.00	0.72	0.95	0.05	0.05	1.00	0.80	0.80	1.00	0.00	0.00
Benson R	1	1	glide	42.00	40.00	3.00	0.45	0.47	b	0.63	y	0.50	0.01	0.01	1.00	0.50	0.50	0.90	1.00	0.90	0.50	0.01	0.01	1.00	0.50	0.50	1.00	0.00	0.00
Benson R	1	1	glide	45.00	43.00	2.75	0.60	0.46	lc	0.76	y	0.21	0.01	0.00	1.00	0.50	0.50	1.00	1.00	1.00	0.21	0.01	0.00	1.00	0.50	0.50	1.00	0.00	0.00
Benson R	1	1	glide	47.50	45.50	1.50	0.50	0.00	lc	0.00	y	0.40	1.00	0.40	1.00	1.00	1.00	1.00	0.81	0.81	0.40	1.00	0.40	1.00	1.00	1.00	1.00	0.80	0.80
Benson R	1	1	glide	48.00	46.00	0.25	0.00	0.00	lc	0.00	y	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.81	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.80	0.00

Substrate codes: f - fines; sg - small gravel; lg - large gravel; sc - small cobble; lc - large cobble; b - boulder

Appendix E. Marble River site and catch data.

System: **Pinch Creek** Site: 1 Reach 1
Habitat: Riffle Date: September 1, 1996 Time: 09:51

Location: Just above Alice Main approximately 300 m upstream from mouth.

Population assessment method: Removal-depletion by electroshocker using Zippin method of catch analysis.

Population estimate:

Species	Pass 1	Pass 2	Pass 3	Float 1	Float 2	Population estimate	Confidence limit	Capture probability
Coho fry	3	2				6.0	6.2	0.6
Cutthroat fry	0	0				0.0	0.0	0.0
Cutthroat parr	0	0				0.0	0.0	0.0
Dolly Varden 0+	7	1				9.0	2.9	0.7
Dolly Varden parr	0	0				0.0	0.0	0.0
Prickly sculpin	0	0				0.0	0.0	0.0
Rainbow fry	1	0				1.0	0.0	1.0
Rainbow parr	0	0				0.0	0.0	0.0

Area: 26.8 m^2

Total cover (percent of habitat area) and cover components (percent of total cover; sum = 100%).

Total cover %	% Deep pool	% LOD	% Boulder	% Instream veg	% Overstream veg.	% Cutbank
20	0	10	90	0	0	0

Maximum depth (cm): 30 Average depth (cm): 16 Maximum velocity ($m \cdot sec^{-1}$): 0.9 Average velocity ($m \cdot sec^{-1}$): 0.24
Temperature (°C): 11 Discharge: 0.3 $m^3 \cdot sec^{-1}$

Bed material

% Fines	% Small gravel	% Large gravel	% Small cobble	% Large cobble	% Boulder	% Bedrock
5	5	10	20	40	20	0

Comments: Area contained small rootwad.

Appendix E. Marble River site and catch data.

System: **Pinch Creek** Site: 1 Reach 1
Habitat: Pool Date: September 1, 1996 Time: 11:45

Location: Just above Alice Main approximately 300 m upstream from mouth.

Population assessment method: Removal-depletion by electroshocker using Zippin method of catch analysis.

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Population estimate:

Species	Pass 1	Pass 2	Pass 3	Float 1	Float 2	Population estimate	Confidence limit	Capture probability
Coho fry	8	8	3			23.0	10.9	0.4
Cutthroat fry	0	0	0			0.0	0.0	0.0
Cutthroat parr	0	0	0			0.0	0.0	0.0
Dolly Varden 0+	0	0	0			0.0	0.0	0.0
Dolly Varden parr	1	0	0			1.0	0.0	1.0
Prickly sculpin	0	0	0			0.0	0.0	0.0
Rainbow fry	0	0	0			0.0	0.0	0.0
Rainbow parr	0	0	0			0.0	0.0	0.0

Area: 24.9 m^2

Total cover (percent of habitat area) and cover components (percent of total cover; sum = 100%).

Total cover %	% Deep pool	% LOD	% Boulder	% Instream. veg	% Overstream veg.	% Cutbank
10	0	20	60	0	0	20

Maximum depth (cm): 54 Average depth (cm): 37 Maximum velocity ($m \cdot sec^{-1}$): 1.35 Average velocity ($m \cdot sec^{-1}$): 0.18
Temperature (°C): 11 Discharge: 0.3 $m^3 \cdot sec^{-1}$

Bed material

% Fines	% Small gravel	% Large gravel	% Small cobble	% Large cobble	% Boulder	% Bedrock
15	20	10	15	20	20	0

Comments: Pool is a back water pool associated with a large boulder.

Appendix E. Marble River site and catch data.

System: **Pinch Creek** Site: 1 Reach 1
Habitat: Glide Date: September 1, 1996 Time: 14:00

Location: Just above Alice Main approximately 300 m upstream from mouth.

Population assessment method: Removal-depletion by electroshocker using Zippin method of catch analysis.

Population estimate:

Species	Pass 1	Pass 2	Pass 3	Float 1	Float 2	Population estimate	Confidence limit	Capture probability
Coho fry	1	1				3.0	10.2	0.4
Cutthroat fry	0	0				0.0	0.0	0.0
Cutthroat parr	0	0				0.0	0.0	0.0
Dolly Varden 0+	1	0				1.0	0.0	1.0
Dolly Varden parr	0	0				0.0	0.0	0.0
Prickly sculpin	0	0				0.0	0.0	0.0
Rainbow fry	0	0				0.0	0.0	0.0
Rainbow parr	0	0				0.0	0.0	0.0

Area: 16.6 m^2

Total cover (percent of habitat area) and cover components (percent of total cover; sum = 100%).

Total cover %	% Deep pool	% LOD	% Boulder	% Instream. veg	% Overstream veg.	% Cutbank
2	0	100	0	0	0	0

Maximum depth (cm): 25 Average depth (cm): 12 Maximum velocity ($m \cdot sec^{-1}$): 0.43 Average velocity ($m \cdot sec^{-1}$): 0.21
Temperature (°C): 11 Discharge: 0.3 $m^3 \cdot sec^{-1}$

Bed material

% Fines	% Small gravel	% Large gravel	% Small cobble	% Large cobble	% Bboulder	% Bedrock
15	20	50	10	15	0	0

Comments: Glide was located under the Alice Main bridge.

Appendix E. Marble River site and catch data.

System: **Yootook Creek** Site: 1 Reach 1
Habitat: Riffle Date: September 1, 1996 Time: 15:40

Location: Just above Southeast Main bridge approximately 200 m upstream from mouth.

Population assessment method: Removal-depletion by electroshocker using Zippin method of catch analysis.

Population estimate:

Species	Pass 1	Pass 2	Pass 3	Float 1	Float 2	Population estimate	Confidence limit	Capture probability
Coho fry	0	0				0.0	0.0	0.0
Cutthroat fry	0	0				0.0	0.0	0.0
Cutthroat parr	0	0				0.0	0.0	0.0
Dolly Varden 0+	5	1				7.0	3.7	0.7
Dolly Varden parr	0	0				0.0	0.0	0.0
Prickly sculpin	0	0				0.0	0.0	0.0
Rainbow fry	0	0				0.0	0.0	0.0
Rainbow parr	0	0				0.0	0.0	0.0

Area: 36.0 m^2

Total cover (percent of habitat area) and cover components (percent of total cover; sum = 100%).

Total cover %	% Deep pool	% LOD	% Boulder	% Instream. veg	% Overstream veg.	% Cutbank
30	0	0	100	0	0	0

Maximum depth (cm): 17 Average depth (cm): 9 Maximum velocity ($m \cdot sec^{-1}$): 0.85 Average velocity ($m \cdot sec^{-1}$): 0.32
Temperature (°C): 11 Discharge: 0.3 $m^3 \cdot sec^{-1}$

Bed material

% Fines	% Small gravel	% Large gravel	% Small cobble	% Large cobble	% Boulder	% Bedrock
0	5	10	15	30	40	0

Comments: none

Appendix E. Marble River site and catch data.

System: **Yootook Creek** Site: 1 Reach 1
Habitat: Pool Date: September 1, 1996 Time: 16:45

Location: Just above Southeast Main bridge approximately 200 m upstream from mouth.

Population assessment method: Removal-depletion by electroshocker using Zippin method of catch analysis.

Population estimate:

Species	Pass 1	Pass 2	Pass 3	Float 1	Float 2	Population estimate	Confidence limit	Capture probability
Coho fry	0	0				0.0	0.0	0.0
Cutthroat fry	0	0				0.0	0.0	0.0
Cutthroat parr	0	0				0.0	0.0	0.0
Dolly Varden 0+	0	0				0.0	0.0	0.0
Dolly Varden parr	0	0				0.0	0.0	0.0
Prickly sculpin	0	0				0.0	0.0	0.0
Rainbow fry	1	0				1.0	0.0	1.0
Rainbow parr	0	0				0.0	0.0	0.0

Area: 27.0 m^2

Total cover (percent of habitat area) and cover components (percent of total cover; sum = 100%).

Total cover%	% Deep pool	% LOD	% Boulder	% Instream veg.	% Overstream veg.	% Cutbank
10	0	60	40	0	0	0

Maximum depth (cm): 45 Average depth (cm): 23 Maximum velocity ($m \cdot sec^{-1}$): 0.99 Average velocity ($m \cdot sec^{-1}$): 0.25
Temperature (°C): 11 Discharge: 0.3 $m^3 \cdot sec^{-1}$

Bed material

% Fines	% Small gravel	% Large gravel	% Small cobble	% Large cobble	% Boulder	% Bedrock
5	5	20	40	10	20	0

Comments: none.

Appendix E. Marble River site and catch data.

System: **Yootook Creek** Site: 1 Reach 1
Habitat: Glide Date: September 1, 1996 Time: 17:30

Location: Just above Southeast Main bridge approximately 200 m upstream from mouth.

Population assessment method: Removal-depletion by electroshocker using Zippin method of catch analysis.

Population estimate:

Species	Pass 1	Pass 2	Pass 3	Float 1	Float 2	Population estimate	Confidence limit	Capture probability
Coho fry	1	0				1.0	0.0	1.0
Cutthroat fry	0	0				0.0	0.0	0.0
Cutthroat parr	0	0				0.0	0.0	0.0
Dolly Varden 0+	4	0				4.0	0.0	1.0
Dolly Varden parr	0	0				0.0	0.0	0.0
Prickly sculpin	0	0				0.0	0.0	0.0
Rainbow fry	0	0				0.0	0.0	0.0
Rainbow parr	0	0				0.0	0.0	0.0

Area: 27.2 m^2

Total cover (percent of habitat area) and cover components (percent of total cover; sum = 100%).

Total cover %	% Deep pool	% LOD	% Boulder	% Instream veg	% Overstream veg.	% Cutbank
20	0	0	100	0	0	0

Maximum depth (cm): 17 Average depth (cm): 9 Maximum velocity ($m \cdot sec^{-1}$): 0.43 Average velocity ($m \cdot sec^{-1}$): 0.21
Temperature (°C): 11 Discharge: 0.3 $m^3 \cdot sec^{-1}$

Bed material

% Fines	% Small gravel	% Large gravel	% Small cobble	% Large cobble	% Boulder	% Bedrock
0	5	10	15	30	40	0

Comments: none.

Appendix E. Marble River site and catch data.

System: **Malook Creek** Site: 1 Reach 1
Habitat: Pool Date: August 30, 1996 Time: 13:00

Location: Approximately 300 m upstream from the mouth.

Population assessment method: Float count.

Population estimate:

Species	Pass 1	Pass 2	Pass 3	Float 1	Float 2	Population estimate	Confidence limit	Capture probability
Coho fry				50				
Cutthroat fry				0				
Cutthroat parr				0				
Dolly Varden 0+				0				
Dolly Varden parr				0				
Prickly sculpin				0				
Rainbow fry				0				
Rainbow parr				0				

Area: 302 m^2

Total cover (percent of habitat area) and cover components (percent of total cover; sum = 100%).

Total cover %	% Deep pool	% LOD	% Boulder	% Instream veg	% Overstream veg.	% Cutbank
10	0	0	0	50	50	0

Maximum depth (cm): 230 Average depth (cm): 128 Maximum velocity ($m \cdot sec^{-1}$): 0.00
Average velocity ($m \cdot sec^{-1}$): 0.00 Temperature (°C): 10

Bed material

% Fines	% Small gravel	% Large gravel	% Small cobble	% Large cobble	% Boulder	% Bedrock
100	0	0	0	0	0	0

Appendix E. Marble River site and catch data.

System: **Howlal Creek** Site: 1 Reach 1
Habitat: riffle Date: September 2, 1996 Time: 13:00

Location: Just above Southeast Main bridge approximately 200 m upstream from mouth.

Population assessment method: Removal-depletion by beach seine and electroshocker using Zippin method of catch analysis.

Population estimate:

Species	Pass 1	Pass 2	Pass 3	Float 1	Float 2	Population estimate	Confidence limit	Capture probability
Coho fry	10	2				13.0	3.0	0.75
Cutthroat fry	0	0				0.0	0.0	0.0
Cutthroat parr	0	0				0.0	0.0	0.0
Dolly Varden 0+	0	0				0.0	0.0	0.0
Dolly Varden parr	0	0				0.0	0.0	0.0
Prickly sculpin	1	0				1.0	0.0	1.0
Rainbow fry	3	2				6.0	6.2	0.6
Rainbow parr	0	0				0.0	0.0	0.0

Area: 32.0 m^2

Total cover (percent of habitat area) and cover components (percent of total cover; sum = 100%).

Total cover %	% Deep pool	% LOD	% Boulder	% Instream veg	% Overstream veg.	% Cutbank
10	0	0	100	0	0	0

Maximum depth (cm): unknown Average depth (cm): unknown Maximum velocity ($m \cdot sec^{-1}$): Average velocity ($m \cdot sec^{-1}$):
Temperature (°C): 12 Discharge: 0.3 $m^3 \cdot sec^{-1}$

Bed material

% Fines	% Small gravel	% Large gravel	% Small cobble	% Large cobble	% Boulder	% Bedrock
0	5	30	35	20	10	0

Comments: none

Appendix E. Marble River site and catch data.

System: **Howlal Creek** Site: 1 Reach 1
Habitat: Pool Date: September 2, 1996 Time: 15:14
Location: Just above Southeast Main bridge approximately 200 m upstream from mouth

Population assessment method: Removal-depletion by beach seine using Zippin method of catch analysis with float counts before and after multiple removal. Area assessed - 54 m^2.

Population estimate:

Species	Pass 1	Pass 2	Pass 3	Float 1	Float 2	Population estimate	Confidence limit	Capture probability
Coho fry	105	6		78	14	125*	1.6	0.9
Cutthroat fry	0	0		0	0	0.0	0.0	0.0
Cutthroat parr	0	0		0	0	0.0	0.0	0.0
Dolly Varden 0+	0	0		0	0	0.0	0.0	0.0
Dolly Varden parr	0	0		0	0	0.0	0.0	0.0
Prickly sculpin	0	0		0	0	0.0	0.0	0.0
Rainbow fry	3	0		0	0	3.0	0.0	1.0
Rainbow parr	0	0		0	1	1.0*	0.0	0.0

*The final float count indicated that the removal-depletion population estimate under estimated the size of the actual population by at least 13 coho fry and 1 rainbow parr. The population estimate was adjusted to reflected the fish observed in the final float.

Total cover (percent of habitat area) and cover components (percent of total cover; sum = 100%).

Total cover %	% Deep pool	% LOD	% Boulder	% Instream veg	% Overstream veg.	% Cutbank
15	0	15	85	0	0	0

Maximum depth (cm): 93 Average depth (cm): 55 Maximum velocity ($m \cdot sec^{-1}$): 0.03
Average velocity ($m \cdot sec^{-1}$): 0.00 Temperature (°C): 12 Discharge: 0.3 $m^3 \cdot sec^{-1}$

Bed material

% Fines	% Small gravel	% Large gravel	% Small cobble	% Large cobble	% Boulder	% Bedrock
20	20	30	10	10	10	0

Comments: none

Appendix E. Marble River site and catch data.

System: **Howlal Creek** Site: 1 Reach 1
Habitat: Glide Date: September 2, 1996 Time: 13:00

Location: Just above Southeast Main bridge approximately 200 m upstream from mouth.

Population assessment method: Removal-depletion by electroshocker and seine net using Zippin method of catch analysis.

Population estimate:

Species	Pass 1	Pass 2	Pass 3	Float 1	Float 2	Population estimate	Confidence limit	Capture probability
Coho fry	30	0				30.0	0.00	1.0
Cutthroat fry	0	0				0.0	0.0	0.0
Cutthroat parr	0	0				0.0	0.0	0.0
Dolly Varden 0+	0	0				0.0	0.0	0.0
Dolly Varden parr	0	0				0.0	0.0	0.0
Prickly sculpin	0	0				0.0	0.0	0.0
Rainbow fry	2	0				2.0	0.0	1.0
Rainbow parr	0	0				0.0	0.0	0.0

Area: 32.0 m^2

Total cover (percent of habitat area) and cover components (percent of total cover; sum = 100%).

Total cover %	% Deep pool	% LOD	% Boulder	% Instream veg	% Overstream veg.	% Cutbank
10	0	0	100	0	0	0

Maximum depth (cm): unknown
Average depth (cm): unknown
Maximum velocity ($m \cdot sec^{-1}$): unknown
Average velocity ($m \cdot sec^{-1}$): unknown
Temperature (°C): 12
Discharge: 0.3 $m^3 \cdot sec^{-1}$

Bed material

% Fines	% Small gravel	% Large gravel	% Small cobble	% Large cobble	% Boulder	% Bedrock
10	10	40	20	10	10	0

Comments: none

Appendix E. Marble River site and catch data.

System: **Lippy Creek** Site: 2 Reach 1
Habitat: Pool Date: September 2, 1996 Time: 17:00

Location: Just above SE 4 bridge approximately 400 m upstream from mouth.

Population assessment method: Removal-depletion by beach seine using Zippin method of catch analysis.

Population estimate:

Species	Pass 1	Pass 2	Pass 3	Float 1	Float 2	Population estimate	Confidence limit	Capture probability
Coho fry	75	22	4			102.0	1.8	0.9
Cutthroat fry	0	2	0			3.0	9.7	0.6
Cutthroat parr	0	0	0			0.0	0.0	0.0
Dolly Varden 0+	2	4	4			10.0*	-*	*1.0
Dolly Varden parr	1	0	0			1.0	0.0	1.0
Prickly sculpin	0	0	0			0.0	0.0	0.0
Rainbow fry	0	0	0			0.0	0.0	0.0
Rainbow parr	0	0	0			0.0	0.0	0.0

*Population estimate is based on total catch. Removal pattern did not allow for population estimate using Zippin method.

Area: 24.7 m^2

Total cover (percent of habitat area) and cover components (percent of total cover; sum = 100%).

Total cover %	% Deep pool	% LOD	% Boulder	% Instream veg	% Overstream veg.	% Cutbank
10	0	0	100	0	0	0

Maximum depth (cm): 60 Average depth (cm): 33 Maximum velocity ($m \cdot sec^{-1}$): 0.00 Average velocity ($m \cdot sec^{-1}$): 0.00
Temperature (°C): unknown

Bed material

% Fines	% Small gravel	% Large gravel	% Small cobble	% Large cobble	% Boulder	% Bedrock
5	10	20	20	15	10	20

Comments: none

Appendix E. Marble River site and catch data.

System: **Lippy Creek** Site: 2 Reach 1
Habitat: Riffle Date: September 2, 1996 Time: 17:00

Location: Just above SE4 bridge approximately 400 m upstream from mouth.

Population assessment method: Removal-depletion by electroshocker using Zippin method of catch analysis.

Population estimate:

Species	Pass 1	Pass 2	Pass 3	Float 1	Float 2	Population estimate	Confidence limit	Capture probability
Coho fry	24	2				27.0	1.8	0.9
Cutthroat fry	20	9				33.0	9.7	0.6
Cutthroat parr	0	0				0.0	0.0	0.0
Dolly Varden 0+	7	2				10.0	3.8	0.7
Dolly Varden parr	0	0				0.0	0.0	0.0
Prickly sculpin	0	0				0.0	0.0	0.0
Rainbow fry	0	0				0.0	0.0	0.0
Rainbow parr	0	0				0.0	0.0	0.0

Area: 20 m^2

Total cover (percent of habitat area) and cover components (percent of total cover; sum = 100%).

Total cover%	% Deep pool	% LOD	% Boulder	% Instream veg	% Overstream veg.	% Cutbank
20	0	0	100	0	0	0

Maximum depth (cm): 40 Average depth (cm): 4 Maximum velocity ($m \cdot sec^{-1}$): 0.22 Average velocity ($m \cdot sec^{-1}$): 0.03
Temperature (°C): unknown

Bed material

% Fines	% Small gravel	% Large gravel	% Small cobble	% Large cobble	% Boulder	% Bedrock
5	10	15	20	20	30	0

Comments: none

Appendix E. Marble River site and catch data.

System: **Sorenson Creek** Site: 1 Reach 1
Habitat: Pool Date: September 5, 1996 Time: 13:00

Location: Approximately 200 m upstream from mouth

Population assessment method: Removal-depletion by beach seine and electroshocker using Zippin method of catch analysis.

Population estimate:

Species	Pass 1	Pass 2	Pass 3	Float 1	Float 2	Population estimate	Confidence limit	Capture probability
Coho fry	69	8				78.0	2.5	0.9
Cutthroat fry	2	0				2.0	0.0	1.0
Cutthroat parr	0	0				0.0	0.0	0.0
Dolly Varden 0+	0	0				0.0	0.0	0.0
Dolly Varden parr	0	0				0.0	0.0	0.0
Prickly sculpin	10	4				15.0	4.4	0.7
Rainbow fry	2	0				2.0	0.0	1.0
Rainbow parr	0	0				0.0	0.0	0.0

Area: 54.7 m^2

Total cover (percent of habitat area) and cover components (percent of total cover; sum = 100%).

Total cover%	% Deep pool	% LOD	% Boulder	% Instream veg	% Overstream veg.	% Cutbank
6	0	60	0	0	40	0

Maximum depth (cm): 82 Average depth (cm): 41 Maximum velocity ($m \cdot sec^{-1}$): 0.05 Average velocity ($m \cdot sec^{-1}$): 0.01
Temperature (°C): 10.5

Bed material

% Fines	% Small gravel	% Large gravel	% Small cobble	% Large cobble	% Boulder	% Bedrock
0	10	70	20	0	0	0

Comments: none

Appendix E. Marble River site and catch data.

System: **Sorenson Creek** Site: 1 Reach 1
Habitat: Riffle Date: September 5, 1996 Time: 15:21

Location: Approximately 200 m upstream from mouth.

Population assessment method: Removal-depletion by electroshocker using Zippin method of catch analysis.

Population estimate:

Species	Pass 1	Pass 2	Pass 3	Float 1	Float 2	Population estimate	Confidence limit	Capture probability
Coho fry	1	0				1.0	0.0	1.0
Cutthroat fry	2	0				2.0	0.0	1.0
Cutthroat parr	0	0				0.0	0.0	0.0
Dolly Varden 0+	0	0				0.0	0.0	0.0
Dolly Varden parr	0	0				0.0	0.0	0.0
Prickly sculpin	3	0				3.0	0.0	1.0
Rainbow fry	0	0				0.0	0.0	0.0
Rainbow parr	0	0				0.0	0.0	0.0

Area: 22.5 m^2

Total cover (percent of habitat area) and cover components (percent of total cover; sum = 100%).

Total cover %	% Deep pool	% LOD	% Boulder	% Instream veg	% Overstream veg.	% Cutbank
13	0	66	0	0	34	0

Maximum depth (cm): 12 Average depth (cm): 6 Maximum velocity ($m \cdot sec^{-1}$): 0.93 Average velocity ($m \cdot sec^{-1}$): 0.36
Temperature (°C): 10.5

Bed material

% Fines	% Small gravel	% Large gravel	% Small cobble	% Large cobble	% Boulder	% Bedrock
0	10	70	20	0	0	0

Comments: none

Appendix E. Marble River site and catch data.

System: **Sorenson Creek** Site: 1 Reach 1
Habitat: Glide Date: September 5, 1996 Time: 16:13

Location: Approximately 200 m upstream from mouth.

Population assessment method: Removal-depletion by beach seine using Zippin method of catch analysis.

Population estimate:

Species	Pass 1	Pass 2	Pass 3	Float 1	Float 2	Population estimate	Confidence limit	Capture probability
Coho fry	4	0				4.0	0.0	1.0
Cutthroat fry	0	0				0.0	0.0	0.0
Cutthroat parr	0	0				0.0	0.0	0.0
Dolly Varden 0+	0	0				0.0	0.0	0.0
Dolly Varden parr	0	0				0.0	0.0	0.0
Prickly sculpin	5	4				11.0	9.6	0.5
Rainbow fry	0	0				0.0	0.0	0.0
Rainbow parr	0	0				0.0	0.0	0.0

Area: 24.1 m^2

Total cover (percent of habitat area) and cover components (percent of total cover; sum = 100%).

Total cover %	% Deep pool	% LOD	% Boulder	% Instream veg	% Overstream veg.	% Cutbank
0	0	0	0	0	0	0

Maximum depth (cm): 25 Average depth (cm): 13 Maximum velocity ($m \cdot sec^{-1}$): 0.16 Average velocity ($m \cdot sec^{-1}$): 0.10
Temperature (°C): 10.5

Bed material

% Fines	% Small gravel	% Large gravel	% Small cobble	% Large cobble	% Boulder	% Bedrock
0	0	100	0	0	0	0

Comments: none

Appendix E. Marble River site and catch data.

System: **Link River** Site: 1 Reach 1
Habitat: Pool Date: September 6, 1996 Time: 13:00

Location: Approximately 100 m upstream from mouth

Population assessment method: Removal-depletion by beach seine using Zippin method of catch analysis.

Population estimate:

Species	Pass 1	Pass 2	Pass 3	Float 1	Float 2	Population estimate	Confidence limit	Capture probability
Coho fry	26	9		43	1	38	7.1	0.7
Cutthroat fry	0	0		0	0	0.0	0.0	0.0
Cutthroat parr	0	0		0	0	0.0	0.0	0.0
Dolly Varden 0+	0	0		0	0	0.0	0.0	0.0
Dolly Varden parr	0	0		1	0	1.0*	0.0	0.0
Prickly sculpin	2	5		2	1	N/A	N/A	N/A
Rainbow fry	1	0		0	0	1.0	0.0	1.0
Rainbow parr	1	0		0	0	1.0	0.0	1.0

N/A - Population estimate is not available as catch on Pass 2 was larger than Pass 1. * - population estimate based on initial float count.
Area: 358 m^2

Total cover (percent of habitat area) and cover components (percent of total cover; sum = 100%).

Total cover %	% Deep pool	% LOD	% Boulder	% In.stream veg	% Overstream veg.	% Cutbank
20	0	1	99	0	0	0

Maximum depth (cm): 150 Average depth (cm): 80 Maximum velocity ($m \cdot sec^{-1}$): 0.30
Average velocity ($m \cdot sec^{-1}$): 0.10 Temperature (°C): unknown

Bed material

% Fines	% Small gravel	% Large gravel	% Small cobble	% Large cobble	% Boulder	% Bedrock
0	5	10	15	40	30	0

Comments: none

Appendix E. Marble River site and catch data.

System: **Link River** Site: 1 Reach 1
Habitat: Riffle Date: September 6, 1996 Time: 14:00

Location: Approximately 100 m upstream from mouth.

Population assessment method: Removal-depletion by electroshocker using Zippin method of catch analysis:

Species	Pass 1	Pass 2	Pass 3	Float 1	Float 2	Population estimate	Confidence limit	Capture probability
Coho fry	1	0				1.0	0.0	1.0
Cutthroat fry	0	0				0.0	0.0	0.0
Cutthroat parr	0	0				0.0	0.0	0.0
Dolly Varden 0+	0	0				0.0	0.0	0.0
Dolly Varden parr	0	0				0.0	0.0	0.0
Prickly sculpin	5	3				9.0	5.5	0.6
Rainbow fry	0	0				0.0	0.0	0.0
Rainbow parr	0	0				0.0	0.0	0.0

Area: 55.5 m^2

Total cover (percent of habitat area) and cover components (percent of total cover; sum = 100%).

Total cover %	% Deep pool	% LOD	% Boulder	% Instream veg	% Overstream veg.	% Cutbank
20	0	0	100	0	0	0

Maximum depth (cm): 34 Average depth (cm): 16 Maximum velocity ($m \cdot sec^{-1}$): 1.10
Average velocity ($m \cdot sec^{-1}$): 0.32 Temperature (°C): unknown

Bed material

% Fines	% Small gravel	% Large gravel	% Small cobble	% Large cobble	% Boulder	% Bedrock
0	0	0	20	40	40	0

Comments: none

Appendix E. Marble River site and catch data.

System: **Link River** Site: 1 Reach 1
Habitat: Glide Date: September 6, 1996 Time: 16:00

Location: Approximately 100 m upstream from mouth.

Population assessment method: Float count by skindiver.

Species	Pass 1	Pass 2	Pass 3	Float 1	Float 2	Population estimate	Confidence limit	Capture probability
Coho fry				21		21		
Cutthroat fry				0		0		
Cutthroat parr				0		0		
Dolly Varden 0+				0		0		
Dolly Varden parr				0		0		
Prickly sculpin				0		0		
Rainbow fry				0		0		
Rainbow parr				0		0		

Area: 118.1 m^2

Total cover (percent of habitat area) and cover components (percent of total cover; sum = 100%).

Total cover %	% Deep pool	% LOD	% Boulder	% Instream veg	% Overstream veg.	% Cutbank
15	0	34	66	0	0	0

Maximum depth (cm): 95 Average depth (cm): 52 Maximum velocity ($m \cdot sec^{-1}$): 0.23
Average velocity ($m \cdot sec^{-1}$): 0.10 Temperature (°C): unknown

Bed material

% Fines	% Small gravel	% Large gravel	% Small cobble	% Large cobble	% Boulder	% Bedrock
0	5	10	15	40	30	0

Comments: none

Appendix E. Marble River site and catch data.

System: **Benson River** Site: 1 Reach 1
Habitat: Riffle Date: September 8, 1996 Time: 09:00

Location: Approximately 600 m upstream from mouth.

Population assessment method: Removal-depletion by electroshocker using Zippin method of catch analysis.

Species	Pass 1	Pass 2	Pass 3	Float 1	Float 2	Population estimate	Confidence limit	Capture probability
Coho fry	0	0	0			0.0	0.0	0.0
Cutthroat fry	0	0	0			0.0	0.0	0.0
Cutthroat parr	0	0	0			0.0	0.0	0.0
Dolly Varden 0+	0	0	0			0.0	0.0	0.0
Dolly Varden parr	0	0	0			0.0	0.0	0.0
Prickly sculpin	4	2	0			7.0	2.9	0.5
Rainbow fry	2	2	0			5.0	4.5	0.4
Rainbow parr	0	0	0			0.0	0.0	0.0

Area: 27.8 m^2

Total cover (percent of habitat area) and cover components (percent of total cover; sum = 100%).

Total cover %	% Deep pool	% LOD	% Boulder	% Instream veg	% Overstream. veg.	% Cutbank
10	0	0	100	0	0	0

Maximum depth (cm): 28 Average depth (cm): 18 Maximum velocity ($m \cdot sec^{-1}$): 0.64
Average velocity ($m \cdot sec^{-1}$): 0.26 Temperature (°C): unknown

Bed material

% Fines	% Small gravel	% Large gravel	% Small cobble	% Large cobble	% Boulder	% Bedrock
0	5	25	30	40	10	0

Comments: none

Appendix E. Marble River site and catch data.

System: **Benson River** Site: 1 Reach 1
Habitat: Pool Date: September 8, 1996 Time: 11:00

Location: Approximately 600 m upstream from mouth.

Population assessment method: Float count by skindiver.

Species	Pass 1	Pass 2	Pass 3	Float 1	Float 2	Population estimate	Confidence limit	Capture probability
Coho fry				11		11		
Cutthroat fry				0		0		
Cutthroat parr				0		0		
Dolly Varden 0+				0		0		
Dolly Varden parr				0		0		
Prickly sculpin				0		0		
Rainbow fry				2		2		
Rainbow parr				0		0		

Area: 161.5 m^2

Total cover (percent of habitat area) and cover components (percent of total cover; sum = 100%)

Total cover %	% Deep pool	% LOD	% Boulder	% Instream veg	% Overstream veg.	% Cutbank
8	0	100	100	0	0	0

Maximum depth (cm): 150 Average depth (cm): 109 Maximum velocity ($m \cdot sec^{-1}$): 0.68
Average velocity ($m \cdot sec^{-1}$): 0.30 Temperature (°C): unknown

Bed material

% Fines	% Small gravel	% Large gravel	% Small cobble	% Large cobble	% Boulder	% Bedrock
0	0	10	20	60	10	0

Comments: none

Appendix E. Marble River site and catch data.

System: **Benson River** Site: 1 Reach 1
Habitat: Glide Date: September 8, 1996 Time: 13:00

Location: Approximately 600 m upstream from mouth

Population assessment method: Float count by skindiver

Species	Pass 1	Pass 2	Pass 3	Float 1	Float 2	Population estimate	Confidence limit	Capture probability
Coho fry				20		20		
Cutthroat fry				0		0		
Cutthroat parr				0		0		
Dolly Varden 0+				0		0		
Dolly Varden parr				0		0		
Prickly sculpin				0		0		
Rainbow fry				0		0		
Rainbow parr				0		0		

Area: 1242 m^2

Total cover (percent of habitat area) and cover components (percent of total cover; sum = 100%).

Total cover %	% Deep pool	% LOD	% Boulder	% Instream veg	% Overstream veg.	% Cutbank
2	0	0	0	0	50	50

Maximum depth (cm): 110 Average depth (cm): 25 Maximum velocity ($m \cdot sec^{-1}$): 0.47
Average velocity ($m \cdot sec^{-1}$): 0.29 Temperature (°C): unknown

Bed material

% Fines	% Small gravel	% Large gravel	% Small cobble	% Large cobble	% Boulder	% Bedrock
0	0	20	30	40	10	0

Comments: Portions of the glide were shocked without stopnets. Some cottids and no salmonids were captured. All the coho were observed along the right bank in the deepest area of the glide near the cutbank and LOD.

Appendix F: Marble River maximum salmonid density data, August-September, 1996.

System	Reach	Site	Habitat	Habitat (%)	Probability of Use						Weight (g)				Alkalinity (mg/L)	MSD (fish/100m-2)				Corrected MSD (fish/100m-2)				Actual densities (fish/100m-2)			
					P(b) fry RB	P(b) parr RB	P(b) adult RB	P(b) fry CT	P(b) parr CT	P(b) fry coho	Trout-DV fry	Trout-DV parr	Trout-DV adult	Coho fry		trout-DV fry	trout-DV parr	trout-DV adult	coho	Corrected fry MSD	Corrected parr MSD	Corrected adult MSD	Corrected coho MSD	Actual fry density	Actual parr density	Actual adult density	Actual coho density
Pinch C	1	1	riffle	80	0.51	0.33	0.32	0.51	0.87	0.12	2.4	15.9	200	3.34	100	154.4	22.8	1.8	188.9	78.8	19.9	0.6	22.7	37.3	0.0	0.0	22.0
Pinch C	1	1	pool	20	0.56	0.31	0.63	0.56	0.44	0.57	1.7	9.7	200	5.10	100	213.6	37.4	1.8	123.7	119.6	16.5	1.1	70.5	0.0	4.0	0.0	92.0
Pinch C	1	1	glide	0	0.51	0.36	0.27	0.51	0.41	0.03	2.3	15.9	200	3.86	100	155.2	22.8	1.8	163.5	79.1	9.4	0.5	4.9	6.0	0.0	0.0	18.0
Yootook C	1	1	pool	20	0.13	0.40	0.36	0.13	0.60	0.17	4.1	15.9	200	3.70	80	78.8	20.4	1.6	156.0	10.2	8.2	0.6	26.5	3.7	0.0	0.0	0.0
Yootook C	1	1	glide	0	0.78	0.54	0.32	0.78	0.19	0.23	4.1	15.9	200	3.70	80	79.2	20.4	1.6	156.0	61.7	11.1	0.5	35.2	0.0	0.0	0.0	3.7
Yootook C	1	1	riffle	80	0.39	0.16	0.18	0.39	0.31	0.02	2.2	15.9	200	3.70	80	149.7	20.4	1.6	156.0	58.4	3.3	0.3	3.1	19.4	0.0	0.0	0.0
Malook C	1	1	pool	100	0.15	0.96	0.75	0.15	0.98	0.75	2.2	15.9	200	4.04	120	183.3	25.0	2.0	168.0	26.9	24.6	1.5	126.0	0.0	0.0	0.0	16.5
Howlal C	1	1	pool	30	0.25	0.89	0.68	0.25	0.91	0.7	0.8	15.9	200	2.81	90	420.1	21.7	1.7	215.3	105.0	19.3	1.2	150.7	5.6	1.9	0.0	231.0
Howlal C	1	1	riffle	60	0.23	0.08	0.1	0.23	0.09	0.02	0.8	15.9	200	1.20	90	410.1	21.7	1.7	504.1	94.3	1.7	0.2	10.1	20.0	0.0	0.0	43.0
Howlal C	1	1	glide	10	0.91	0.47	0.28	0.91	0.58	0.24	0.7	15.9	200	1.63	90	492.1	21.7	1.7	371.1	447.8	10.2	0.5	89.1	6.3	0.0	0.0	93.8
Lippy C	1	6	riffle	50	0.36	0.09	0.07	0.36	0.10	0.06	0.8	15.9	200	1.68	180	626.8	30.6	2.4	475.1	226.5	3.1	0.2	30.0	215.0	0.0	0.0	135.0
Lippy C	1	6	pool	50	0.64	0.83	0.56	0.64	0.86	0.64	0.9	6.3	200	2.44	180	531.7	76.8	2.4	327.1	339.0	66.0	1.4	210.3	52.6	4.0	0.0	413.0
Sorenson C	1	1	pool	50	0.44	0.80	0.59	0.44	0.83	0.62	1.5	11.2	200	2.07	160	316.7	41.0	2.3	367.9	138.2	34.2	1.4	227.1	3.7	0.0	0.0	142.6
Sorenson C	1	1	riffle	50	0.23	0.08	0.10	0.23	0.09	0.02	1.3	11.2	200	3.20	160	353.3	41.0	2.3	238.0	82.2	3.6	0.2	3.8	8.9	0.0	0.0	4.4
Sorenson C	1	1	glide	0	0.91	0.47	0.28	0.91	0.58	0.24	1.4	11.2	200	1.98	160	328.0	41.0	2.3	384.6	299.7	23.7	0.6	91.9	0.0	0.0	0.0	16.6
Link R	1	5	riffle	20	0.37	0.28	0.28	0.37	0.32	0.04	4.6	20.0	200	7.30	40	49.9	11.5	1.1	59.9	18.4	3.7	0.3	2.4	0.0	0.0	0.0	1.8
Link R	1	5	pool	31	0.25	0.90	0.79	0.25	0.92	0.46	4.6	20.0	200	5.57	40	49.9	11.5	1.1	78.5	12.4	10.6	0.9	36.3	0.3	0.3	0.0	10.6
Link R	1	5	glide	49	0.34	0.91	0.80	0.34	0.92	0.62	4.6	20.0	200	5.57	40	49.9	11.5	1.1	78.5	17.1	10.6	0.9	48.6	0.0	0.0	0.0	17.8
Benson R	1	1	riffle	44	0.58	0.50	0.33	0.58	0.61	0.12	3.6	15.9	200	3.34	90	97.0	21.7	1.7	181.1	56.1	10.7	0.6	21.3	18.0	0.0	0.0	0.0
Benson R	1	1	pool	19	0.07	0.66	0.92	0.07	0.66	0.33	3.6	15.9	200	3.34	90	95.7	21.7	1.7	181.1	6.6	14.2	1.6	59.1	1.2	0.0	0.0	6.8
Benson R	1	1	glide	38	0.29	0.54	0.51	0.29	0.61	0.11	3.6	15.9	200	3.34	90	95.7	21.7	1.7	181.1	27.3	11.7	0.9	20.4	0.0	0.0	0.0	1.6

Codes: CT - cutthroat trout, DV - Dolly Varden, MSD - Maximum salmonid densities, P(b) - Probability of Use (depth and velocity)

MSD was calculated for trout and DV using the Ptolemy et al. 1991 MSD equation log10(FPU)=1.56+0.50log10(ALK)-1.00log10(SIZE)

MSD was calculated for coho using the Ptolemy et al. 1991 MSD coho equation FPUcoho = 100*Alk^0.4*size^-1

Corrected MSD = P(b)*MSD

RB P(b) was used to calculated trout-DV fry and parr CMSD for Benson R, Link River, Howlal Creek and Yootook Creek

CT P(b) was used to calculated trout-DV fry and parr CMSD for Pinch C, Lippy C and Sorenson C.

Appendix G. MINFILE data for the Marble River watershed (BC Min. Energy, Mines and Petroleum Resources map 092L).

Location	MINFILE no.	Name	Status	Commodity	UTM zone	Northing	Easting
Alice Lake	57	Pilgrim (L.2035)	developed prospect	Zn,Ag,Au,Pb,Cd	9	5587516	614035
Alice Lake	284	Marble River	past producer	Ls	9	5588441	613916
Alice Lake	55	Alice Lake	prospect	Au,Ag,Pb,Zn	9	5588864	612033
Alice Lake	56	June (L.180)	prospect	Fe,Cu,Au,Ag,Su,Zn,Pb,Ma	9	5588049	612938
Alice Lake	112	Minerva Fr. (L.171,183)	prospect	Zn,Cu,Fe,Ma	9	5588409	612437
Alice Lake	314	Big Zinc	prospect	Zn	9	5588385	611293
Benson River	35	Old Sport(L.1480,1486	past producter	Cu, Ma, Fe, Ag,Au	9	5582057	625416
Benson River	44	Merry widow 5 (L.15533-1543)	past producter	Ma,Fe,Cu,Au,Zn,Co			
Benson River	45	Kingfisher (L.1532)	past producter	Ma,Fe	9	5579629	624643
Benson River	46	Raven (L.1542)	past producter	Ma,Fe,Cu,Au,Ag,Zn			
Benson River	91	Benson Lake (L.l555,1557)	past producter	Cu,Ma,Fe,Au,Ag	9	5579596	625869
Benson River	295	Benson Lake Limestone	producer	Ls	9	5582854	623816
Benson River	40	Shamrock (L.1744)	prospect	Ma,Fe			
Benson River	41	Blackjack (L.1498)	prospect	Ma,Fe	9	5580953	624454
Benson River	190	Bluebird 1	prospect	Cu,Zn,Au,Co			
Benson River	42	Ajax (L.1502)	showing	Ma,Fe	9	5580498	624820
Benson River	43	Summit (L.1554)	showing	Ma,Fe	9	5580343	624765
Benson River	47	Whiskey Jack (L.1529)	showing	Ma,Fe	9	5579875	624578
Benson River	48	Rambler (L.1537)	showing	Ma,Fe	9	5579730	625016
Benson River	49	Keystone (L.1534)	showing	Ma,Fe	9	5579269	625086
Benson River	50	Marten	showing	Cu,Au,Ag,As	9	5579101	624517
Benson River	51	Snowline (L.1535)	showing	Ma			
Benson River	59	Blue Ox	showing	Cu,Zn	9	5576043	625895
Benson River	102	Snowbird (L. 1586-1588)	showing	Ma,Fe			
Benson River	114	Eagle (L.1154)	showing	Cu,Co	9	5579008	624029
Benson River	115	Dry Hill (L. 1548)	showing	Co,Cu	9	5579283	625679
Benson River	189	Radio (L.1627)	showing	Cu,Fe			
Benson River	322	Happy Jack (L.1495)	showing	Cu,Ma,Fe	9	5581447	625727
Benson River	340	Bluebird 2	showing	Cu, Zn,Au,Co			
Benson River	341	Snowline 2	showing	Cu,Zn,Au			
Benson River	342	North notch	showing	Cu,Co			
Lower Marble	11	Golden Peak (L.1801)	showing	Au,Ag	9	5542979	657400
Lower Marble	319	For 40	showing	Cu	9	5597955	606423
Lower Marble	327	PL	showing	Cu	9	5599765	611762
Lower Marble	111	Marble Creek	showing	Cu,Ag,Au	9	5598732	609657

Appendix H. Data for Marble River fish sampled for DNA analysis, Aug. - Oct., 1996.

Date:	September 1, 1996
Place name:	Pinch Creek
UTM:	9.616102.5587867
Watershed:	Marble River
Species:	Dolly Varden
Habitat type:	Stream
Collector:	Rob Fielden, Aquatic Resources Limited
Phone:	(604) 266-1113
Project reference:	238
Weight taken by:	Ohaus electronic balance for fish <400g
Stocking history:	none

Vial number	Fork length (mm)	Weight (g)	Sex	Comments
1	65	2.8		

Appendix H. Data for Marble River fish sampled for DNA analysis, Aug. - Oct., 1996.

Date:	September 2, 1996
Place name:	Lippy Creek
UTM:	9.611269.5591543
Watershed:	Marble River
Species:	Dolly Varden
Habitat type:	Stream
Collector:	Rob Fielden, Aquatic Resources Limited
Phone:	(604) 266-1113
Project reference:	238
Weight taken by:	Ohaus electronic balance for fish <400g
Stocking history:	none

Vial number	Fork length (mm)	Weight (g)	Sex	Comments
2	87			otolith - age 1+

Appendix H. Data for Marble River fish sampled for DNA analysis, Aug. - Oct., 1996.

Date:	September 3, 1996
Place name:	Malook Creek
UTM:	9.616839.5586487
Watershed:	Marble River
Species:	Dolly Varden
Habitat type:	Stream
Collector:	Rob Fielden, Aquatic Resources Limited
Phone:	(604) 266-1113
Project reference:	238
Weight taken by:	Ohaus electronic balance for fish <400g
Stocking history:	none

Vial number	Fork length (mm)	Weight (g)	Sex	Comments
3	164			otolith - age 3+

Appendix H. Data for Marble River fish sampled for DNA analysis, Aug. - Oct., 1996.

Date:	September 4, 1996
Place name:	Unnamed Creek - Alice Lake tributary #7
UTM:	9.615242.5592059
Watershed:	Marble River
Species:	Dolly Varden
Habitat type:	Stream
Collector:	Rob Fielden, Aquatic Resources Limited
Phone:	(604) 266-1113
Project reference:	238
Weight taken by:	Ohaus electronic balance for fish <400g
Stocking history:	none

Vial number	Fork length (mm)	Weight (g)	Sex	Comments
4	150		M	otolith - age 2+; mature

Appendix H. Data for Marble River fish sampled for DNA analysis, Aug. - Oct., 1996.

Date:	September 4, 1996
Place name:	Marble River (Link River)
UTM:	9.614054.5588280
Watershed:	Marble River
Species:	Rainbow trout
Habitat type:	Stream
Collector:	Rob Fielden, Aquatic Resources Limited
Phone:	(604) 266-1113
Project reference:	238
Weight taken by:	Ohaus electronic balance for fish <400g
Stocking history:	none

Vial number	Fork length (mm)	Weight (g)	Sex	Comments
5	126	20		age 1+

Appendix H. Data for Marble River fish sampled for DNA analysis, Aug. - Oct., 1996.

Date:	September 7, 1996
Place name:	Jeune Creek
UTM:	9.613200.5587500
Watershed:	Marble River
Species:	Rainbow trout
Habitat type:	Stream
Collector:	Rob Fielden, Aquatic Resources Limited
Phone:	(604) 266-1113
Project reference:	238
Weight taken by:	Ohaus electronic balance for fish <400g
Stocking history:	none

Vial number	Fork length (mm)	Weight (g)	Sex	Comments
6	117	21.4	M	age 1+, probably resident

Appendix H. Data for Marble River fish sampled for DNA analysis, Aug. - Oct., 1996.

Date:	October 9, 1996
Place name:	Unnamed Lake (L5)
UTM:	9.610000.5601000
Watershed:	Marble River
Species:	Dolly Varden
Habitat type:	Lake
Collector:	Rob Fielden, Aquatic Resources Limited
Phone:	(604) 266-1113
Project reference:	238
Weight taken by:	Ohaus electronic balance for fish <400g
Stocking history:	none

Vial number	Fork length (mm)	Weight (g)	Sex	Comments
12	211	102.5	F	otolith, age 3+, mature

APPENDIX I
MARBLE RIVER VIDEO LOG

MARBLE RIVER VIDEO LOG

System	Counter Start (Time)
Lower Marble River	00:00:00
Lower Marble River tributary #1	00:10:01
Lower Marble River tributary #2	00:14:00
Lower Marble River tributary #3	00:19:44
Lake L1	00:21:53
Marsh M1	00:22:22
Lake L3	00:24:52
Lake L5	00:25:56
Lippy Creek	00:29:45
Sorenson Creek	00:37:00
Pinch Creek	00:43:10
Benson River	00:46:00
Middle Benson River	00:52:45
Yootook Creek	00:55:44
Malook Creek	01:02:00
Howlal Creek	01:04:00
Link River	01:09:00
Jeune Creek	01:11:00
Teihsum River	01:14:00
Teihsum River main tributary	01:22:20
Upper Marble River	01:27:00
Upper Marble River tributary	01:34:00
Victoria Lake	01:38:00
Lake L1	01:40:00
Lake L3	01:40:15
Marsh M2	01:40:29
Lake L5	01:40:40
Lake L4	01:41:33
Lake L3	01:42:20
Lake L1	01:42:52