Sawmill Creek Fisheries Survey Annual Report
For 2003 Studies

Blue Lake Project, Federal Energy Regulatory Commission (FERC) No. 2230
City and Borough of Sitka, Licensee

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INTRODUCTION AND BACKGROUND

GENERAL

This report documents results of fisheries surveys conducted during 2003 on Sawmill Creek near Sitka, Alaska. The studies of which this report is a part are in support of the relicensing of the Blue Lake hydroelectric project (Project, FERC No. 2230). The City and Borough of Sitka (City) holds the project's FERC license which will expire on March 31, 2008. Relicensing the project requires an environmental data base sufficient to allow FERC, as lead agency under the National Environmental Policy Act (NEPA), to evaluate existing environments, potential impacts, and mitigation measures associated with reauthorization of the project.

This is the third in a series of relicensing fisheries reports. The first (Wolfe, 2002) was issued in February 2002, and documented fisheries studies conducted during summer, fall and early winter, 2001. The second (Wolfe 2003) documented fisheries studies conducted during the entire 2002 field season.

2003 STUDY PLANNING

A Draft Fisheries Study Plan for 2003 was distributed by the City for agency review, via e-mail, on April 14, 2003, with an invitation to an interagency meeting scheduled for April 24, 2003, to discuss this and the Draft Wildlife Study Plan (distributed at the same time). Minutes of the interagency meeting were distributed in draft on April 29, 2003. Final meeting minutes were returned on July 1, 2003, and used as one basis for revision of the Draft Plan.

Written comments on the Draft Plan were submitted by ADF&G on June 17, 2003, and by USFWS on June 20, 2003. In the City's opinion, the written comments and those received during the interagency meeting represented no substantive dispute with the elements of the Draft Plan.

2003 FISHERIES STUDIES OBJECTIVES

2003 Field Studies therefore had the following objectives:

1. Continue index area and stream survey fish observations, from April through December (if possible given access restrictions) for relicensing study period;

2. Expand the index surveys downstream to include the intertidal reaches of Sawmill Creek and more accurately determine the relative utilization of up and downstream habitats by pink and chum salmon;

3. Evaluate condition factors of rainbow trout in all Reaches to determine differences in condition which may be due to food supply, habitat availability, competition or other factors;

4. Develop fish survey methods to fulfill the needs for 1) NEPA analyses in the FERC relicensing process, and 2) ongoing ADF&G stream surveys and the USFS and STA information needs;

5. Gather data useful to extend the information base on species composition, distribution, periodicity, stream life, and habitat use;

6. Begin to integrate information onto a scaled mapping platform in order to help facilitate decision making processes.

METHODS

SAWMILL CREEK STREAM REACHES

Fish sampling was conducted within six stream reaches, established according to differences in fish habitat type, stream gradient or access considerations were developed (Table 1). Several project features referenced in this report are more fully described in the Initial Consultation Document (ICD, City and Borough of Sitka, 2002) and Scoping Document (SD1), City and Borough of Sitka, 2003.

The "Falls" referenced in the Reach designations is at Stream Mile (SM) 0.73 and is a major stream feature approximately 23 feet high. The "Slot", an area in which Sawmill Creek passes through an extremely narrow canyon constriction, is located from SM .95 to SM 1.06, and the "Fish Valve Unit" is the project powerhouse at SM 1.63 at which minimum stream flows are released into Sawmill Creek.

Table 1. Sawmill Creek reach numbering from lower Powerhouse Bridge upstream to base of Blue Lake Project Dam.

Stream Reach and Location (Name)	Identifying Aquatic Habitats and Stream Characteristics
Reach 1 (Index Survey Area).	From inlet at SM 0.36 upstream to top of Index Area. (SM 0.43)
Reach 2.	Inlet of Index Pool (SM 0.43) to the Pulp Mill Feeder Pool (SM 0.55) (Includes Concrete Area)
Reach 3.	Pulp Mill Feeder Outflow pool to the base of the Falls (SM 0.73)
Reach 4.	From the top of the Falls to the Slot outflow (SM .95)
Reach 5.	From Slot outflow to Fish Valve Unit (SM 1.63)
Reach 6	From the Fish Valve Unit to the base of the Project dam (SM 2.03)

Certain specific names were applied over the course of studies to describe areas or features in which fish were routinely observed, or which offered unique habitats (Table 2).

Table 2. Specific Sawmill Creek sampling features or areas (Reach or sampling area in parentheses, acronyms in bold)

Name of Observation/Sampling Area	Description
Bridge Hold (Reach 1)	A small hold located under and directly below the bridge at SM 0.38
Index Pool (Index Area)	Pool located upstream of bridge at SM 0.38.
Concrete Area **(CA)** (Reach 2)	A long run, pool, and tail out from SM 0.46 to SM 0.49
Pulp Mill Outflow **(PMO)** Pool (Reach 3)	A deep pool just downstream of the Pulp Mill Feeder Unit outflow. (SM. .55)
Pipe Fitting Area **(PFA)** (Reach 3)	A deep run directly upstream of the PMO. (SM .57)
Wild Bill's Pool **(WBP)** (Reach 3)	A short run, pool, and tail out at SM 0.67
Falls Pool (Reach 3)	A large deep pool located at the base of the Falls. (SM 0.73 to SM 0.75)

Slot Pool (Reach 4)	A large pool at SM .95 at the base of the Slot
Long Pool (Reach 5)	A long run, pool, and tail out at SM 1.32
Spring Creek (off Reach 5)	A short, primarily spring feed area in Reach 5 that receives additional flows and connects to the main stem in periods of wet weather and high flows.
Boom Log Area (Reach 5)	A small scour pool at SM 1.52
Campground Bridge Pool **(CBP)** (Reach 5)	A pool at SM 1.57 near the USFS Campground footbridge
FVU area (Reach 5)	The stream area adjacent to the FVU
First, Second and Third Pools (Reach 6)	Pools in the lower segment of Reach 6
Beaver Lake Falls **(BLF)** area (Reach 6)	A deep pool at SM 1.82 just below the Beaver Lake Falls-Sawmill Creek confluence.
Plunge Pool	A deep pool just below Blue Lake Dam. (SM 2.02)

Detailed maps of each reach were developed during the 2001 sampling season and details were added during the 2002, and 2003 sampling seasons (Appendix I). These maps were annotated with fish locations, habitat utilization, and aquatic and riparian habitat descriptions. In 2003 this maps were scaled using both field measurements, and existing and new aerial photographs. The maps were then integrated into a CADD-based system. As field measurements and as surveys continue details will be added to these maps in future reports as features change.

The 2003 Sawmill Creek fish studies consisted of both observation and fish captures. Observations consisted of streamside or instream methods. Fish captures were performed using minnow traps and hook and line. All methods are described in more detail below. Intertidal and tailrace observations were added in 2003 pursuant to the study planning comments described above.

FISH SURVEY METHODS

Fish Observations

Fish were observed either by streamside observation or snorkeling at various locations on Sawmill Creek. During each field survey, the observer noted the following.

- Number of fish by species
- Time of day
- General weather condition
- Water temperature
- Relation of observation time to tide status (for areas up to Reach 3)

- Water transparency
- Activity (actively moving upstream, milling, exhibiting spawning behavior, etc.)
- Location of fish in the stream (i.e., are they concentrated in a pool or run, or are they spread evenly through out the stream). Notations included locations of fish both across and up and down the channel.

A base map of the stream was annotated during each survey to show specific points of observation within the channel. Notes were made of species composition, spawning activity, and habitat conditions and utilization.

Observations fell into three categories: **1) Index Surveys; 2) Stream Surveys; and 3) Snorkel Surveys**.

Index Surveys were frequent general abundance surveys conducted in the vicinity of the powerhouse bridge (SM 0.38) due to its ease of access and because the resting habitat visible from the bridge usually held fish on the day of their inmigration to Sawmill Creek. Information from these surveys was used both for general information and to determine times when the stream surveys, described below, would best be conducted. Index surveys were conducted from March 31, 2003 to December 5, 2003.

Stream Surveys were conducted as needed throughout all representative habitats and reaches to determine anadromous and resident fish distribution, abundance, and habitat utilization throughout the potentially occupied sections of the stream. Polarized glasses were used to reduce water surface glare during all foot surveys.

Stream surveys in 2003 were begun on April 1, just prior to expected in-migration of the earliest anadromous species, steelhead trout (*Oncorhynchus mykiss),* and continued until the end of the coho salmon (*O. kisutch*) run in early December. Stream foot surveys were conducted about once per week, except during adult steelhead and coho immigration where snorkel surveys were often utilized instead (Table 3).

Snorkel Surveys were conducted within accessible areas in which stream hydraulics offered suitable observation conditions. Snorkel surveys were begun on February 23, and were performed primarily to better evaluate occurrence and habitat use of juvenile and adult populations of steelhead/rainbow trout, coho salmon, and Dolly Varden. Observations were initially recorded on a wrist mounted slate with a 100mm scale in order to reduce disturbance and to allow for optic magnification due to the dive mask (Goldstein 1978, Gardiner 1984). Due to similar objectives snorkel survey data results are included with stream survey results for all species. Snorkel surveys were conducted about once a month with the frequency increasing during adult steelhead and coho immigration.

New 2003 Observation Areas. During the 2003 field season, two new observation areas were added to the study scope. These were:

1. **Intertidal Surveys,** conducted from the Blue Lake Powerhouse downstream to tidewater to determine pink and chum salmon abundance and habitat utilization within a newly defined reach referred to as Reach 0; and

2. **Tailrace Surveys,** conducted on a weekly basis at the Blue Lake hydro generating plant tailrace to document fish distribution near the tailrace and evaluate the potential for false attraction. The tailrace was defined as the area from the Blue Lake Project powerhouse downstream to Sawmill Creek. Just downstream of the powerhouse was the **afterbay**, or area upstream of a low regulation weir, and the **tailrace channel**, the free-flowing reach from the weir downstream to Sawmill Creek.

Fish Capture Methods

Two Fish Capture methods were used depending upon the size and life stage of the fish to be sampled. **Minnow Trapping** was used to determine presence and habitat usage of juvenile anadromous and resident fish in various stream reaches. **Hook and Line Sampling** was conducted throughout the stream to capture fish too large to be captured by minnow trapping.

Minnow Trapping. Baited minnow traps were placed in areas selected to optimize capture efficiency for all expected species. Minnow traps were baited with salmon eggs and soak time and exact location using stream maps were recorded. To minimize mortality, traps were checked within 26 hours. MS-222 or a clove oil and grain alcohol solution was used when fish were too active to otherwise handle. Anesthetized fish were allowed to fully recover in a five-gallon bucket while all others were returned immediately to the water. Minnow traps were set in all Reaches, and also in areas of Reach 5 referenced as "Spring Creek" and the adjacent ephemeral channels.

Minnow trapping was begun in Reaches 5 and 6 in February in order to investigate the use of Reach 6 as winter rearing habitat. Trapping then resumed in early April in order to ensure that coho salmon juveniles would be sampled prior to smoltification and out migration, and was continued throughout the summer.

The reference for species identification was Pollard, 1997. Fork length of fish caught, soak time, and exact trap location were noted for each trapping episode and location.

Hook and Line Sampling. Hook and line methods were used to sample fish too large to be captured in traps. Hook and line sampling was conducted from February 15th to August 18th in Reaches 1-6 of Sawmill Creek.

Both spinning and fly tackle were used to effectively cover all habitat types and depth levels. Ultra light and light action spin rods with four and twelve pound-test fluorocarbon line respectively were used for the majority of the sampling. Jigs, spoons, spinners, and fly rigs were all utilized depending on habitat and conditions. Fly rods varying from four-weight to six-weight were used during aquatic insect hatches and in

areas such as riffles where it was superior to spin casting due to habitat conditions. A variety of surface and subsurface flies were used alone and as part of a dropper system according to conditions and insect species present.

Location, species caught, and fork length were recorded for each fish captured, and weight was recorded for a sub sample of rainbow trout. The weight sub sample was often anesthetized using either MS-222 or a clove oil/alcohol solution. All fish were released immediately once they had fully recovered.

Condition Factor Calculations.

Condition factor (K) was calculated for all fish for which length and weight were measured, using the formula:

$$K= (W/L^3)*C$$

Where:

W=weight
L=length
C=a factor (100,000) to bring the result near unity.

SAMPLING DATES

Sampling dates for the various observation techniques varied, as shown in Table 3. Sampling began in February with focused minnow trapping, and ended December 5, when the last of the coho salmon observations occurred.

Table 3. 2003 Sampling dates, type, and area sampled

Date	Index	Tailrace	Stream (F=foot) (S=snorkel)		Inter-tidal	Hook & Line
			Type	Reach		
2/15/03			F	5-6		Reach 5-6
2/23/03			F/S	6		Reach 6
3/4/03	X		F	1-3		
3/10/03	X		F	1-3		
3/17/03	X		F	1-3		
3/23/03	X		F	1-3		
3/31/03	X		F/S	1-6		
4/06/03						
4/07/03	X		F	1-3		
4/14/03	X		F	1-3		
4/20/03	X	X	F/S	1-6		
4/28/03	X	X	F	1-4		Reach 6
5/03/03	X	X	S	1-6		
5/11/03						Reach 5
5/12/03	X	X	F	1-3		Reach 4
5/13/03						Reach 1-3
5/14/03						
5/15/03						
5/16/03	X	X	F	1-3		
5/23/03	X	X	F	1-3		
5/26/03	X	X	F	1-3		Reach 1-3
5/29/03	X	X	S	1-3		
6/2/03	X	X	S	1-6		
6/5/03						
6/6/03						
6/10/03	X	X	F	1-3		
6/13/03	X	X	F	1-3		
6/26/03	X	X				Reach 1-3
6/30/03	X	X	F	1-4		Reach 3-4
7/01/03			F/S	5/6		Reach 5
7/05/03			F		X	
7/06/03	X	X	F	1-3		
7/10/03	X	X	F	1-3	X	
7/14/03	X	X	F	1-3		
7/18/03	X	X	F	1-3	X	
7/25/03	X	X	F	1-3		Reach 1-3
7/30/03	X	X	F	1-3	X	
8/04/03	X	X	F	1-3		
8/08/03	X	X	F	1-3	X	
8/11/03	X	X	F	1-3		
8/15/03			F/S	5-6		
8/18/03	X	X	F	1-4	X	Reach 4
8/19/03	X	X				
8/25/03	X	X	F	1-3		
8/29/03	X	X				
8/30/03	X	X				
9/2/03	X	X				
9/03/03	X	X	F	1-3		
9/05/03	X	X	F	1-3	X	
9/08/03	X	X				
9/11/03		X	F	1-3	X	
9/15/03	X	X	F	1-3	X	
9/25/03	X	X				
9/28/03	X		F	1-2, 5	X	
9/30/03	X					
10/04/03	X	X	F/S	1-3	X	
10/08/03	X					
10/10/03	X	X	F/S	1-6	X	
10/26/03			F/S	1-3		
10/30/03			F/S	1-3		
11/05/03	X	X	F/S	1-6		
11/17/03			F/S	1-6		
12/05/03	X	X	F/S	1-6		

RESULTS

GENERAL

Sawmill Creek surveys in 2003 resulted in the observation of seven anadromous fish species. These were:

- Steelhead trout *(Oncorhynchus mykiss)*;
- Chum salmon *(O. keta)*;
- King salmon *(O. tshawytscha)*;
- Dolly Varden char *(Salvelinus malma)*;
- Pink salmon *(O. gorbuscha)*;
- Coho salmon *(O. kisutch)*; and
- Sockeye salmon *(O. nerka)*.

All anadromous species were found in all Reaches below the Falls at SM 0.84. No anadromous fish were observed or captured upstream of the Falls.

In addition, two non-anadromous fish species were observed or collected in 2003:

- "Resident" rainbow trout *(Oncorhynchus mykiss)* (considered "resident" if between 250 and 490mm in length); and
- Staghorn sculpin *(Leptocottus armatus*).

Resident rainbow trout were termed "juvenile" if less than approximately 250mm in length, and "adult" if between 250mm and 490mm in length. Resident rainbow trout of both size classes were observed and/or captured in all stream reaches. Three staghorn sculpin were captured in Reaches 1 and 2 on May 13, 2003.

Following is a species-by-species account of fish observations and captures during the 2003 field season. Species are presented in chronological order of appearance in Sawmill Creek.

STEELHEAD

Index Surveys

Steelhead were the first anadromous species to appear in Sawmill Creek in 2003. Two steelhead were observed in the Index Area on May 28, and one steelhead was each day was observed on June 3 and 5. All four steelhead were holding and not spawning. Steelhead appeared to hold briefly in the Index Area before moving upstream to spawn. Therefore stream surveys were utilized more to define steelhead run timing and habitat use than were index surveys.

Stream Surveys.

Steelhead surveys in 2003 began in March, and the first two fish were observed on March 31st at the PMO Pool (Table 4). Inmigration increased from April 20 until steelhead numbers peaked on May 12 with 38 fish being observed. Redding and spawning activities were first observed on April 28. The last sighting was on June 2.

All steelhead were observed in Reaches 1 through 3 (below the falls at SM 0.84) with the majority of steelhead holding and all spawning activity concentrated in Reaches 2 and 3. Most steelhead appeared to utilize the Falls Pool area for ripening and spawning, and were only more dispersed during in migration.

Table 4. Steelhead observed during 2003 stream surveys.

Date	Number	Comments
3/31/03	2	Both fish were at the Pipe Fitting Area (PFA).
4/07/03	2	Both fish were at a current seam in the Falls Pool.
4/14/03	4	Three fish were at the Pipe Fitting Area and one at the base of the Falls. All the fish in were in holding areas.
4/20/03	8	Fish were located in resting and holding areas throughout Reaches 2 and 3.
4/28/03	18 .	One fish came off the gravel below the Falls Pool and two darker males appear to have some lower fin wear at the PMO Pool All but one fish are at the Falls Pool and the PMO Pool
5/03/03	30	There was gravel turnover at the Concrete Area (CA) , the Falls Pool and the PMO Pool. 18 Steelhead were at the Falls Pool, 3 at the PFA, 2 at the PMO pool, and three 3 at the CA
5/12/03	39	Falls Pool, and PMO Pool redds have been expanded, and there were 2 fish in holes in the riffle directly below the Falls Hole 33 fish were at the Falls Pool, the PFA/PMO areas were not visible, and 6 were at the CA
5/13/03	36	Some loose eggs in Falls Pool redds
5/16/03	31	
5/23/03	25	
5/26/03	18	
5/29/03	14 S.H.	Active spawning observed at the Falls Pool tailout bank, and the redd at CA was larger.
6/2/03	12	
6/10/03	0	

Tailrace Surveys

Tailrace surveys began on April 14 and continued throughout the 2003 field season. Two steelhead were observed in the tailrace channel on April 20. No fish were evident there during surveys from April 28 through May 23, 2003. One steelhead was also observed in the tailrace channel area on May 25. No steelhead were observed in the afterbay, and all steelhead observed were bright.(Table 5)

Table 5. Steelhead observed during 2003 tailrace surveys.

Date	Tide	Number	Comments
4/20/03	High/ slack	2	One in center, two on sides, all bright
4/28/03	High/ rising	2	Holding in center, both bright
5/03/03	High/ rising	1	Holding in center, and bright

CHUM SALMON

Index Surveys.

Chum Salmon were first observed during index surveys on June 14, 2003 and chum salmon were present in the here until October 8. Chum salmon observations at the Index Area displayed a bimodal distribution with the first inmigration peak around August 11 and the second around September 2. (Table 6).

Table 6 2003 Chum salmon observed during 2003 index surveys.

Date	7/14	7/18	7/25	7/30	8/4	8/8	8/9	8/11	8/18	8/19	8/25	8/29	8/30	9/2	9/5	9/8	9/15	9/25	9/28	9/30	10/4	10/8
Number	2	18	30	70	61	52	58	207	23	44	29	29	37	68	27	35	17	8	12	9	2	9

Stream Surveys

Adult chum salmon were first observed during stream surveys on June 30 first in the CA and then in the PMO area. Around July 18 there was a dramatic increase in immigration, and limited spawning began with chum salmon utilizing all suitable habitats in Reaches 0-3. Adult chum held in deeper areas until ripe and then spawned in tailouts, riffles, and along the outer edges of bars. A peak count of 618 chum salmon was observed on August 11 and two smaller peak counts occurred on September 3 (Table 7). There appeared to be two peaks in spawning activity with the first occurring around August 8 and the second around September 5. The last chum salmon were observed on October 10.

Chum salmon fry were first observed on April 14th between the PMO and the CA and were subsequently observed on April 28, and June 12, at the lower concrete structure in the CA (Table 7).

Table 7. Chum salmon observed during 2003 stream surveys

Date	Number	Comments
4/14/03		Pink and Chum fry below PMO
4/28/03		Chum fry in CA under lower fitting
5/12/03		Chum fry in lower CA
6/30/03	10	No chum were observed past the CA
7/10/03	6	No anadromous fish were observed past the PMO Pool.
7/14/03	5	Stopped at top of CA due to a bear.
7/18/03	115	Observed a dramatic increase in chum immigration with chums being found to the Falls. Chums were observed on redds at the Falls Pool tailout and downstream of the Powerhouse Bridge. There were also redds with loose eggs at the CA area and PMO area.
7/25/03	114	New redds observed at the Index Pool.
7/30/03	241	More chums observed over spawning habitat than in holding areas.
8/04/03	498	57 dead chums; many were ragged or spawned out.
8/08/03	497	128 dead chums; other were actively spawning throughout Reaches 1-3.
8/11/03	618	115 dead chums; others seen actively spawning throughout Reaches 1-3.
8/18/03	59	168 dead chums; very few seen spawning.
8/25/03	100	Fresh chum observed throughout Reaches 1-3, 22 dead chum, very few observed spawning.
9/03/03	143	More chums seen back on redds and actively spawning
9/05/03	94	Remaining chums spawning in tailouts at WBP and PMO bars
9/11/03	30	
9/15/03	59	
9/28/03	12	Impassible past concrete area
10/04/03	8	All chums were in poor condition.
10/10/03	10	

Intertidal Surveys

Chum salmon were first observed during intertidal surveys on July 5, and observations continued until October 10. Intertidal counts contained three significant peaks with the first occurring around August 8, the second occurring around September 5, and a third occurring on September 28 (Table 8).

Table 8. 2003 Chum salmon observed during 2003 intertidal surveys

Date	7/5	7/10	7/18	7/30	8/8	8/18	9/5	9/11	9/15	9/28	10/4	10/10
Number	10	4	120	175	250	59	110	85	120	200	40	6

Tailrace Surveys

Chum salmon were first observed in the tailrace on July 6 and the last chums were observed on October 4. Tailrace survey numbers showed three peaks. The first occurred on August 11 when 26 chums were observed. The second occurred on September 2 when 20 chums were counted, and the third on September 8 when 45 chum were counted (Table 9). The condition of chum salmon in the tail race varied with most of the being bright to water marked. However some chum salmon did ripen in the tailrace area and spawning activity was observed on the gravel bar at the Sawmill Creek confluence.

Table 9. Chum salmon observed during 2003 tailrace surveys

Date	7/6	7/10	7/14	7/18	7/25	7/30	8/4	8/8	8/11	8/18	8/19	8/25	8/29	8/30	9/2	9/5	9/8	9/11	9/15	9/25	9/28	10/4
Number	2	0	4	3	11	14	17	23	26	5	5	3	2	10	20	8	45	23	11	2	5	2

KING SALMON

Index Surveys

King salmon were first observed during 2003 index surveys on July 25, and the last king salmon were observed on September 2 (Table 10). King salmon numbers peaked on August 18. King salmon numbers remained stable from August 8 through August 18, and then dropped significantly between August 18 and 19.

Table 10. King salmon observed during 2003 index surveys

Date	7/25	7/30	8/4	8/8	8/9	8/11	8/18	8/19	8/25	8/29	8/30	9/2
Number	2	6	17	34	33	33	36	16	21	20	23	9

Stream Surveys

The first king salmon were observed during a stream survey on July 10, 2003. Kings ascended Reaches 1-3 slowly until they reached the Falls Pool were the majority of the kings were found from mid to late in the run. Spawning began during the first week of August and continued throughout the month. A peak count of 573 kings was taken on August 18, with 400 of the fish located at the Falls Pool. The last kings were observed on September 3, 2003 (Table 11).

Table. 11 King salmon observed during 2003 stream surveys

Date	Number	Comments
July 10	4	All fish were bright and holding at the head of the CA
July 14	0	Stopped at the top of CA due to a bear
July 18	2	All at the PFA Pool
July 25	56	All kings in holding areas
July 30	80	70 counted at the Falls Pool
August 4	227	Kings were mostly in deeper areas of upwelling
August 8	430	Some adult kings were spawning; king jacks were spilling milt
August 11	393	
August 18	573	400 kings counted at the Falls Pool, many attempting to ascend Falls.
August 25	490	King spawning throughout
September 3	67	All kings spawned out

Intertidal Surveys

King salmon were observed during the first intertidal survey on July 5, and the last king salmon was observed on September 1. King salmon observed in the intertidal area peaked on August 11 (Table 12).

Table 12. 2003 King salmon observed during 2003 intertidal surveys

Date	7/5	7/10	7/18	7/30	8/4	8/8	8/11	8/18	9/5	9/11
Number	26	30	40	82	85	75	79	73	1	0

Tailrace Surveys

King salmon were observed during tailrace surveys from July 30 until September 2 with a peak count of 37 kings on August 19 (Table 13). 7 kings were only present in the afterbay on August 19, during a maintenance period when output was limited.

Table 13. King salmon observed during 2003 tailrace surveys

Date	7/30	8/4	8/8	8/11	8/18	8/19	8/25	8/29	8/30	9/2	9/5
Number	3	3	6	6	25	37	8	0	6	5	0

Minnow Trapping

No juvenile king salmon were sampled during minnow trapping.

Hook and Line Sampling

Three jack male king salmon were captured by hook and line sampling on July 25 in Reaches 2-3. Numerous adults were also taken on July 25 from the Falls's Pool while attempting to sample other species. No length data was recorded for any king salmon.

PINK SALMON

Index Surveys

Pink salmon were first observed in the index area on July 25, and were last observed there on October 8. Pink salmon numbers at the index area contained three peaks with each consecutive peak containing more fish. The first peak of 1385 fish was on August 11, the second peak of 3450 fish occurred on September 2, and the largest peak of 4920 fish occurred on September 8 (Table 14).

Table 14. Pink salmon observed during 2003 index surveys

Date	7/25	7/30	8/4	8/8	8/9	8/11	8/18	8/19	8/25	8/29	8/30	9/2	9/5	9/8	9/15	9/25	9/28	9/30	10/4	10/8
Number	3	20	282	580	270	1385	750	1063	1425	1445	1716	3450	2570	4920	4080	420	300	67	52	47

Stream Surveys

Pink salmon were first observed during stream surveys on July 25, and the last were surveyed on October 10(Table 15). A peak count of 36,130 fish was observed on September 11, 2003. Pinks began to spawn during the first and second weeks of August, peaked during the first week of September, and continued on into the second week of September. Pinks were observed spawning in all areas of Reaches 0-3 except in the deepest areas of pools and in high gradient locations.

Table 15. Pink salmon observed during 2003 stream surveys.

Date	Number	Comments
4/14/03		Pink fry was observed below PMO
4/28/03		Pink fry was observed below PMO
7/25/03	3	All three below Lower Power House Bridge.
7/30/03	80	All pinks were in active immigration and/or holding areas.
8/04/03	459	Most pinks in active immigration and/or holding areas, however 10 pinks were in riffle below Falls Pool.
8/08/03	2263	Darker pinks appeared to be waiting off occupied redds, and chums were observed defending redds against pinks at the Index Pool Bar

8/11/03	7469	100 pinks in spawning area/riffle below Falls Pool
8/18/03	8380	Pinks were only pushing falls and only making it a few feet up before being forced back. 120 pinks in spawning area below Falls Pool
8/25/03	10,345	Pinks were occupying all unoccupied redds
9/03/03	13,335	1000 pinks in spawning area below Falls Pool
9/05/03	15,405	585 pinks in spawning area below Falls Pool
9/11/03	36,128	Active pink spawn throughout creek
9/15/03	24,700	370 pinks in spawning area below Falls Pool
9/28/03	725	Impassible past Concrete Area
10/04/03	86	All pinks in poor condition

Intertidal Surveys

Pink Salmon were present at the mouth during the first intertidal survey on July 5, and were present until October 10 (Table 16). A peak intertidal count of about 40,000 pinks was taken on August 18.

Table 16. Pink Salmon observed during 2003 intertidal surveys.

Date	7/5	7/10	7/18	7/30	8/4	8/8	8/11	8/18	9/5	9/11	9/15	9/28	10/4	10/10
Number	18	20	40	170	850	3500	5265	40,000	15,400	20000	7500	5000	1275	100

Tailrace Surveys

Pink Salmon were first observed in the tailrace on July 10 and were last seen on September 28 (Table 17). The number of pinks observed peaked on September 2, with 1200 pinks counted. Pink conditions varied and some spawning was observed at the bar separating the area from the main creek.

Table 17. Pink salmon observed during 2003 tailrace surveys.

Date	7/10	7/25	7/30	8/4	8/8	8/11	8/18	8/19	8/25	8/29	8/30	9/2	9/5	9/8	9/11	9/15	9/25	9/28	10/4
Number	10	2	6	15	27	22	10	15	6	40*	150	1037	1180	1200	1780	720	120	56	0

SOCKEYE SALMON.

Index Surveys

One sockeye was observed in the Index Area on September 2. Sockeye apparently moved past this rapidly. Also, the sockeye run was quite small, reducing the chance of observing them at a single point.

Stream Surveys

Three sockeye salmon were observed during a stream survey on September 11. Two were located in the Concrete Area and one was located in the Fall's Pool. One sockeye was spotted close to the bank in the index area during a high flow episode (1999.9 cfs) on September 28.

Intertidal Surveys.

No sockeye salmon were observed during intertidal surveys.

Tailrace Surveys

Two sockeye were observed during tailrace surveys on September 2.

COHO SALMON.

Index Surveys

A coho salmon was first observed in the Index Area on September 5, and the last coho was observed in the Index Area on October 10. A peak count of 3 coho was observed in the index area on September 3 (Table 18).

Table 18. Number of adult coho salmon observed during 2003 index surveys.

Date	9/3	9/5	9/11	9/15	9/28	9/30	10/4	10/8	10/10	10/24	10/30
Number	0	1	0	0	1	3	0	1	1	0	0

Stream Surveys

Three coho were observed during a stream survey on September 3. The last seven coho were observed on December 12 (Table 19). The number of fish observed between these two dates ranged between 3 and 10 fish. No coho spawning was documented at any location, however darker fish began to act aggressively and were observed near tailouts on October 23 and the 30. The majority of fish were observed in the Falls Pool, with the rest being located in Reaches 1-3.

Table 19. Number of coho salmon observed during 2003 stream surveys

Date	Number	Comments
9/03/03	3	One fish each at PMO Pool ,WBP, and the Falls Pool
9/05/03	1	At Index Pool
9/11/03	2	Both fish at Falls Pool
9/15/03	3	2 fish at the head of the CA, and 1 at the PFA,
9/28/03	1	Impassable past the head of the CA.
10/04/03	6	4 fish at Falls Pool, 2 at PMO.
10/10/03	7	6 fish at the Falls Pool, 1 at the PMO Pool. All coho were bronze to black.
10/23/03	10 .	All 10 were at the Falls Pool and those towards the tailout were

		acting aggressively.
10/30/03	8	Six fish at the Falls Pool, and 2 were pushed off tailout of PMO on way up.
11/05/03	7	All coho were red to black with 6 at the Falls Pool, and 1 at the PMO. Coho carcass at the bottom of the PMO Pool.
11/17/03	10	8 at the Falls Pool, one dark fish in eddies in both WBP and PMO Pool
12/05/03	7	All in Falls Pool

DOLLY VARDEN

Index Surveys

During index surveys ten Dolly Varden were seen on July 25 and two on August 4.

Stream Surveys

Dolly Varden were observed and counted during four stream surveys (Table 20). The lack of counts from July 25 to September 15 was likely due to the difficulty of accurately observing and viewing the char among the thick salmon densities. Although no Dolly Varden were observed spawning, one male Dolly Varden in spawning dress was observed at the tailout of the Falls Pool.

Table 20. Dolly Varden observed during 2003 stream surveys.

Date	Number	Comments
7/18/03	1	Located mid way in thalweg of CA
7/25/03	33	10 fish were at the Index Pool, 10 were at the CA, 10 were at the PMO/ PFA Areas, and 5 were at the WBP.
9/15/03	8	Dolly Varden in PFA with Dollies towards scour pool, and rainbow trout in the run behind.
10/30/03	1	Dolly Varden male in spawning dress at Falls Pool tailout

Tailrace Surveys

Dolly Varden were observed during tailrace surveys from July 14 until August 8. (Table 21.)

Table 21. Dolly Varden observed during 2003 tailrace surveys.

Date	7/10	7/14	7/25	7/30	8/04	8/08	8/11
Number	0	25	25	27	15	10	0

Intertidal Surveys

25 Dolly Varden were observed at the creek mouth on July 25.

Minnow Trapping

No juvenile Dolly Varden were sampled during minnow trapping.

Hook and Line Sampling

Dolly Varden char were caught during hook and line sampling sessions on July 18, 2003 and on July 25, 2003 (Table 22). The length of the char sampled ranged from a minimum of 153mm to a maximum of 391mm. Dolly Varden were not caught during any trapping sessions or during other hook and line sampling sessions.

Table 22. Dolly Varden char sampled during 2003 hook and line sampling

Date	Location	Length (mm)
7/18/03	Concrete Area	Lost at shore
7/25	Tailrace	153
		358
		223
		241
		185
		275
	CA	183
		162
		391
		218
		268
	PMO	196
		190
	WBP	231

RESIDENT RAINBOW TROUT

For the purposes of this study rainbow trout ranging from 250-490mm were considered resident adults. Rainbow less then 250 were considered resident juveniles, although fish in this size range could end up as either anadromous steelhead or resident rainbows.

Index Surveys

Although no fish were positively identified as resident rainbows during index surveys, 6-10 juvenile rainbow were observed during a snorkel survey on October 4.

Stream Surveys

Rainbow Juveniles

Juvenile rainbow were observed in limited areas associated with food and adjacent overhead cover during stream surveys (Table 23). These areas included: the north west side of the Index Pool tailout, the northwest side of the CA, the eastern side of the PMO area, Spring Creek, the Third Pool (ascending upstream of Reach 6) and the BLF area.

Table 23. Juvenile rainbow observed during 2003 stream surveys

Date	Reach	Location	Number	Approx. Size
3/31/03	5	LWD in Spring Creek	1	One slow rise > 150 mm
5/03/03	6	2 at BLF Pool 1 at 3rd Pool	3	All <200 mm
7/1/03	5	Log Boom	3	3 <200 mm
10/04/03	1	Tailout/riffle of Index Pool	6-10	<100mm actively feeding
10/26 /03	2	By/under CA rocks and LWD	2	Few rainbow fry >90 mm
10/30/03	3	Over carcasses at PMO	1	one fry
11/05/03	3	At LWD /rock PMO	6	<100mm

Adult Resident Rainbow Trout

Generally, the PFA, the PMO Pool and the Falls Pool were the areas where residents were most often found in Reaches 1-3 (Table 24). Reach 4 appeared to have a very limited population with at most 2 fish per survey being observed at the Slot Exit Pool. Observations in Reach 5 were limited to the BLA, the Campground Bridge (CBP), the area directly adjacent to the FVU and Spring Creek. Resident rainbow were observed in all pool areas in Reach 6 except the First Pool above the FVU and the Plunge Pool.

Table 24. Resident rainbow trout 250-490mm observed during 2003 stream surveys

Date	Reach	Location	Number
3/31/03	3	Both Fish at PFA	2

	6	3 at BFA , 2 at 2nd Pool	5
4/07/03	3	All at Falls Pool	2
4/14/03	3	All at PFA	3
4/20/03	3	All at PFA	1
	4	Slot Exit Pool	1
	5	All at FVU Area	4
	6	3 at BLF pool, 2 at 3rd Pool	5
4/28/03	3	PMO	2
4/28/03	5	Spring Creek	1
5/03/03	1-3	PFA	3
	4	Slot Exit Pool	2
	5	CBP	4
5/26/03	1-3	PMO tailout,	2
5/29/03	1	Index Pool tailout	2
6/2/03	1-3	3 at Falls Pool tailout, 1 at PFA tailout, 2 at PMO tailout	6
	4	Slot Exit Pool tailout	2
	5	CBP tailout	6
6/5/03	6	BLF area	4
6/10/03	3	PFA	1
6/26/03	3	PFA	2
6/28/03	3	PFA	2
6/30/03	3	4 at Falls Pool, 3 at PFA/PMO	7
	4	2 at Slot Exit Pool	2
7/1/03	5	2 at CBP, 1 at Boom Logs	3
	6	Spooked fish at BFA Pool	?
7/10/03	3	2 at log in PMO, 1 Large rainbow at P.F.A	3
8/15	5	2 at FVU, 1 at CBP	3
	6	3 at BFA, 1 at Plunge Pool	4
9/15		PFA	3
9/28	5	In flood channel behind Boom Logs	1
10/04	3	1 at WBP, 1 at PFA	2
10/30	3	Falls Pool	2
11/05	3	PFA	2
	5	All at FVU area	15
	6	5 at BFA area, 1 at 2nd Pool	6
12/12	5	2 at FVU	2

Minnow Trapping.

Minnow trapping results are summarized in Table 25. In general 68 rainbow were sampled ranging in size from 27- 191mm. Important rearing areas in Reaches 1-3 included the Index Pool tailout, and the NW side of the CA (Table 25). No juveniles were captured in Reach 4. The edge water below Long Pool, Spring Creek, the Boom Log Area, and the CBP, were important in Reach 5. All slower water areas trapped in Reach 6 contained juveniles.

Table 25. Juvenile rainbow captured by minnow trapping, 2003

Date	Reach	Number of Traps	Soak Time (hr)	Number
Feb. 15/16	5	10	162.3	17
Feb 23	6	8	114.3	5
April 6/7	1-3	10	157.5	8
April 7	5	10	16.5	4
April 27/28	4	8	163.0	0
May10/ 11	5	10	184.5	4
May 12	5	8	163.0	5
May 13	1-2	7	174.0	3
May 13	4	8	141.75	0
May 15	3	10	200.00	9
June 5	6	6	39.25	4
June 6	6	10	147.5	3
July 18/19	2	2	29.25	4
August 30	2	4	4.75	2

Hook and Line Sampling

Juvenile Rainbow

Twenty-two juvenile rainbow were sampled during hook and line sampling. They ranged in length from 121-249mm and weights ranged from 75-210 gm. condition factors ranged from .88-1.84 with all but two of the factors being greater then one (Table 26). The majority of fish sampled came from Reaches 3 and 6.

Table 26. Juvenile rainbow trout sampled during 2003 hook and line sampling

Date	Reach	Location	Length (mm.)	Weight (gm.)	K
4/28	6	BFA	196	81	1.08
	6	BFA	168	75	1.58
	6	Plunge Pool	241	160	1.14
5/11	5	Edge water below Spring Creek	225	N.A.	
	5	CBP	221	N.A.	
5/26	3	PMO Tailout	182*	N.A.	
		PMO Tailout	212**	N.A.	
6/5	6	BFA	201	N.A.	
	6	BFA	120	N.A.	
	6	3rd Pool	151	N.A.	
	6	3rd Pool	123	N.A.	
	6	2nd Pool	156	N.A.	
	6	2nd Pool	121	N.A.	
6/26	3	PMO	249	178	1.15
	3	PFA	112	N.A.	
	3	PFA	227	112	0.96
	3	WBP	225	210	1.84
	3	WBP	189	105	1.56
7/10	3	Falls Pool	223	98	0.88
7/18	3	CA	184	82	
7/25	3	PMO	213	111	1.15
	3	PMO	243	185	1.29

* Male in spawning dress
**Female spilling eggs

Adult Rainbow Trout

Ten adult resident rainbow ranging in length from 253mm to 552mm and weight 415-783gm. were sampled during hook and line sampling. Condition Factors ranged from 0.89 to 1.79 with only one fish having a factor of less then 1.0. All fish except one were from Reaches 3 and 6 (Table 27).

Table 27. Resident rainbow trout sampled during 2003 hook and line sampling

Date	Reach	Location	Length (mm.)	Weight (gm.)	K
4/28	6	BFA	365	432	0.89
	6	BFA	296	274	1.06
	6	2nd pool	284	261	1.14
	6	Plunge Pool	368	527	1.06
	6	Plunge Pool	385	648	1.14
6/26	3	PFA	345	450	1.10
	3	PFA	552	N.A.	
	3	PFA	415	783	1.10
6/30	tailrace	TR channel	253	236	1.46
7/25	3	PMO	278	385	1.79

DISCUSSION

OVERALL SPECIES REPRESENTATION

Sawmill **C**reek fish surveys during 2003 resulted in observations or capture of five pacific salmon species (pink, chum, coho, king, and sockeye) and two other anadromous species, Dolly Varden char and steelhead trout. Two resident species, rainbow trout and staghorn sculpin were documented. No anadromous fish were observed upstream of the Falls at SM 0.84.

The 2003 anadromous fish observation and capture results differ from information in the Alaska Department of Fish and Game (ADF&G) Catalogue and Atlas of anadromous fish distribution Alaska ADF&G 1993a and b). These publications indicate that pink, chum, coho, and steelhead are found in Sawmill Creek to the base of Blue Lake dam (ADF&G 1993 a and b).

The absence of anadromous fish upstream of the Falls may be due to the Falls' height and the cascades within the Slot area which present a second barrier to upstream access, particularly during high flows. A Powers and Osborne fish passage evaluation study was begun on the lower falls on November 19, 2003 and a second is planned on the Slot area during the 2004 Field Season.

Indian River, a nearby river with similar flows and a smaller drainage basin, is used in some species discussion for run strength comparison. Peterson Creek a similar system on the Juneau road system is used in steelhead comparison. Indian River and Peterson Creek data are not directly comparable, however due to differences in study methods and objectives.

STEELHEAD

Relative Abundance

Based on counts for both 2002 and 2003, steelhead numbers in Sawmill Creek ranged from about 30 to about 50 fish. Observation conditions were good for both years and fish were concentrated in specific locations, making enumerations more reliable. Fish and Game Surveys conducted on May 9 in 1994 and 1995 observed 17 and 31 fish respectively. Peterson Creek, a similar system located at mile 25 on the Glacier Highway in Juneau had peak counts of 13 fish in 2002, and 36 fish in 2003 (Bob Chadwick personal communication).

Periodicity

Steelhead life history in Sawmill Creek is similar to that in other Southeast Alaska streams, but differs from those further south. Inmigration has been observed to occur in late March through early May, and spawning begins in late April through early June (Wolfe 2003, Table 5). Instead of residing in the stream until the following fall or subsequent spring, however, Sawmill Creek steelhead begin spawning very shortly after their arrival in the stream. Emergence, while not directly observed in our studies, occurs very shortly after spawning, and emerged rainbow were present by July 18. Rearing occurs in the stream, and has not been adequately observed, partly because of the presence of resident rainbow, and difficulty distinguishing between steelhead and resident rainbow juveniles. Since the habitat requirements are similar regardless of there destination, information on smaller mykiss can be found below. Outmigration has not been observed.

Table 28. 2002/2003 Composite Sawmill Creek steelhead periodicity.

Life Stage	Jan.	Feb.	Mar	Apr	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
In-migration				xxxx	xxxx	xx						
Spawning					xxxx	xxx						
Incubation					xxxx	xxxx	xxxx	xxxx				
Rearing	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
Out-migration ?												

Habitat Use.

The majority of adult steelhead utilized the Falls Pool for ripening and spawning. The PMO Pool and PFA areas were the second most important areas. The P.F.A was third in importance, but appeared to have increased spawning activity from last year with a subsequent decrease in spawning at the PMO. This was most likely due to an increase in depth between the adjacent areas creating less distinct stream sections. At the CA at least one pair spawned off a small bar formed by the angled concrete at the inlet, and

inmigrating fish utilized the deeper portions as resting areas while moving upstream. In all areas steelhead utilized deep areas below current seams and then moved into adjacent areas of upwelling in order to spawn.

CHUM SALMON

Relative Abundance

With estimated escapements of 250-300 chum in 2002 and 700-850 chum in 2003, Sawmill Creek chum salmon numbers have ranged between about 250 and 850 fish. The large range between these estimates could be do to natural factors such as ocean survival, stream flow (i.e. flood events), or spawning densities. Also it may be due to the increase of chum production and thereby strays from the nearby Medevejie Hatchery and Deep Inlet chum rearing facilities.

In both 2002 and 2003, there appeared to be two run peaks, one in early August and the other in early September. Fish and Game aerials in on August 6, and August 10, 2001 counted 300 and 500 chums respectively (ADF&G aerials primarily intertidal and mouth counts due to terrain). A September 4, 2002 Indian River chum count contained 152 chum while a September 6, 2002 Saw Mill Creek count contained 28 chum.

Periodicity

Chum salmon life history in Sawmill Creek appears to follow the standard pattern seen in other Southeast Alaska streams (Table 29). Chums arrive in Sawmill Creek in July and inmigrate through early October. Spawning occurs from July through September with a peak in late August, early September. Sawmill Creek chum eggs incubate through March of the following year and emerge during March and early April with little rearing occurring in the stream. Smolts are thought to travel immediately to tidewater, based on the typical pattern for this species. Outmigration was observed during in mid to late April through mid-June.

Table 29. 2001-2003 Composite (2001-2003) chum salmon periodicity

Life Stage	Jan.	Feb.	Mar	Apr	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Inmigration							xx	xxxx	xxxx	xx		
Spawning							xx	xxxx	xxxx	x		
Incubation	xxxx	xxxx	xxxx	xx			xx	xxxx	xxxx	xxxx	xxxx	xxxx
Out-migration				xxxx	xxxx	xx						

Habitat Use

Adult chum salmon utilized pools and other deeper water areas for holding and ripening and then moved into adjacent areas for spawning. Chum salmon appeared more selective then pink salmon however with more spawners occupying and defending redds closer to faster flows and gradient changes.

Post emergent chum salmon have been shown to prefer shaded areas during outmigration (Iwata 1982). When observed and sampled during their out migration, chum fry were found among cobble and boulders with pink fry below the PMO in mid-April, then later on under an undercut concrete slab in the CA. Fry where observed in the area below the PMO probably due to the fact that it is the only slow current available in this fast water section. This area contained water during 2003 stream flows of 64-65 cfs. A further reduction might hasten smolt outmigration by limiting the edge area available for this purpose in this short area.

KING SALMON

Relative Abundance.

In 2002 peak count data was inconclusive due to access difficulties. In 2003 peak counts for both stream surveys and index surveys were taken on August 18, with the peak count for the stream survey being 573 fish. Qualitatively the 2003 run was much stronger. Since the king run in Saw Mill Creek consists of hatchery strays, run strength most likely relates to ocean survival, hatchery production, and variances in fresh water flow between Medevejie Cr. and hatchery, and Saw Mill Creek. As a portion of the headwaters from both systems are adjacent it is possible that when Medevejie is experiencing lower flows due to dry conditions, the more regulated and thereby constant flows of Saw Mill Creek serve to attract a greater percentage of the run.

Periodicity

Composite king salmon periodicity is displayed in Table 30. Other then immigration and spawning king salmon periodicity is speculative as no juveniles have been observed to date.

Table 30. Composite (2002-2003) king salmon periodicity

Life Stage	Jan.	Feb.	Mar	Apr	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
inmigration							xxxx	xxx				
spawning							x	xxxx				
Incubation	xxxx	xxxx	xxx				xxx	xxxx	xxxx	xxxx	xxxx	xxxx
Rearing	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
outmigration			xxxx	xxxx	xxx							

Habitat Use.

In 2002 and 2003 king salmon utilized deep-water habitats, holding there until they were ready to spawn in adjacent upwelling areas. However in 2003 they were also observed spawning in shallower areas along the stream margins probably due to lack of more suitable areas. King salmon have been observed utilizing areas through out Reaches 0-3 for holding and spawning, however in 2003 the greatest concentrations were found in the Fall's Pool.

PINK SALMON

Relative Abundance

In both 2002 and 2003 inmigration peaked during the first and second weeks of September, and peak counts of 10,740 and 36,130 fish were observed during on September 25, 2002 and September 11, 2003 respectively (Wolfe 2003, See Table 15). This would be considered a "middle run timing" for Southeast Alaska and this is consistent with the Sawmill Creek's location (Sheridan 1962a and Royce1962). Even numbered years have been shown to be stronger runs in most southeastern systems. (INPFC Stat Books). However, it is difficult to say whether Sawmill Creek is an "odd" or "even" year pink salmon run because of the unusually large escapement for 2003. 52,000 fish appeared to be the maximum that this stream could contain with pinks utilizing all available areas in Reaches 1-3. The composite pink salmon escapement estimates for 2002-2003 ranged from 11,000 to 52,000 pinks, and no estimate was made for 2001.

Periodicity

Pink salmon periodicity in Sawmill Creek is typical for streams in Southeast Alaska (Table 31). No rearing period is shown because post-emergent fry begin moving toward tidewater almost immediately after buttoning up in April. Post emergent pink fry were observed on April 14, 2003 and April 28, 2003 below the PMO.

Table 31. Composite (2001-2003) pink salmon periodicity.

Life Stage	Jan.	Feb.	Mar	Apr	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
inmigration							xxxx	xxxx	xxxx			
spawning								xxxx	xxxx	xx		
Incubation	xxxx	xxxx	xxxx	xxxx					xxxx	xxxx	xxxx	xxxx
outmigration			xx	xxxx	xxxx	xx						

Habitat Use

Adult pink salmon primarily used pools and slower habitats for holding and ripening and then moved to nearby riffles, tail outs and bars to spawn. With the large escapement of 2003, however, pink salmon could also be found in limited numbers holding in eddies and holes.

Like post emergent chum salmon pink salmon tended to be found in more areas along the edge of the stream, however they appeared to have less of a preference for cover then chum salmon even when pressured with a dip net.

SOCKEYE SALMON

Only one sockeye salmon was observed during the 2002 survey season, and no sockeye salmon were observed during the 2001 survey season. In 2003 one to two sockeye were seen on different dates in different areas of the stream, late in the life when they are highly visible. Sockeye are known to require an accessible lake system for rearing. Sockeye salmon seen in Sawmill Creek are likely a strays from a nearby system.

COHO SALMON

Relative Abundance.

Peak counts were eleven coho were on October 6, 2001, nine coho on November 9, 2002, and 10 coho on October 23, and November 17, 2003. Peak counts occurring after what is considered the peak immigration period are probably due to better observation conditions during these later surveys.

The 2001 coho escapement was estimated at 10-20 coho, the 2002 and 2003 coho escapements were estimated to be 10-30 fish and 10-20 fish, respectively. Average 2001-2003 coho escapement is therefore estimated at 10-30 fish. A survey taken on October 3, 1985 consisted of 100 coho, and is the only other recent observation from Saw Mill Creek (ADF&G Stream Survey records).

Periodicity

Sawmill Creek coho salmon periodicity is typical for this species in Southeast Alaska (Table 32). The lack of coho rearing and outmigration observations limits confidence in the overall life history information base.

Table 32. Composite (2001-2003) coho periodicity.

Life Stage	Jan.	Feb.	Mar	Apr	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Inmigration									xxxx	xxxx	xx	
Spawning										xxxx	xxxx	
Incubation	xxxx	xxxx	xxxx	xxxx						xxx	xxxx	xxxx
Rearing	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
Out-migration					xxxx	xxxx	xxxx					

The first coho of the 2001 and 2002 runs were both observed on September 25, and on September 5, in 2003. The last coho were observed on December 12, 2001, and on December 3, 2002. Estimated peak immigration time for all years is mid September to mid October. A better estimate is difficult due to the substantial amount of other salmon obscuring the deeper pool areas, and also flows and weather conditions which make access and visibility poor at this time of year. Historical sport fish records (Chadwick 2004) indicate that angling pressure was high on weekends (as many as 25-30 anglers) in the "gorge area" or lower ¼ mile of Sawmill Creek, during mid- to late September. Anglers were seen catching coho salmon and Dolly Varden char.

Habitat Use

In 2003 Adult coho primarily held, rested, and ripened in slower water habitats of the Falls Pool and PMO Pool. Coho salmon were seen defending redd sites at the tailout of the Falls Pool. During this same time two coho were pushed from the tailout of the PMO Pool into deeper water.

During 2002 only three juvenile coho were sampled in the PMO Pool and during 2003 no juvenile coho were sampled or observed. Coho, unlike pink and chum salmon, require instream rearing habitat for one to three years after emergence. During that resident time period, coho salmon prefer the slow back waters and side channel habitat. The relative absence of this habitat below the Falls, as well as the absence of a lake downstream of the spawning areas, may explain the low numbers of coho salmon.

DOLLY VARDEN

Relative Abundance

In 2002 the absence of pre-smolt Dolly Varden in the trapping data, the absence of spawning Dolly Varden, and the size the six char caught seemed to indicate that they were strays from a nearby system. However, the presence of two Dolly Varden fry in 2002 indicated that at least a limited amount of successful spawning takes place. Also, many of the Dolly Varden sampled with hook and line in 2003 were of spawning class size, and a male in spawning coloration was observed in the Falls Pool on October 30, 2003. Relative abundance of resident Dolly Varden appears to be fairly low when compared to other systems which typically contain more rearing habitat.

Periodicity

In 2003, anadromous Dolly Varden appeared to begin immigration in mid-July with numbers peaking and declining soon after. Resident and spawning use is highly speculative as observations are limited to an observation of two fry in 2003 and one adult male in spawning dress (Table 33).

Anadromous Dolly Varden populations in southeast Alaska often have complex migration patterns (Armstrong 1984). In spring, the spawning portions of Dolly Varden populations leave lake wintering areas and migrate directly to their resident spawning streams. Sexually immature Dolly Varden leave either resident streams as smolts or lake wintering areas and travel in and out of nearby watersheds until a watershed with an accessible lake is found.

Table 33. 2001-2003 Composite (2001-2003) Dolly Varden char periodicity

Life Stage	Jan.	Feb.	Mar	Apr	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Inmigration										xxxx	xx	

Spawning										xxxx	xxxx	
Incubation	xxxx	xxxx	xxxx	xxxx						xxx	xxxx	xxxx
Rearing	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
Out-migration					xxxx	xxxx						

Habitat Use

Adult Dolly Varden were found throughout Reaches 1-3, usually in association with salmon spawning. Like juvenile coho salmon, resident juvenile Dolly Varden prefer slower back waters and side channel habitat for winter residency and Sawmill Creek has limited areas of this habitat type.

RESIDENT RAINBOW TROUT

Resident adult and juvenile rainbow trout were observed and/or captured in all reaches during the 2001 through 2003 study period. However, during that period, Reach 4 had consistently fewer sightings and captures. No rainbow were caught using hook and line sampling in this Reach in 2003.

"Adult" resident rainbow in the 250 to 490 mm size category were not aged, but some inferences about age can be drawn from the literature. Most of these fish would be greater then three years old which is the most common freshwater residency for steelhead in British Columbia and Alaska (Withler 1966, Van Hulle 1985). All age class characterizations are based on previous Blue Lake studies and have not been verified in Sawmill Creek (Chadwick 2004, Der Hovanisian 1994).

Relative Abundance.

The relative abundance of rainbow trout is speculative due to many factors. **N**umbers of rainbow trout adults and juveniles appear to vary according to habitat, recruitment from dam spill episodes, seasonal habitat preferences, angler harvest and, in cases where juveniles might be steelhead and not residents, smolt outmigration.

Immediately after a spill episode, there are often more adult and juvenile rainbow in Reaches 5 and 6, especially in the area near the FVU. Increased juvenile utilization in this area may be the result of those fish seeking optimal temperatures in winter and spring, and subsequent dispersal over summer as stream temperatures rise (Meyer and Griffith 1997, Campbell and Neuner 1985).

Since the "stocking" effect of dam spills is fairly well known among local anglers adult rainbows in this area receive a large amount of fishing pressure. Therefore it is difficult to determine the extent to which angler harvest (which is expected to be periodically high) affects results over the sampling period each year. Finally, especially in the lower stream Reaches, it is not possible to determine numbers of fish identified as juvenile

rainbow which will become steelhead and which will eventually be lost to the population through outmigration.

Generally, it is thought that overall rainbow trout abundance is strongly influenced by both juvenile and adult recruitment from spill, leading to higher overall numbers. These higher numbers, in the case of resident fish, may be offset by angler harvest. In the case of juvenile fish those forced off suitable rearing habitat may be moved into brackish areas thereby becoming anadromous steelhead.

It is not an objective of this study to estimate Sawmill Creek rainbow trout populations; any such estimates might be strongly influenced by the recruitment and loss factors discussed above. Compared to other streams in the area, however, it is estimated that overall Sawmill Creek rainbow trout abundance is relatively high. The exceptions to this would a those systems with lakes not dominated by cutthroat trout *(O. clarki)*.

Periodicity.

Rainbow trout periodicity is based on the limited resident trout observations and professional judgment (Table 34). Although it varies between individual fish strains the rate of rainbow trout egg development is dependent in regards to water temperature. At the stream temperatures encountered, even taking into account the inaccuracies involved, for there to be emerged rainbow fry in mid July some rainbow or steelhead spawning would have had to occurred early to mid-May (Leitritz and Lewis 1980).

Table 34. Composite rainbow trout periodicity.

Life Stage	Jan.	Feb.	Mar	Apr	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Spawning					xxxx	xxxx						
Incubation					xxxx	xxxx	xxxx	xxxx	xxx			
Rearing	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx

Habitat Use

Resident Rainbow Adults

Rainbow in the 250-490mm size range tended to utilize deeper areas with cover, and moved into shallower nearby tailouts only during spawning or when feeding behind spawning anadromous fish or during insect hatches. Deep-water habitats with concentrations of trout included the PFA, the Falls Pool, the PMO area, near the FVU, the BLF area, and the Plunge Pool.

During winter, rainbow of all size classes used slow, deep water areas with large boulders or woody debris such as at the PMA, PMO, Long Pool, Spring Creek, and in slow water areas in Reach 6. As water temperatures increased these fish spread out to utilize more different habitats.

Rainbow Trout Juveniles

Until mid-May when water temperatures approached 6.0 degrees C, rainbow juveniles utilized the cliff wall on the northwest side of the Index Area, the rocks and under cut LWD of the northwest side of the CA, the edge water below Long Pool, and the LWD at the inlet to the Spring Creek Pool. As water temperatures increased, the smallest fish continued to utilize these areas but larger fish moved nearer the current or into adjacent riffles to feed.

Fish in the 150-250mm size range were sampled early the year in the same habitats as the smaller fish. As the season progressed, many moved out into more exposed habitats. This movement was particularly pronounced during peak feeding periods such as at twilight, during aquatic insect hatches, and in the presence of spawning salmon. Tailouts, eddies near current, and submerged boulders were utilized in all areas during these periods. Fish in this size range were also found behind larger fish in deep water habitats with submerged large boulders, the PFA, the Falls Hole and the numbered pools in Reach 6

Condition Factor

All but a few adult rainbow had Condition Factors greater than 1.00. Chadwick, 2004, also reported Sawmill Creek rainbow with small heads and robust bodies. The majority of fish in Sawmill Creek appear to be in very good condition.

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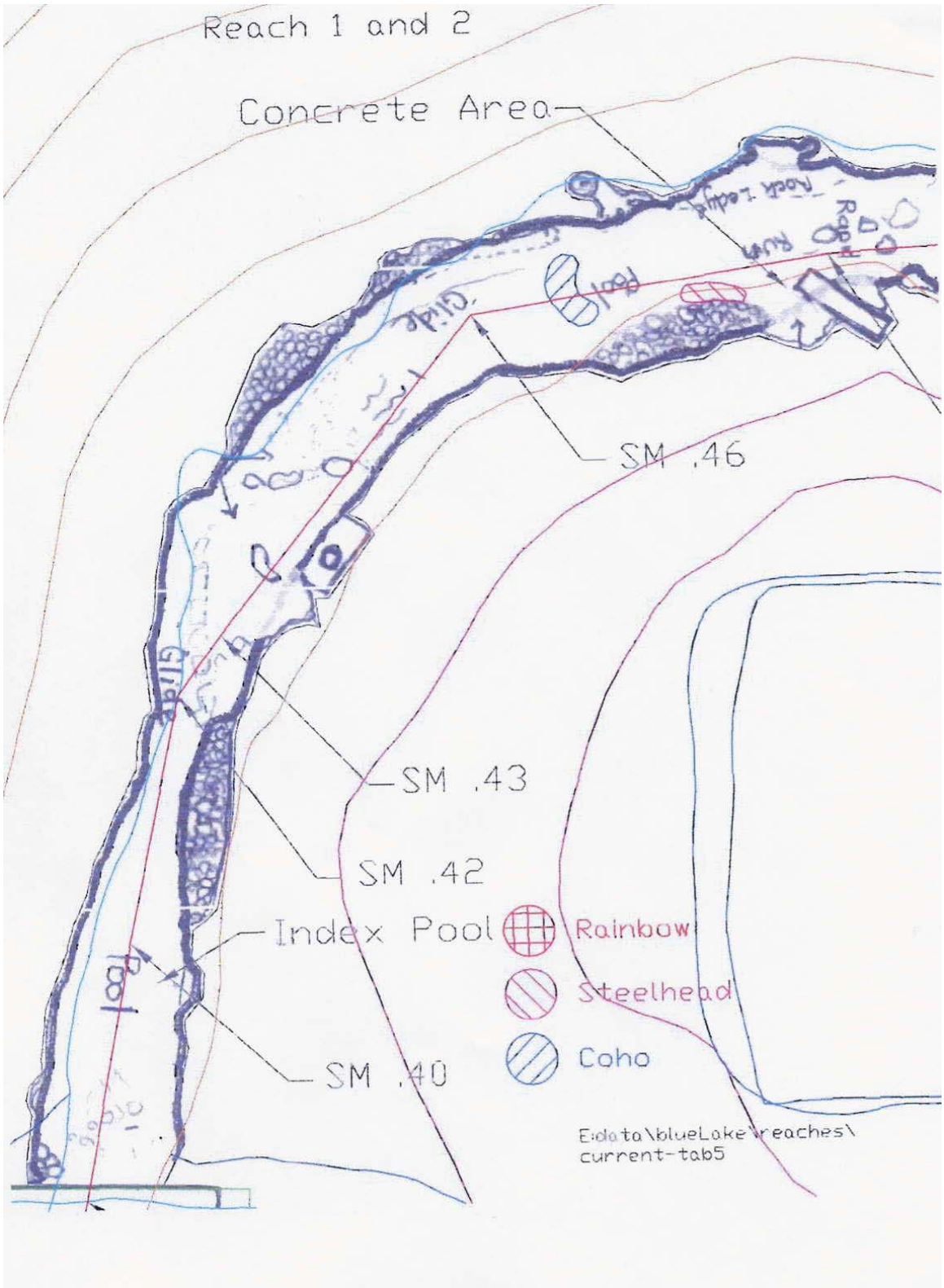
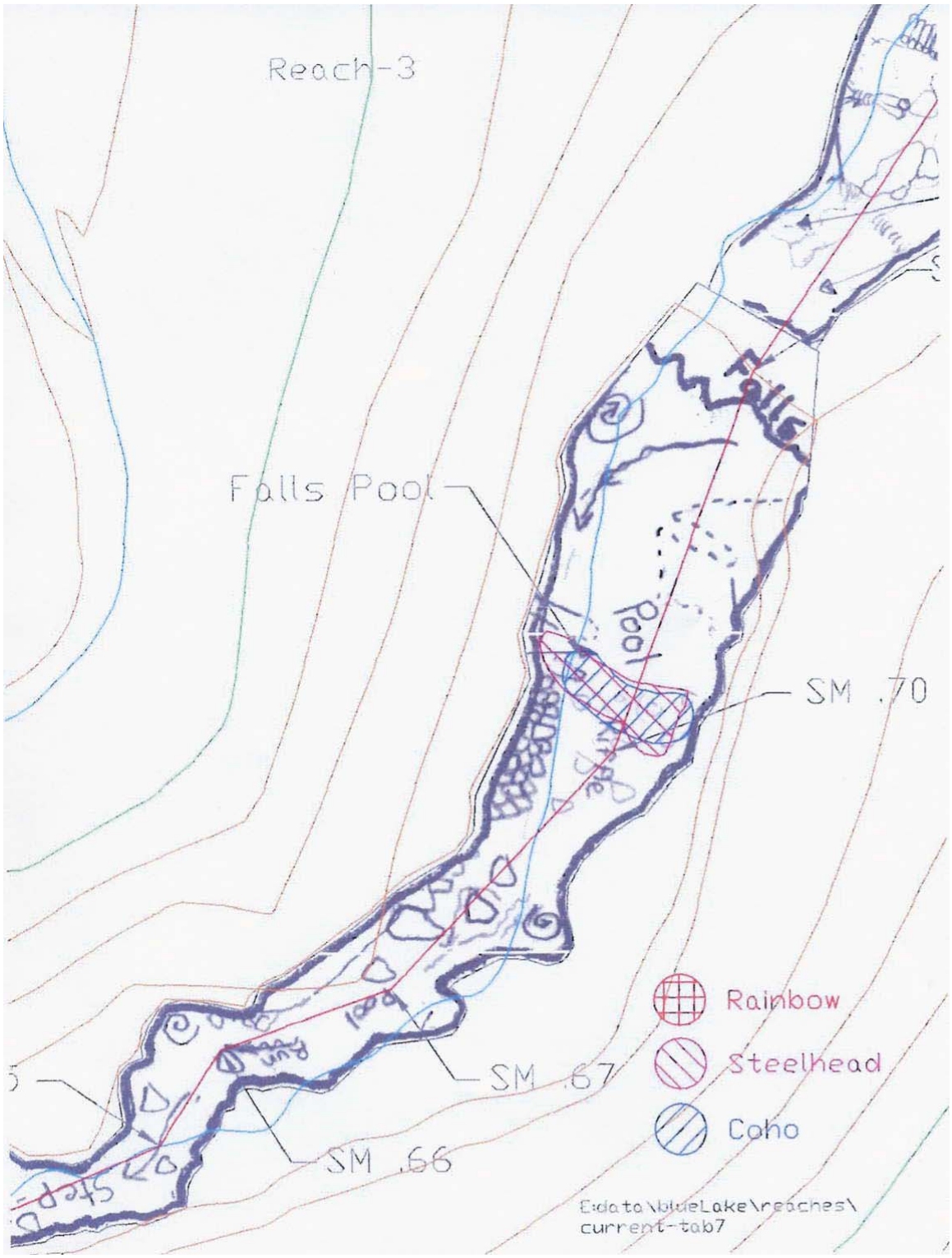
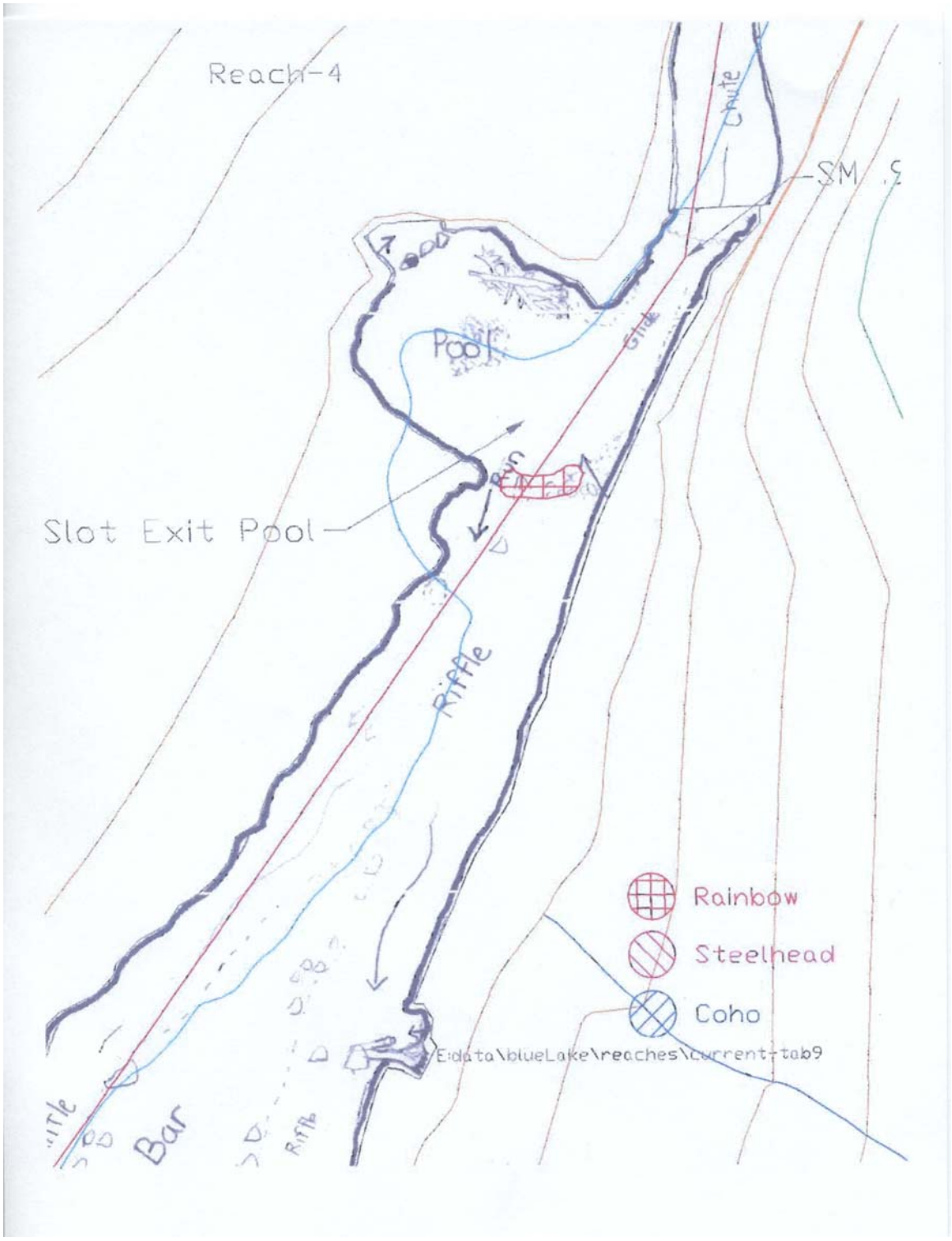
APPENDIX I

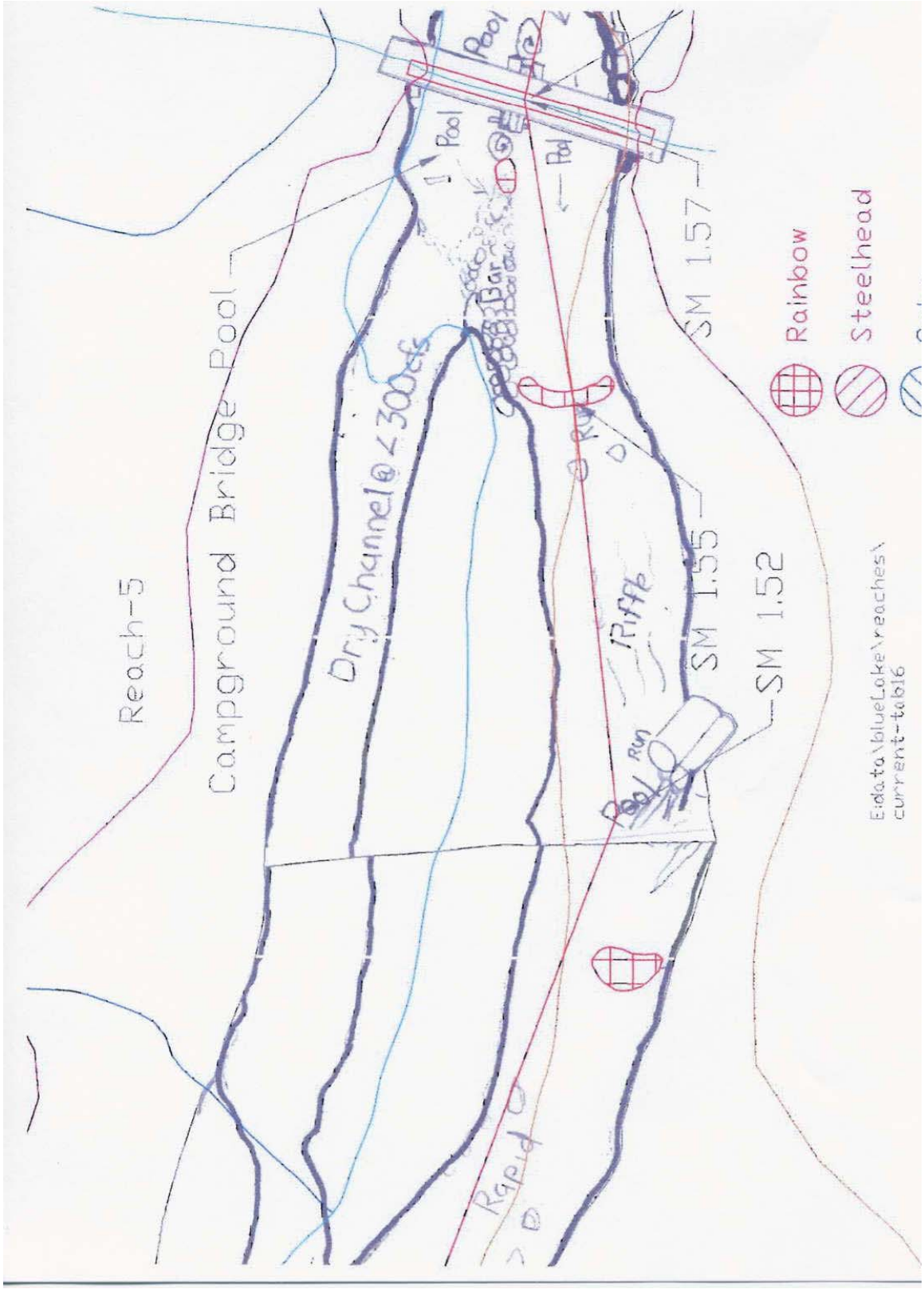
Sawmill Creek Maps of Reaches 1-6 Annotated as of December, 2003


Reach 1 and 2
Concrete Area
SM .46
SM .43
SM .42
Index Pool
SM .40
Rainbow
Steelhead
Coho
E:\data\blueLake\reaches\
current-tab5


Reach-3
Falls Pool
Falls
Pool
SM .70
SM .67
SM .66
Rainbow
Steelhead
Coho
E:data\blueLake\reaches\
current-tab7

Reach-3
SM .61
Rapids
Scour Pool
Run
Pipe Fitting Area
Rainbow
Steelhead
Coho
SM .55
GLIDE
RIFFLE
Pulp Mill Outfal
E:data\blueLake\reaches\
current-tab6
SM .49


Reach-4
Chute
SM
Pool
Glide
Slot Exit Pool
Riffle
Rainbow
Steelhead
Coho
E:\data\blueLake\reaches\current-tab9
Bar
Riffle


Reach-5
Campground Bridge Pool
Dry Channel @ < 300cfs
Pool
Pool
Bar
Pool
Run
Riffle
Pool
Run
Rapid
SM 1.57
SM 1.55
SM 1.52
Rainbow
Steelhead
E:\data\BlueLake\reaches\current-table