S.S.R.A.A.

HATCHERY CREEK

106-30-51

HABITAT ASSESSMENT

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1.0 Introduction

The Hatchery Creek system, on the northern end of Prince of Wales Island (Fig. 1), has two barrier falls, located approximately 2.4 and 2.7km (1.5 and 1.7 miles) upstream from Sweetwater Lake, which limit the accessible stream length for anadromous fish. The stream system may have potential for rehabilitation since alteration of the falls to improve fish passage would increase the accessible stream length for salmonids. To evaluate this potential, the spawning and rearing habitat for salmonids above and below the falls was assessed during three surveys conducted between August 1 and 26, 1978.

The falls have been described as partial barriers during average water levels and as complete barriers during extreme water levels.[1] Historically, pink salmon utilize the stream below the falls, while coho and sockeye use the upper stream area. During the present survey above the falls, approximately 100 adult coho and 2 sockeye salmon were observed and juvenile coho salmon were abundant in some of the tributaries. Below both falls, an estimated 430 pink, 795 coho and 110 sockeye salmon adults were observed and an additional 86 adult coho and 15 sockeye salmon were observed between the falls. Several coho salmon were successfully jumping the upper falls.

2.0 Procedure

The stream was surveyed in sections by walking its length. The parameters recorded for each stream section were:

(1) length
(2) width (average and range)
(3) depth (average and range)
(4) gradient (^{o})
(5) substrate:
    (a) percent composition of:
        (1) exposed bedrock
        (2) large boulder (greater than 0.9 m diameter)
        (3) small boulder (0.3 - 0.9 m diameter)
        (4) large cobble (15.2 - 30.5 cm diameter)
        (5) small cobble (7.6 - 15.2 cm diameter)
        (6) course gravel (2.5 - 7.6 cm diameter)
        (7) fine gravel (less than 2.5 cm diameter)
        (8) fines (sand, silt, clay, muck)
    (b) compaction:
(6) pool/riffle/rapid ratio (P:R:R)
(7) available spawning area (%)
(8) juvenile and adult fish species and abundance
(9) aquatic vegetation density
(10) instream organic debris and cover

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[1] Crowell, William B., 1972. Report to U.S.F.S. Ketchikan, Alaska Office: Hatchery Creek Survey and Recon. 9 pp.

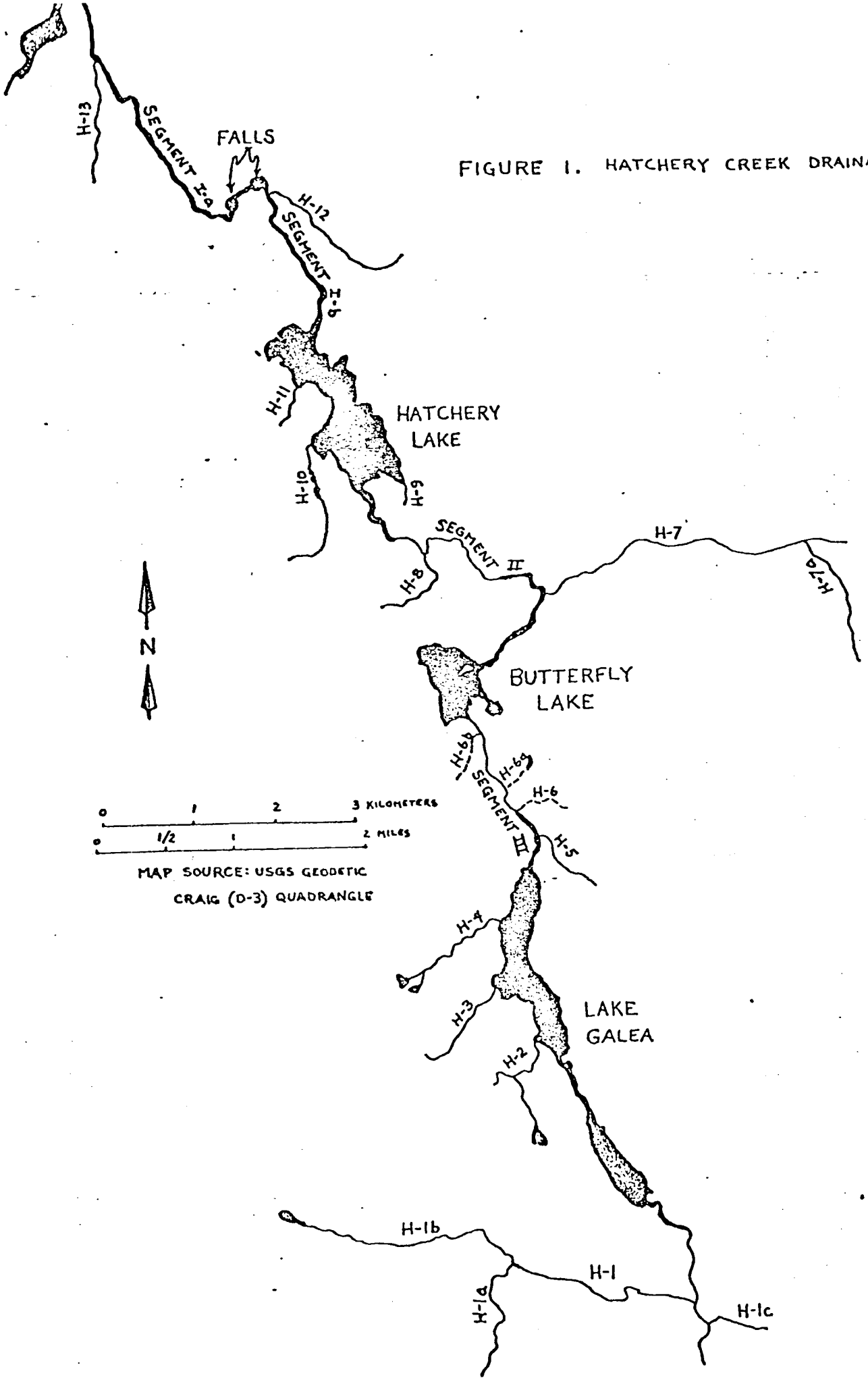

FIGURE 1. HATCHERY CREEK DRAINAGE.

2.0 Procedure

(Continued)

(11) density of canopy and species
(12) pool type
(13) quality of rearing habitat

Most parameters were based on observations by the surveyor. However, stream dimensions were usually measured using a distance-finder or tape and gradients were determined with a clinometer. Additional information was recorded for representative stream sections; these were temperature, using a hand-held thermometer, and discharge, estimated by the "chip method."

The available spawning area was estimated as the percentage of riffle area which contained adequate water depth and suitable substrates for spawning salmon. Generally, non-compacted substrates between 2.5cm and 15.2cm (1 and 6 inches) were considered spawnable.

Rearing area was quantified as the instream pool area. Since rearing is not restricted to the pools, these values are conservative.

The pool/riffle/rapid ratio was determined by estimations of the surface water velocity. Generally, pools were considered to be less than 0.2 meters per second (0.7 feet/second) and riffles between 0.2 and 1.0 meters per second (0.7 and 3.3 feet/second); surface water velocities greater than 1.0 meter per second were considered rapids.

3.0 Results and Discussion

A total of 29.6km (18.4 miles) of stream were surveyed in the Hatchery Creek drainage. The total stream area surveyed (310,962 m^2) contained 16% (51,197 m^2) spawning area and 50% (155,412 m^2) pool area. The upper falls restricts utilization of 79% of the total stream area, 78% of the total spawning area and 91% of the total instream pool area (Table 1). Physical characteristics of the streams are summarized in Table 2.

3.1 Below the Falls

Segment I-a of the Hatchery Creek mainstem extends 2,744m upstream to the upper barrier falls. The total area (65,968 m^2) contains 17% (11, 177 m^2) spawning area and 21% (13,818 m^2) pool area.

Additional spawning and rearing areas are available on Tributary H-13 which enters Segment I-a of the mainstem approximately 0.6 km upstream on the west bank. Although this stream was not assessed during the present survey, it has been described as a major fish stream and is useable for its entire length (2.4km)[1].

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[1] Ibid.

TABLE I. Distribution of Spawning and Rearing Areas in Hatchery Creek Drainage Summarized by Stream.

LOCATION	LENGTH SURVEYED (m)	TOTAL AREA (m^2)	SPAWNING AREA (m^2)	SPAWNING AREA (%)	REARING AREA (m^2)	REARING AREA (%)	PERCENT OF TOTAL: SPAWNING AREA	PERCENT OF TOTAL: REARING AREA
Below Falls								
Mainstem: Seg. I-a	2,744	65,968	11,177	17	13,818	21	22	9
Below Falls Total	2,744	65,968	11,177	17	14,818	21	22	9
Above Falls								
Mainstem: Seg. I-b	2,405	52,868	2,792	5	20,700	39	5	13
Seg. II	2,790	54,575	11,744	22	26,020	48	23	17
Seg. III	2,568	39,075	3,171	8	35,670	91	6	23
Tributaries: H-1	4,285	41,785	6,017	14	32,798	78	12	21
H-1a	1,372	4,901	12	< 1	2,390	49	< 1	< 1
H-1b	1,683	5,647	2,111	37	3,515	48	4	2
H-1c	2,978	5,493	0	0	4,954	90	0	3
H-2	689	4,841	0	0	4,639	96	0	3
H-3	995	957	0	0	916	96	< 1	< 1
H-5	510	742	114	15	492	66	0	< 1
H-7	3,700	23,504	11,973	51	6,250	27	23	4
H-7a	1,052	4,214	247	6	1,001	24	< 1	< 1
H-8	841	2,969	959	32	987	33	2	< 1
H-12	950	3,423	880	26	1,262	37	2	< 1
Above Falls Total	26,818	244,994	40,020	16	141,594	58	78	91
Drainage Total	29,562	310,962	51,197	16	155,412	50	100	100

TABLE II. Physical Characterstics of Hatchery Creek Drainage Summarized by Stream.

LOCATION	ESTIMATED DISCHARGE (CFS)	WATER TEMP. (°C)	GRADIENT (°)	WIDTH (m)		DEPTH (cm)	
				$\bar{X}$	RANGE	$\bar{X}$	RANGE
Mainstem:							
Seg. I-a	-	-	0.5-3.0	24	18-40	25	5-132
Seg. I-b	150	17	0.5-1.0	22	12-34	28	5-152
Seg. II	325	14-17	<1.0	20	2-33	58	3-152
Seg. III	-	18-19	0.5	20	3-21	64	3-122
Tributaries:							
H-1	7	15-18	<1.0-2.5	16	0.3-38	36	3-305
H-1a	2	15	0.5-2.0	4	0.3-12	20	3- 91
H-1b	1	17-19	0.5	3	0.3-12	15	3-122
H-1c	-	-	0.5-3.0	2	0.2-12	25	1-152
H-2	-	18-19	0.5-2.0	7	0.3-30	43	1-183
H-3	-	11-14	<1.0-5.0	1	0.3- 6	30	1- 91
H-4	-	-	-	-	-	-	-
H-5	1.5	12	1.0	2	0.2- 8	18	1-122
H-6	-	-	-	-	-	-	-
H-7	25	11	<1.0-2.0	6	1.0-21	25	3-122
H-8	8	9-13	1.0-2.0	3	2.0- 8	18	8-122
H-9	-	-	-	-	-	-	-
H-10	1	14	-	1	0.6- 6	20	5- 46
H-11	-	-	-	-	-	-	-
H-12	5	12	0.5-1.0	4	0.6-12	13	3- 96

3.1.1 Spawning Area

Most (98%) of the spawning area in Segment I-a was contained in Reach 1 (0 to 1,134m upstream), while Reach 2 (1,134 to 2,744m upstream), the stream length containing the two barrier falls, contained the remaining 2% of spawning area (Table 3).

The total area of Reach 1 (29,180 m^2) included 37% (10,956 m^2) spawning area. Substrate compostion was predominately coarse and fine gravels (52% and 32%, respectively) of moderately loose compaction and the water surface was mostly riffles (63%), especially in the upper length. During the survey (August 26, 1978), an estimated 430 pink, 800 coho, and 100 sockeye salmon were observed; approximately half of the pink salmon were spawning.

In Reach 2, a canyon-like area with increased gradient, the streambed was mostly large and small boulders (25% and 55%, respectively) with, generally, swift waters (82% riffles; 10% rapids). Consequently, less than 1% (221 m^2) was considered spawnable. No spawning salmon were observed in this reach, however, an estimated 86 coho and 15 sockeye salmon adults were holding near the base of the upper falls.

3.1.2 Rearing Area

Based on the instream pool area, 79% (10,875 m^2) of the rearing area below the falls was located in Reach 1, which appeared to be good to fair-quality rearing habitat (Table 4). Reach 2 contained the remaining 21% of rearing area below the falls and offered fair-quality rearing habitat. The pools tended to be larger in Reach 1 and contained higher amounts of instream cover than Reach 2. During the survey, a few juvenile coho salmon were observed in Reach 1, however, they were more common in Reach 2.

3.2 Above the Falls

The total stream area above the falls (244,944 m^2) contained 16% (40,020 m^2) spawning area and 58% (141,594 m^2) pool area.

3.2.1 Spawning Area

Most (74%) of the total spawning area above the falls was contained in three streams:

(1) Tributary H-7 (30%)
(2) Segment II of the mainstem (29%)
(3) Tributary H-1 (15%).

The remaining 26% of total spawning area was distributed among eight other streams (Table 5 - Appendix I).

Mainstem:

Segment I-b

Segment I-b of the Hatchery Creek mainstem extends 2,405 meters from the upper falls to the outlet of Hatchery Lake over a gentle gradient. The total area (52,868 m^2) contains 5% (2,792 m^2) spawning area, which comprises 7%

TABLE III. Distribution of Spawning Areas, Substrate Size and Surface Water Velocities Below the Falls in Hatchery Creek Drainage Summarized by Stream Reach and Section.

OCATION Section	LENGTH (m)	TOTAL AREA (m^2)	SPAWNING AREA (m^2)	SPAWNING AREA (%)	PERCENT OF TOTAL SPAWNING AREA: Below Falls	PERCENT OF TOTAL SPAWNING AREA: Drainage	SUBSTRATE COMPOSITION (%): Bedrock	Large Boulder	Small Boulder	Large Cobble	Small Cobble	Coarse Gravel	Fine Gravel	Fines	SURFACE WATER VELOCITY: P	R	R
instem:																	
g I-a																	
ach: 1																	
c. 1	402	9,810	2943	30	26	6	0	0	0	0	15	35	35	15	60	40	0
2	229	5,574	1115	20	10	2	0	0	0	0	10	60	30	0	40	60	0
3	503	13,796	6898	50	62	13	0	0	0	0	10	60	30	0	20	80	0
tal	1134	29,180	10,956	37	98	21	0	0	0	0	12	52	32	5	37	63	0
ach: 2																	
c. 1	805	22,073	221	1	2	< 1	5	15	65	15	0	0	0	0	10	90	0
2	805	14,715	0	0	0	0	15	40	40	5	0	0	0	0	5	70	25
ach tal	1610	36,788	221	< 1	2	< 1	9	25	55	11	0	0	0	0	8	82	10
OTAL	2744	65,968	11,177	17	100	22	5	14	31	6	5	23	14	2	21	73	6

TABLE IV. Distribution of Rearing Areas Below the Falls in Hatchery Creek Drainage Summarized by Stream Reach and Section

LOCATION	TOTAL AREA (m^2)	POOL AREA (m^2)	POOL AREA (%)	PERCENT OF TOTAL REARING AREA BELOW FALLS	PERCENT OF TOTAL REARING AREA DRAINAGE	QUALITY OF HABITAT FOR REARING	JUV. FISH SPECIES PER RELATIVE ABUNDANCE
Mainstem:							
Seg. I-a							
Reach: 1							
Section: 1	9,810	5,886	60	43	4	Fair	Coho/Few
2	5,574	2,230	40	16	1	Good/Fair	Coho/Few
3	13,796	2,759	20	20	2	Good	Coho/Few
Reach Total	29,180	10,875	37	79	7	Good/Fair	Coho/Few
Reach: 2							
Section: 1	22,073	2,207	10	16	1	Fair	-0-
2	14,715	736	5	5	<1	Fair	Coho/Moderate
Reach Total	36,788	2,943	8	21	2	Fair	Coho/Moderate
TOTAL	65,968	13,818	21	100	9	Good/Fair	Coho/Few-Moderate

TABLE V. Distribution of Spawning Areas, Substrate Size and Surface Water Velocities Above the Falls in Hatchery Creek Drainage Summarized By Stream. See Appendix I for Summarization by Stream Reach and Section.

ATION	LENGTH SURVEY (m)	TOTAL AREA (m^2)	SPAWNING AREA (m^2)	SPAWNING AREA (%)	PERCENT OF TOTAL SPAWNING AREA: Above Falls	PERCENT OF TOTAL SPAWNING AREA: Drainage	SUBSTRATE COMPOSITION (%): Bedrock	Large Boulder	Small Boulder	Large Cobble	Small Cobble	Coarse Gravel	Fine Gravel	Fines	SURFACE WATER VELOCITY: P	R	R
tem:																	
I-b	2,405	52868	2792	5	7	5	<1	0	4	28	31	19	9	8	39	61	0
II	2,790	54575	11744	22	29	23	<1	0	1	10	11	35	22	20	48	51	1
III	2,568	39075	3171	8	8	6	0	0	<1	0	3	46	19	32	91	9	0
itaries																	
	4,285	41785	6017	14	15	12	3	1	1	5	8	51	23	9	78	21	<1
	1,372	4901	12	1	<1	<1	7	3	9	24	31	19	4	3	48	51	1
	1,683	5647	2111	37	5	4	0	0	0	0	17	53	22	8	62	38	0
	2,978	5493	0	0	0	0	0	1	3	13	20	33	11	19	90	10	0
	689	4841	0	0	0	0	4	0	<1	1	7	2	<1	85	96	4	0
	995	957	0	0	0	0	0	0	0	20	16	43	11	10	96	4	0
	510	742	114	15	<1	<1	4	<1	1	12	20	54	6	2	66	29	5
	3,700	23504	11973	51	30	23	0	<1	<1	2	16	58	17	6	27	73	0
	1,052	4214	247	6	<1	<1	1	2	13	30	39	11	3	2	24	58	18
	841	2969	959	32	2	2	3	<1	4	24	24	32	8	4	33	65	2
	950	3423	880	26	2	2	0	0	0	4	21	48	25	2	37	63	0
L	26,818	244994	40020	16	100	78											

Segment I-b

(Continued)

of the total spawning area above the barrier falls. The streambed was mostly large and small cobbles (28% and 31%,respectively) with moderately compact coarse gravels (19%); substrate size tended to increase with distance upstream. The water surface was predominantly riffles (61%) for the stream length except in the upper 567 meters to the lake which was mostly pool area.

Segment II

Segment II of the mainstem extends an estimated 4.0km (2.5 miles) from Hatchery Lake to the outlet of Butterfly Lake, however, only the lower 2.8km (1.7 miles) were surveyed. The total area surveyed (54, 575 m^2) contained 22% (11,744 m^2) spawning area which comprised 29% of the total spawning area above the falls. Most (73%) of the spawning area in Segment II occurs in Reach 2 (745 to 2,124m upstream); Reach 3 (2,124 to 2,790m upstream) contains the remaining 27% of spawning area in Segment II while Reach 1 (0 to 745m upstream), a slough-like area, contains no spawning area.

In Reach 1, the streambed was mostly silt (45%) with moderately compact fine gravels (40%). Characteristically, the slough was relatively deep with sluggish water (100% pool).

The total area of Reach 2 (22,932 m^2) contains 37% (8,541 m^2) spawning area. The surface water was mostly riffles (70%) and the streambed was, generally, similar throughout the reach. Substrate compostion was coarse and fine gravels (58% and 19%,respectively) which ranged between loose and moderately compact. One area containing mostly riffles (90%) and a high concentration of loosely compacted gravels was located near the island, approximately 1.7km upstream, and provided high quality spawning potential.

In Reach 3, water velocities (89% riffles; 4% rapids) were faster than Reach 2 as the gradient was moderately increased. Also, substrate sizes were larger than in Reach 2 and tended to increase further with distance upstream. The streambed contained mostly large and small cobbles (36% and 28%,respectively) with moderately compact coarse gravels (23%). The total area (13,487 m^2) contained 24% (2,303 m^2) spawning area, most of which was located in the lower 300 meters of the reach length (666 m).

Above Reach 3 the gradient continued to increase moderately and rapids became prevalent. The substrate also appeared to increase in size over Reach 3. Beyond this area, the upper stream length (estimated 0.7km) to Butterfly Lake was slough-like. Although the area above Reach 3 was not surveyed, the spawning potential appears limited.

Segment III

Segment III of the mainstem extends 2,568 meters from Butterfly Lake to the outlet of Lake Galea. The total area (39,075 m^2) includes 8% (3,171 m^2) spawning area which comprises 8% of the total spawning area above the falls. Reach 1 (0 to 916m upstream) contains 64% of the spawning area in Segment III while Reach 2 (916m to 2,568m upstream) contains the remaining 36% of spawning area.

Segment III

(Continued)

Reach 1 has a gentle gradient and contains a total area of 8,985 m^2, of which 22% (2,017 m^2) was spawning area. The streambed was mostly coarse and fine gravels (32% and 48%, respectively) of moderately loose compaction with isolated pockets of sand (20%). Spawning potential was limited in this area by the relatively slow water velocity (78% pool; 22% riffles) but tended to increase with distance upstream as did the occurrance of riffle areas.

Reach 2 was characterized by relatively deep ($\bar{x}$ depth = 0.9m) sluggish water (91% pool) created by the beaver dam at the lower boundary of the reach. Substrate compostion was coarse and fine gravels (50% and 10%, respectively) with silt and sand (35%). The only spawning area was located between 549m and 928m upstream from the beaver dam which comprised 4% (1,154 m^2) of the total area (30,090 m^2) in the reach.

Tributaries:

H-1

Tributary H-1 enters the southern end of Lake Galea and extends 4.3km (2.7 miles) upstream to the fork. The total area (41,785 m^2) includes 14% (6,017 m^2) spawning area which comprises 15% of the total spawning area above the falls. At the time of the survey (August 1 - 5, 1978), water levels appeared to be below normal and the spawning area values are considered conservative due to the reduced volume of water. Most (92%) of the spawning area in Tributary H-1 was located in Reach 4 (2,508 to 4,285m upstream); Reach 2 (982 to 1,930m upstream) comprised 8% of the spawning area in Tributary H-1 while Reach 3 (1,930 to 2,508m upstream) comprised less than 1% and Reach 1 (0 to 982m upstream) contained no spawning area.

Reach 1 has a gentle gradient and, at least partially due to the below normal flows, contained essentially no riffle areas. Consequently, the total area (23,353 m^2) contained no spawning area, even though the streambed was mostly coarse and fine gravels (60% and 27%, respectively) of moderate compaction.

Reach 2 has a slightly increased gradient and water velocity (13% riffles) than Reach 1. Coarse and fine gravels (39% and 36%, respectively) of moderate compaction continued to dominate the streambed with isolated patches of sand and silt (18%). Although high concentrations of spawnable substrates were present, only 8% (474 m^2), of the total area (5,822 m^2) was considered spawnable. Again, spawning potential would increase considerably during higher water levels.

Reach 3 was a canyon area with an increased but, generally, moderate gradient and contained two short falls. Here water velocities were faster (51% riffles; 3% rapids) and substrates were larger than in Reach 2. The streambed was comprised of bedrock and boulders (37%, combined) with large and small cobbles (30% and 16%, respectively) and patches of moderately compact coarse gravels (14%). The only spawning area occurred in the upper 82 meter length of the reach and comprised less than 1% (13 m^2) of the total area (2,408 m^2).

H-1

(Continued)

In Reach 4, the gradient decreased, however, riffles (68%) remained prevalent. Spawning potential was reduced in places by bedrock outcroppings usually accompanied by large cobbles, however, most of this reach contained favorable substrates. The streambed was comprised of small cobbles(23%) with intermixed coarse and fine gravels (47% and 12%,respectively) of moderate compaction. The total area (10,202 m^2) contained 54% (5,530 m^2) spawning area.

H-1a

Tributary H-1a was surveyed for a length of 1,372 meters. The total area (4,901 m^2) included less than 1% (12 m^2) spawning area which comprises an insignificant portion of the total spawning area above the falls. However, water levels appeared below normal during this survey, consequently, the spawning area values are conservative and would be greater during periods of normal flows. During this survey, the only spawning area was located in Reach 1 (0 to 641m upstream) while Reach 2 (641 to 1,107m upstream) and Reach 3 (1,107 to 1,372m upstream) contained no spawning area.

Reach 1 has a gentle gradient and a relatively slow water velocity (71% pool; 29% riffles). The streambed was composed of large and small cobbles (16% and 41%,respectively) with loosely compacted coarse and fine gravels (25% and 6%,respectively). The only spawning area was located in the lower 107 meters of this reach and comprised less than 1% (12 m^2) of the total area (2,705 m^2).

In Reach 2, the water velocity increased (78% riffles) as did the gradient. The lower stream length has a cascade with a total vertical drop of approximately 3 meters occurring in several steps over a 15 meter distance. Above the cascade, the gradient was gentle to moderate. The streambed contained bedrock and boulders (28%,combined) with generally compacted coarse gravels (13%) distributed among large and small cobbles (37% and 20%,respectively). The total area (1,852 m^2) contained no spawning area.

Reach 3 has a one-step bedrock falls with a total vertical drop of approximately 2.5 meters at the lower boundary of the reach. Above the falls, the gradient was gentle to moderate and the water surface was mostly riffles (80%), however, spawning potential was limited by the relatively large substrates. The streambed contained mostly bedrock and boulders (72%,combined) with large and small cobbles (14%,each). The total area (344 m^2) contained no spawning area.

H-1b

Tributary H-1b was surveyed for a length of 1,683 meters. The total area (5,647 m^2) contained 37% (2,111 m^2) spawning area which comprises 5% of the total spawning area in the drainage above the barrier falls. Most (53%) of the spawning area in this tributary was located in Reach 2 (467 to 1,111 m upstream) while Reach 1 (0 to 467m upstream) contained 32% and 15% was in Reach 3 (1,111 to 1,683m upstream). Spawning area values for this tributary are also conservative due to the reduced flows at the time of the survey.

H-1b

(Continued)

Reach 1 has a gentle gradient and a relatively slow water velocity (61% pool; 30% riffle). The streambed was comprised of loosely compacted coarse and fine gravels (33% and 44%,respectively) with some sand and silt (21%). The total area (1,652 m^2) contained 41% (684 m^2) spawning area which appeared to be of high quality, considering substrate size and compaction.

The gradient in Reach 2 remained gentle, although water velocities (48% pool; 52% riffles) were generally faster and substrates were larger than Reach 1. Here, the streambed was mostly small cobbles (40%) and moderately compacted coarse gravels (53%). The total area (2,252 m^2) contained 50% (1,118 m^2) spawning area.

In Reach 3, the gradient remained gentle while water velocities (82% pool; 18% riffles) and substrate sizes were less than those in Reach 2. Substrate composition was mostly coarse and fine gravels (71% and 26%,respectively) of moderately loose compaction. This reach also appeared to offer high quality spawning potential based on substrate size and compaction. The total area (1,743 m^2) contained 18% (309 m^2) spawning area. Beaver dams marked the upper boundary of this reach.

H-1c

Tributary H-1c was surveyed for a length of 2,978 meters. Although the total area (5,493 m^2) contained no spawning area during the survey, due to below normal stream flows, it appeared to have high spawning potential during periods of normal stream flows.

Reach 1 (0 to 1,036m upstream) had a gentle gradient with slow water velocity (95% pool). The streambed was comprised of mostly small cobbles (26%) and loosely compacted coarse gravels (50%). The total area (2,090 m^2) appeared to offer high quality spawning potential, based on substrate size and compaction, however, the low volume of water provided no spawning area.

In Reach 2 (1,036 to 1,790m upstream) the gradient was moderate while water velocities were faster (73% pool; 27% riffle) and substrates were larger than Reach 1. In this reach, the streambed contained mostly large and small cobbles (47% and 23%,respectively) with small boulders (14%). The total area (1,354 m^2) did not appear to provide significant spawning area, even during normal stream flows.

Reach 3 (1,790 to 2,978m upstream) had a gentle to moderate slope, increasing slightly in the upper stream length, and slow moving water (97% pool). The streambed contained small cobbles (12%) and moderately loose coarse and fine gravels (28% and 20%,respectively) with areas of sand or silt (40%). Again, the total area (2,049 m^2) appeared to have high spawning potential during periods of increased stream flow.

H-2

Tributary H-2 enters Lake Galea approximately mid-way along its western shoreline and was surveyed for a length of 689 meters. Most (91%) of the total area surveyed (4,841 m^2) was contained in beaver ponds which covered the lower

H-2

(Continued)

61 meters and upper 354 meters of the surveyed length. Substrate composition was mostly silt (95%) in the upper pond and small cobbles (60%) with silt (30%) in the lower pond. Between the ponds, the stream was shallow and moderately steep with an exposed bedrock streambed containing some large and small cobbles. The stream has no spawning potential.

H-3

Tributary H-3 enters Lake Galea along the western shoreline and was surveyed for a length of 995 meters. This relatively shallow, narrow stream has a gentle to moderate gradient and a very low discharge. Although the streambed contained coarseand fine gravels (43% and 11%, respectively) with large and small cobbles (20% and 16%, respectively), the substrates were mostly covered with mosses and filamentous algae. The total area surveyed (957 m^2) contained no spawning area.

H-4

Tributary H-4 also enters the western shoreline of Lake Galea. This narrow tributary was mostly slough-like with a silt bottom, had an imperceptible discharge and offered no spawning potential.

H-5

Tributary H-5 enters Segment III of the mainstem approximately 2.2km upstream on the east bank and was surveyed to a barrier falls located 510m upstream. The total area (742 m^2) contained 15% (114 m^2) spawning area which comprises less than 1% of the total spawning area in the drainage above the main barrier falls. Most (86%) of the spawning area in Tributary H-5 was located in Reach 1 (0 to 315m upstream) while Reach 2 (315 to 510m upstream) contained the remaining 14% of spawning area. During this survey, stream flows appeared below normal, consequently, spawning area values are conservative and would be greater during normal stream flows.

In Reach 1, the gradient was gentle and the surface water was mostly pool (66%). The streambed was dominated by loosely compacted coarse and fine gravels (70% and 9%, respectively). The total area (524 m^2) contained 19% (98 m^2) spawning area, most of which was located in the lower reach length where riffles were prevalent.

In Reach 2, the gradient remained gentle and the surface water was mostly pools (67%) with isolated riffle areas (17%). Substrate composition was mostly large and small cobbles (17% and 47%, respectively) with moderately compact coarse gravels (16%). The total area (218 m^2) contained 7% (16 m^2) spawning area.

H-6, H-6a and H-6b

These tributaries are located in Segment III of the mainstem, however, none of them appeared to exist during this survey possibly due to the period of low stream flows.

H-7

Tributary H-7 enters Segment II of the mainstem approximately 3.2km (2.0 miles) upstream on the east bank and was surveyed to the stream fork located 3.7km (2.3 miles) upstream. The total area (23,504 m^2) contained 51% (11,973 m^2) spawning area which comprises 30% of the total spawning area in the drainage above the main barrier falls. The stream has a gentle gradient and the surface water velocity (27% pool; 73% riffles) and substrate composition were similar throughout the length. The streambed contained moderately compact to moderately loose coarse and fine gravels (58% and 17%, respectively) with small cobbles (16%). The entire stream appeared to have high spawning potential, however, the upper 2.0km of stream was exposed as the streamside forest had been logged without leaving a buffer zone.

H-7a

Tributary H-7a, the south fork to Tributary H-7, was surveyed for a length of 1,052 meters. Except for the upper 434 meters,which was a canyon area,the stream length was exposed in the clear-cut forest. The total area (4,214 m^2) contained 6% (242 m^2) spawning area which comprises less than 1% of the total spawning area in the drainage above the barrier falls. Most (78%) of the spawning area in this tributary was located in Reach 1 (0 to 380m upstream) while Reach 2 (380 to 1,052m upstream) contained the remaining 22% of spawning area.

Reach 1 has a moderate gradient and the surface water was mostly riffles (83%). The streambed contained large and small cobbles (13% and 70%, respectively) with coarse gravels (8%) which ranged between moderately compact and moderately loose. The total area (1,671 m^2) contained 11% (194 m^2) spawning area.

In Reach 2, the gradient increased as did the water velocity (42% riffles; 30% rapids) and substrates were larger than in Reach 1. The streambed was composed of mostly large and small cobbles (41% and 19%, respectively) with small boulders (21%) and moderately compact coarse gravels (13%). Only 2% (54 m^2) of the total area (2,543 m^2) was considered spawnable.

H-8

Tributary H-8 enters Segment II of the mainstem approximately 0.5km upstream and was surveyed for a length of 841 meters. The total area (2,969 m^2) contained 32% (959 m^2) spawning area which comprises 2% of the total spawning area in the drainage above the barrier falls. Most (88%) of the spawning area was located in Reach 1 (0 to 502m upstream) while Reach 2 (502 to 841m upstream) contained the remaining 12% of spawning area.

Reach 1 had a gentle to moderate gradient and the surface water was mostly riffles (65%). Substrate size tended to increase with distance upstream and the streambed contained loosely compacted small cobbles (41%) and coarse gravels (48%). The total area (1,677 m^2) contained 50% (844 m^2) spawning area.

A bedrock falls was located 73 meters upstream in Reach 2. Below the falls, the gradient was gentle and 19 m^2 of spawning area are available. Above the falls the gradient increased and, although spawning area was present(96 m^2), it probably would not be accessible. Substrates tended to be large and moderately

H-8

(Continued)

compact in this reach. The streambed contained mostly large and small cobbles (47% and 15%, respectively) with coarse gravels (12%).

H-9, H-10 and H-11

Tributary H-9 enters the southern shoreline of Hatchery Lake while Tributaries H-10 and H-11 are located along the western shoreline. Generally, these tributaries are short with very low discharges and have silt bottoms with no spawning area.

H-12

Tributary H-12 enters the east bank of Segment I-b of the mainstem approximately 3.9km (2.4 miles) upstream and was surveyed to the road located 950 meters upstream. The total area (3,423 m^2) contains 26% (880 m^2) spawning area, which comprises 2% of the total spawning area in the drainage above the barrier falls. The stream had a moderate velocity (37% pool; 63% riffles) and flowed over a gentle gradient. The streambed contained small cobbles (21%) with moderately compact to moderately loose coarse and fine gravels (48% and 25%, respectively). The upper stream length was braided and spawning areas were less concentrated than in the lower stream length. Also, the upper stream enters a clear-cut area.

3.2.2 Rearing Area

Based on the percentage of pool area present in the streams, most (81%) of the total rearing area above ther barrier falls (141,594 m^2) was located in four streams:

(1) Segment III of the mainstem (25%),
(2) Tributary H-1 (23%),
(3) Segment II of the mainstem (18%),
(4) Segment I-b of the mainstem (15%).

The remaining 19% of total rearing area was contained in ten other streams (Table 6;- Appendix II).

Additional rearing area is available in the three lakes included in the system which, combined, contain a total surface area of approximately 262 hectares (648 acres):

(1) Lake Galea (126 hectares),
(2) Butterfly Lake (19 hectares),
(3) Hatchery Lake (117 hectares).

All lakes appeared to offer good-quality rearing habitat.

TABLE VI. Distribution of Rearing Areas Above the Falls in Hatchery Creek Drainage Summarized by Stream. Refer to Appendix II for Summarization by Stream Reach and Section.

LOCATION	TOTAL AREA (m^2)	POOL AREA		PERCENT OF TOTAL REARING AREA		QUALITY OF HABITAT FOR REARING	JUV. FISH SPECIES PER RELATIVE ABUNDANCE
		(m^2)	(%)	ABOVE FALLS	DRAINAGE		
Mainstem:							
Seg. I-b	52,868	20,700	39	15	13	Good	Coho/Few-Moderate
Seg. II	54,575	26,020	48	18	17	Good/Fair	None observed
Seg. III	39,075	35,670	91	25	23	Good/Fair	Coho/Few
Tributaries:							
H-1	41,785	32,798	78	23	21	Good/Fair	Coho/Few-Moderate
H-1a	4,901	2,390	49	2	1	Good/Fair	Coho/Moderate
H-1b	5,647	3,515	62	2	2	Exc./Good	Coho/Abundant
H-1c	5,493	4,954	90	3	3	Good/Fair	Coho/Moderate-Abundant
H-2	4,841	4,639	96	3	3	Good/Fair	Coho/Few
H-3	957	916	96	< 1	< 1	Good	Coho/Few
H-5	742	492	66	< 1	< 1	Fair	Coho/Few
H-7	23,504	6,250	27	4	4	Good	Coho/Very Few
H-7a	4,214	1,001	24	< 1	< 1	Fair/Poor	Coho/Very Few
H-8	2,969	987	22	< 1	< 1	Good/Fair	Coho/Very Few
H-12	3,423	1,262	37	< 1	< 1	Good	Coho/Moderate
TOTAL	244,994	141,594	58	100	91		

Mainstem:

Segment I-b

Segment I-b contained 39% (20,700 m^2) pool area which appeared to be good-quality rearing habitat. Pools tended to be relatively large throughout the stream length, however, instream cover appeared to be moderately low. Most (58%) of the pool area was located in the upper 567 meters of the stream length (2,405m). Moderate numbers of juvenile coho salmon were observed in most of this stream.

Segment II

Pools comprised 48% (26,020 m^2) of the total area in Segment II of the mainstem. Most (70%) of this pool area was located in Reach 1, while Reach 2 contained 26% and Reach 3 contained 4%.

Reach 1 was a slough and, characteristically, the total area (18,156 m^2) was pool. Even though instream cover was moderately low and no juvenile fish were observed, the slough appeared to be good-quality rearing habitat.

In Reach 2, pools comprised 30% (6,922 m^2) of the total area and offered good to fair-quality rearing habitat. Most of the pools were relatively large and occasionally contained instream cover, however, no juvenile fish were observed.

Only 7% (942 m^2) of the total area in Reach 3 was pool area. Generally, these pools were smaller than those in the lower reaches and isolated near the banks by riffle areas. Again, no juvenile fish were observed and instream cover was moderately low. Most of the area was considered fair-quaility rearing habitat.

Segment III

In Segment III of the mainstem, 91% (35,670 m^2) of the total area was pool, most of which (80%) was located in Reach 2 while the remaining 20% of pool area was located in Reach 1.

Reach 1 contained 78% (7,022 m^2) pool area and provided good to fair-quality rearing habitat. The pools were relatively large and frequently deep but contained little instream cover. Few numbers of juvenile coho salmon were observed throughout the reach length.

In Reach 2, 95% (28,648 m^2) of the total area was pool area created by a beaver dam at the lower boundary of the reach. This pond area was relatively deep and offered good-quality rearing habitat. Although there was little instream cover, overhanging streamside vegetation provided some additional cover in places. A few juvenile coho salmon were observed but only in the lower reach length.

Tributaries:

H-1

Tributary H-1 contained 78% (32,798 m^2) pool area, however, this would probably be reduced during periods of normal, increased, stream flows. Most (71%) of the pool area was located in Reach 1; 16% was located in Reach 2

H-1

(Continued)

while 3% was in Reach 3 and 10% in Reach 4.

The total area of Reach 1 (23,342 m^2) was essentially pool area, however, due to below normal stream flows, much of this area was relatively shallow. A few juvenile coho salmon were observed throughout the stream length and, although there was little instream cover, the quality of habitat for rearing appeared good.

In Reach 2, pools comprised 87% (5,056 m^2) of the total area and offered good-quality rearing habitat. Although these pools would probably be smaller during normal stream flows, they were relatively large and contained moderate amounts of instream cover. Juvenile coho salmon were more common than in Reach 1 as moderate numbers were observed throughout the reach.

Pool areas decreased in Reach 3, a canyon area, and comprised 46% (1,089 m^2) of the total area. The pools remained relatively large but were frequently shallow and instream cover was essentially absent. A few juvenile coho were observed through most of the reach and the quality of rearing habitat appeared to be fair to poor.

Pool areas continued to decrease in Reach 4 and comprised 32% (3,311 m^2) of the total area. The pools were frequently large but shallow and contained moderately low amounts of cover. Moderate numbers of juvenile coho salmon were observed throughout the reach which appeared to provide good to fair-quality rearing habitat.

H-1a

Tributary H-1a contained 49% (2,390 m^2) pool area which comprises 2% of the total rearing area in the drainage above the barrier falls. Again, these areas may be reduced during normal stream flows. Most (81%) of this pool area was located in Reach 1 while 17% was located in Reach 2 and 2% in Reach 3.

In Reach 1, pools comprised 71% (1,929 m^2) of the total area and provided excellent to good-quality rearing habitat. Generally, the pools were relatively large and deep and often contained high amounts of instream cover. Juvenile coho salmon were observed in moderate numbers thoughout the reach.

Pools comprised 22% (398 m^2) of the total area in Reach 2. These pools were relatively shallow and contained little instream cover. Moderate numbers of juvenile coho salmon were observed throughout the reach and the quality of rearing habitat was considered fair.

Reach 3 has a bedrock falls at the lower boundary and the pools which comprised 18% (63 m^2) of the total area did not appear available for rearing salmonids. The rearing habitat appeared to be of fair-quality, however, no juvenile fish were observed.

H-1b

Tributary H-1b contained 62% (3,515 m^2) pool area which comprises 2% of the total rearing area above the barrier falls. This tributary also may contain less pool area during normal stream flows. Reach 1 contained 28% of the pool area in this stream while Reach 2 and Reach 3 contained 31% and 41%,respectively.

In Reach 1, pools comprised 61% (1,003 m^2) of the total area and offered excellent to good-quality rearing habitat. Generally, the pool areas were extensive and relatively deep, especially in the lower reach, but contained moderately low amounts of instream cover. Juvenile coho salmon were observed in abundant numbers throughout the reach.

The total area of Reach 2 contained 48% (1,078 m^2) pool area which provided good-quality rearing habitat. Similar to Reach 1, these relatively large and deep pools contained moderately low amounts of cover and juvenile coho salmon were abundant throughout the reach.

Pools comprised 62% (1,434 m^2) of the total area in Reach 3 and offered excellent to good-quality rearing habitat. The pools remained relatively large and deep and contained moderately low amounts of instream cover. Juvenile coho salmon were abundant in the lower reach but only a few were observed in the upper reach. Beyond Reach 3, beaver ponds provided additional good-quailty rearing habitat.

H-1c

Tributary H-1c contained 90% (4,954 m^2) pool area, which comprises 3% of the total rearing area above the barrier falls. During normal stream flows, these pool areas would probably be reduced. Reach 1 and Reach 3 contained 40%, each, of the pool area in this stream while Reach 2 contained 20%.

In Reach 1, pools comprised 95% (1,980 m^2) of the total area and offered good-quality rearing habitat. Much of this reach was relatively shallow, however, in places it contained deeper pool areas and moderately high amounts of instream cover. Moderate to abundant numbers of juvenile coho were observed throughout.

Pools comprised 73% (995 m^2) of the total area in Reach 2 and offered fair quality rearing habitat. Although moderately high amounts of instream cover was available, the pool areas were relatively shallow. Moderate numbers of juvenile coho salmon were observed throughout this reach.

In Reach 3, pools comprised 97% (1,979 m^2) of the total area and provided good-quality rearing habitat. Pool areas tended to be deeper in this reach and contained moderate amounts of instream cover. Juvenile coho salmon were observed in abundance throughout the reach.

H-2

Tributary H-2 contained 96% (4,639 m^2) pool area which comprises 3% of the total rearing area in the drainage above the barrier falls. Beaver ponds in the upper and lower stream length contained 95% of the pool area in this tributary and offered good-quality rearing habitat. The remaining 5% of pool area was contained in the stream length between the ponds where the pools were relatively large but shallow and provided fair-quality rearing habitat. A few juvenile coho salmon were observed in the tributary.

H-3

Tributary H-3 contained 95% (916 m^2) pool area which comprises less than 1% of the total rearing area in the drainage above the barrier falls. The stream contained moderately high amounts of instream cover and the quality of rearing habitat appeared good through most of the stream but tended to be better in the lower stream where pool areas were relatively deep. A few juvenile coho were observed in the lower stream length.

H-5

Tributary H-5 contained 66% (492 m^2) pool area which comprises less than 1% of the total rearing area in the drainage above the barrier falls. Most (70%) of the pool area was located in Reach 1 while Reach 2 contained the remaining 30% of pool area. Since stream flows appeared below normal during this survey, pool areas may be reduced during normal stream flows.

Reach 1 contained 66% (346 m^2) pool area and provided good-quality rearing habitat. Much of the area was relatively shallow with isolated deeper pools. In the upper reach length, pools tended to be larger and deeper and contained moderately high amounts of instream cover. A few juvenile coho salmon were observed throughout the reach.

In Reach 2, pools comprised 67% (146 m^2) of the total area and offered good to fair-quality rearing habitat. Similar to Reach 1, much of this area was relatively shallow with deeper pools in places, especially in the lower length of the reach, and contained moderately high amounts of instream cover. A few juvenile coho salmon were observed in this reach.

H-7

Tributary H-7 contained 27% (6,250 m^2) pool area which comprises 4% of the total rearing area in the drainage above the barrier falls. Generally, pool areas were uniformly distributed throughout the stream and provided good-quality rearing habitat. However, most of the stream canopy had been removed. The pools tended to be isolated by riffle areas but were often relatively deep and contained high amounts of instream cover from fallen trees. A few juvenile coho salmon were observed in the lower and upper stream length, however, none were observed through most of the stream.

H-7a

Tributary H-7a contained 24% (1,001 m^2) pool area which comprises less than 1% of the total rearing area in the drainage above the barrier falls. However, the useable stream length may be limited by a log jam located 380m upstream. The area below the log jam contained 17% (289 m^2) pool area and provided fair-quality rearing habitat. These pools tended to be isolated by faster waters but were often relatively deep and contained high amounts of instream cover. Although a few juvenile coho salmon were observed below the log jam, none were observed in the area above which would offer fair to poor-quality rearing habitat.

H-8

The useable stream length in Tributary H-8 (575 m) was limited by a falls and contained 33% (650 m^2) pool area, which comprises less than 1% of the total rearing area in the drainage above the main barrier falls. Most of this pool area

H-8

(Continued)

offered excellent to good-quality rearing habitat and contained moderately high amounts of instream cover. Generally, the pool areas were relatively large and often deep. Only a few juvenile coho salmon were observed in this stream.

H-12

Tributary H-12 contained 37% (1,262 m^2) pool area which comprises less than 1% of the total rearing area in the drainage above the barrier falls. Pool areas varied in size but were often relatively large and deep and tended to increase with distance upstream. Most of the stream contained high amounts of instream cover and provided good-quality rearing habitat. Moderate numbers of juvenile coho salmon were observed throughout the stream.

3.3 Access

The two main falls in Segmen I-a of the mainstem constitute the principle barriers in the Hatchery Creek drainage. However, these falls appear to be partial barriers since numerous juvenile coho were observed in some of the tributaries above the falls, as well as, approximately 100 adult coho salmon. Complete utilization of the upstream habitat may be limited by these falls.

Three other falls were found which may be partial barriers, however, the amount of spawning and rearing potential above them appears negligible. These falls were located:

(1) 1.1 km (0.7 miles) upstream in Tributary H-1a (Fig. 2),
(2) 0.5 km (0.3 miles) upstream in Tributary H-5 (Fig. 3),
(3) 0.5 km (0.3 miles) upstream in Tributary H-8 (Fig. 4).

Also, two minor falls were located between 2.1 and 2.2km (1.3 and 1.4 miles) upstream in Tributary H-1 which did not appear to be serious barriers since numerous juvenile coho were observed in the stream area above them (Fig. 5).

Tributary H-7 contains numerous log jams throughout the stream length (Figs. 6 and 7). At present, none of these restrict fish passage, however, several are potential barriers. Another major log jam and potential barrier was located approximately 1.8km (1.1 miles) upstream in Segment II of the mainstem.

The beaver dam located approximately 0.9km (0.6 miles) upstream in Segment III of the mainstem may be a serious barrier since there was no launching pool and the dam was about one-meter high (Fig. 8).

4.0 Summary and Conclusions

(1) The spawning and rearing habitat of the Hatchery Creek system above and below the barrier falls was assessed during three surveys conducted between August 1 and 26, 1978.

(2) Based on observations of juvenile and adult salmonids during these surveys, the main falls appeared to be partial barriers which may reduce utilization of the upstream habitat. The stream system above the falls includes three lakes (total surface area = 262 hectares) and 26.8km (16.7 miles) of streams which contain a total area of 244,944 m^2.

4.0 Summary and Conclusions

(Continued)

(3) There was approximately four times as much spawning area above the falls (40,020 m^2) as there was below (11,177 m^2). The total spawning area above the falls may be increased during normal stream flows since stream flows appeared below normal during the survey of Tributary H-1 and its contributing streams (H-1a, H-1b, and H-1c). Three streams above the falls (Tributary H-7, mainstem Segment II and Tributary H-1) had the highest potential for spawning salmonids as they contained most (74%) of the total spawning above the falls.

(4) Based on the instream pool area, there was approximately ten times as much rearing area above the falls (141,594 m^2) as there was below (13,818 m^2). Most (81%) of the pool area above the falls was contained in four streams: Tributary H-1 and Segments I-b, II and III of the mainstem. However, Tributary H-1 may contain less pool area during normal stream flows.

(5) Observations of juvenile coho salmon indicate that Tributaries H-1, H-1b and H-1c are presently important salmon producing streams while most of the other streams above the falls are not. This suggests that underutilized spawning and rearing habitat might be available in the other streams above the falls.

(6) Above the main falls, fish passage may be impeded by the beaver dam in Segment III of the mainstem and the two falls in Tributary H-1. However, the beaver dam may be readily corrected and the falls in Tributary H-1 did not appear to be serious barriers. Generally, the other falls located in the stream system contained negligible spawning and rearing habitat above them and the log jams, most common in Tributary H-7, were not barriers.

(7) Relatively extensive areas of good-quality spawning and rearing habitat are contained above the falls in the Hatchery Creek system. Although some of these areas are currently utilized by salmonids, alteration of the falls may increase utilization of the upstream habitat.

Fig. 2. Tributary H-1a falls
(slope = 19°; slope distance = 6 m)

Fig. 3. Tributary H-5 barrier
(slope = 13°; slope distance = 15 m)

Fig. 4. Tributary H-8 falls
(slope = 15°: slope distance = 24 m)

Fig. 5. Tributary H-1 lower falls
(slope = 8°; slope distance = 9 m)

Fig. 6. Tributary H-7
(approximately 1.7 km upstream)

Fig. 7. Tributary H-7
(approximately 3.6 km upstream)

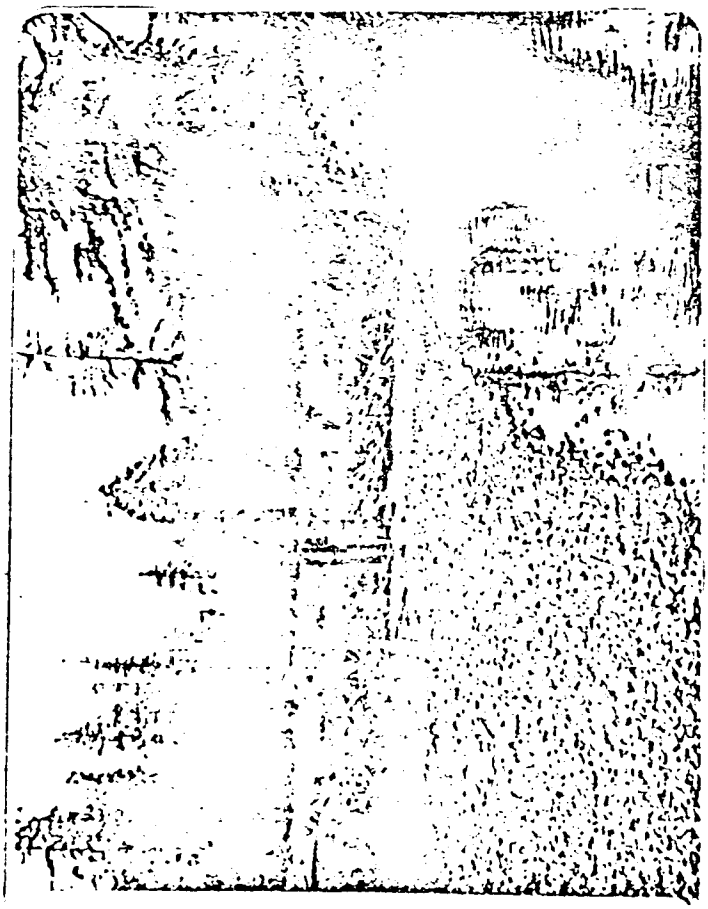

Fig. 8. Segment III beaver dam

APPENDIX I. Distribution of Spawning Areas, Substrate Size and Surface Water Velocities Above the Falls in Hatchery Creek Drainage Summarized By Stream Reach and Section for Each Stream.

AINSTEM: SEG I-b

OCATION Section	LENGTH (m)	TOTAL AREA (m^2)	SPAWNING AREA (m^2)	SPAWNING AREA (%)	PERCENT OF TOTAL SPAWNING AREA Above Falls	PERCENT OF TOTAL SPAWNING AREA Drainage	SUBSTRATE COMPOSITION (%) Bedrock	Large Boulder	Small Boulder	Large Cobble	Small Cobble	Coarse Gravel	Fine Gravel	Fines	SURFACE WATER VELOCITY P	R	R
1	302	7,358	368	5	< 1	< 1	0	0	0	5	35	35	20	10	30	70	0
2	187	4,548	227	5	< 1	< 1	5	0	0	0	35	35	20	10	30	70	0
3	453	10,347	1,552	15	4	3	0	0	0	25	25	25	25	0	35	65	0
4	229	3,484	35	1	< 1	< 1	0	0	10	30	40	20	0	0	10	90	0
5	667	12,207	610	5	1	1	0	0	10	40	45	5	0	0	10	90	0
6	567	14,924	0	0	0	0	0	0	5	40	20	15	0	30	80	30	0
TOTAL	2,405	52,868	2,792	5	7	5	1	0	4	28	31	19	9	8	39	61	0

NSTEM: Segment II

1	745	18,156	0	0	0	0	0	0	0	0	0	15	40	45	100	0	0
REACH TOTAL	745	18,156	0	0	0	0	0	0	0	0	0	15	40	45	100	0	0
1	835	15,300	5,355	35	13	10	0	0	0	0	10	55	20	15	20	80	0
2a	213	1,948	779	40	2	1	0	0	0	0	10	70	10	10	30	70	0
2b	213	1169	1,052	90	3	2	0	0	0	0	5	75	15	5	10	90	0
3	329	4515	1,355	30	3	3	0	0	0	5	10	60	20	5	70	30	0
REACH TOTAL	1,379	22,932	8,541	27	21	17	0	0	0	1	10	58	19	12	30	70	0
1	172	3458	1,383	40	3	3	0	0	0	35	20	40	5	0	0	100	0
2	115	2634	1,317	50	3	3	0	0	2	18	35	35	10	0	20	80	0
3	130	2256	226	10	< 1	< 1	0	0	10	45	25	15	5	0	0	100	0
4	126	2769	277	10	< 1	< 1	0	0	2	35	45	15	3	0	15	85	0
5	123	2370	0	0	0	0	10	0	20	50	15	5	0	0	0	80	20
REACH TOTAL	666	13,487	3,203	24	8	6	2	0	6	36	28	23	5	0	7	89	4
TOTAL	2,790	54,575	11,744	22	29	23	< 1	0	1	10	11	35	22	20	48	51	1

APPENDIX I.(Continued)

MAINSTEM: Segment III

LOCATION Section	LENGTH (m)	TOTAL AREA (m^2)	SPAWNING AREA (m^2)	SPAWNING AREA (%)	PERCENT OF TOTAL SPAWNING AREA: Above Falls	PERCENT OF TOTAL SPAWNING AREA: Drainage	SUBSTRATE COMPOSITION (%): Bedrock	Large Boulder	Small Boulder	Large Cobble	Small Cobble	Coarse Gravel	Fine Gravel	Fines	SURFACE WATER VELOCITY: P	R	R
1	101	1,073	54	5	<1	<1	0	0	0	0	0	15	65	20	100	0	0
2	115	1,397	140	10	<1	<1	0	0	0	0	0	20	55	25	90	10	0
3	131	1,278	192	15	<1	<1	0	0	0	0	0	20	60	20	85	15	0
4	155	1,421	284	20	<1	<1	0	0	0	0	0	20	60	20	80	20	0
5	169	1,805	451	25	1	<1	0	0	0	0	0	50	30	20	75	25	0
6	120	1,095	438	40	1	<1	0	0	0	0	0	50	35	15	60	40	0
7	125	916	458	50	1	<1	0	0	0	0	0	50	25	15	50	50	0
REACH TOTAL	916	8,985	2017	22	5	4	0	0	0	0	0	32	48	20	78	22	0
1	549	8,361	0	0	0	0	0	0	0	0	0	0	0	100	100	0	0
2	379	5,769	1154	20	3	2	0	0	2	0	5	50	20	23	75	25	0
3	283	5,184	0	0	0	0	0	0	5	0	20	70	5	0	100	0	0
4	117	2,861	0	0	0	0	0	0	0	0	0	75	15	10	100	0	0
5	210	5,128	0	0	0	0	0	0	0	0	0	75	15	10	100	0	0
6	114	2,787	0	0	0	0	0	0	0	0	0	80	20	0	100	0	0
REACH TOTAL	1,652	30,090	1154	4	3	2	0	0	1	0	4	50	10	35	95	5	0
TOTAL	2,568	39,075	3171	8	8	6	0	0	<1	0	3	46	19	32	91	9	0

APPENDIX I. (Continued)

TRIBUTARIES: H-1

LOCATION Reach Section	LENGTH (m)	TOTAL AREA (m^2)	SPAWNING AREA (m^2)	SPAWNING AREA (%)	PERCENT OF TOTAL SPAWNING AREA: Above Falls	PERCENT OF TOTAL SPAWNING AREA: Drainage	SUBSTRATE COMPOSITION (%): Bedrock	Large Boulder	Small Boulder	Large Cobble	Small Cobble	Coarse Gravel	Fine Gravel	Fines	SURFACE WATER VELOCITY: P	R	R
1	457	13,935	0	0	0	0	0	0	0	0	0	75	20	5	100	0	0
2	91	2,508	0	0	0	0	0	0	0	0	0	40	40	20	100	0	0
3	107	2,601	0	0	0	0	0	0	0	0	0	40	40	20	100	0	0
4	85	1,561	0	0	0	0	0	0	0	0	0	40	40	20	100	0	0
5	53	569	0	0	0	0	0	0	0	0	0	35	35	30	98	2	0
6	82	878	0	0	0	0	0	3	2	10	5	30	35	15	100	0	0
7	107	1,301	0	0	0	0	0	3	2	15	10	30	25	15	100	0	0
TOTAL EACH	982	23,353	0	0	0	0	0	<1	<1	1	<1	60	27	11	100	0	0
1	81	1,108	55	5	<1	<1	0	0	0	0	0	40	40	20	95	5	0
2	114	697	35	5	<1	<1	0	0	0	0	0	40	40	20	95	5	0
3	69	418	21	5	<1	<1	0	0	0	0	0	40	40	20	90	10	0
4	72	655	0	0	0	0	0	0	0	0	0	40	40	20	98	2	0
5	157	957	191	20	<1	<1	0	0	0	0	0	40	40	20	70	30	0
6	49	223	11	5	<1	<1	0	0	0	0	0	40	40	20	90	10	0
7	87	397	40	10	<1	<1	0	0	0	0	0	40	40	20	80	20	0
8	83	503	25	5	<1	<1	0	0	0	0	0	40	40	20	90	10	0
9	61	149	30	20	<1	<1	0	0	0	0	0	40	40	20	80	20	0
10	53	195	49	25	<1	<1	0	0	0	20	15	40	15	10	60	40	0
11	61	223	11	5	<1	<1	0	0	0	20	40	30	5	5	80	20	0
12	61	297	6	2	<1	<1	0	0	0	30	40	20	10	0	90	10	0
REACH TOTAL	948	5,822	474	8	1	1	0	0	0	3	4	39	36	18	87	13	0

. . . Continued

APPENDIX I. (Continued)

TRIBUTARIES: H-1 (Continued)

LOCATION		LENGTH	TOTAL AREA	SPAWNING AREA		PERCENT OF TOTAL SPAWNING AREA		SUBSTRATE COMPOSITION (%)								SURFACE WATER VELOCITY	
Reach	Section	(m)	(m^2)	(m^2)	(%)	Above Falls	Drainage	Bedrock	Large Boulder	Small Boulder	Large Cobble	Small Cobble	Coarse Gravel	Fine Gravel	Fines	P	R
3	1	56	172	0	0	0	0	5	5	5	55	10	10	10	0	40	50
	2	46	279	0	0	0	0	15	2	8	30	20	20	5	0	100	0
	3	53	244	0	0	0	0	20	2	20	20	18	15	5	0	50	40
	4	23	118	0	0	0	0	90	0	0	0	0	10	0	0	75	0
	5	56	137	0	0	0	0	30	5	15	25	15	10	0	0	40	60
	6	11	10	0	0	0	0	100	0	0	0	0	0	0	0	0	0
	7	84	511	0	0	0	0	30	3	2	40	10	15	0	0	20	80
	8	114	523	0	0	0	0	10	10	15	35	20	10	0	0	30	70
	9	53	163	0	0	0	0	40	15	20	15	10	0	0	0	40	60
	10	82	251	13	5	<1	<1	5	5	5	15	30	30	10	0	60	40
REACH TOTAL		578	2,408	13	1	<1	<1	22	5	10	30	16	14	3	0	46	51
4	1	120	657	164	25	<1	<1	0	0	0	8	60	22	10	0	75	25
	2	133	566	255	45	<1	<1	0	0	0	2	18	50	30	0	55	45
	3	101	429	150	35	<1	<1	0	0	1	10	50	35	4	0	65	35
	4	152	650	553	85	1	1	0	0	1	5	40	50	4	0	15	85
	5	82	351	70	20	<1	<1	11	2	5	45	25	8	4	0	80	20
	6	113	484	266	55	<1	<1	3	1	1	14	40	31	7	3	10	90
	7	134	940	47	5	<1	<1	50	0	0	30	10	10	0	0	20	80
	8	108	658	230	35	<1	<1	3	0	2	19	45	30	1	0	40	60
	9	244	1,784	1,427	80	4	3	3	0	0	10	15	47	20	5	5	95
	10	178	1,087	870	80	2	2	2	0	0	10	33	50	4	1	15	85
	11	137	920	828	90	2	2	0	0	0	0	3	80	16	1	10	90
	12	275	1,676	670	40	2	1	0	0	0	0	2	75	20	3	60	40
REACH TOTAL		1,777	10,202	5,530	54	14	11	6	<1	<1	10	23	47	12	2	32	68
TOTAL		4,285	41,785	6,017	14	15	12	3	<1	1	5	8	51	23	9	78	21

APPENDIX I. (Continued)

TRIBUTARIES: H-1a

LOCATION Section	LENGTH (m)	TOTAL AREA (m^2)	SPAWNING AREA (m^2)	SPAWNING AREA (%)	PERCENT OF TOTAL SPAWNING AREA: Above Falls	PERCENT OF TOTAL SPAWNING AREA: Drainage	SUBSTRATE COMPOSITION (%): Bedrock	Large Boulder	Small Boulder	Large Cobble	Small Cobble	Coarse Gravel	Fine Gravel	Fines	SURFACE WATER VELOCITY: P	R	R
1	107	488	12	2	<1	<1	0	0	0	10	10	60	20	20	90	10	0
2	123	376	0	0	0	0	0	5	5	10	50	20	5	5	80	20	0
3	53	163	0	0	0	0	0	0	0	5	65	20	5	5	80	20	0
4	128	468	0	0	0	0	0	0	0	15	60	20	5	0	70	30	0
5	104	632	0	0	0	0	0	0	5	20	40	20	5	10	70	30	0
6	126	578	0	0	0	0	5	5	10	25	40	10	5	0	50	50	0
REACH TOTAL	641	2,705	12	<1	<1	<1	1	2	4	16	41	25	6	5	71	29	0
1	122	557	0	0	0	0	15	5	15	30	25	5	5	0	10	88	2
2	131	320	0	0	0	0	5	5	20	40	20	10	0	0	20	80	0
3	91	418	0	0	0	0	15	0	15	40	15	15	0	0	40	60	0
4	122	557	0	0	0	0	10	0	10	40	20	20	0	0	20	80	0
REACH TOTAL	466	1,852	0	0	0	0	12	2	14	37	20	13	2	0	22	78	1
1	6	28	0	0	0	0	100	0	0	0	0	0	0	0	0	0	100
2	259	316	0	0	0	0	20	20	30	15	15	0	0	0	20	80	0
REACH TOTAL	265	344	0	0	0	0	26	18	28	14	14	0	0	0	18	74	8
TOTAL	1,372	4,901	12	<1	<1	<1	7	3	9	24	31	19	4	3	48	51	1

APPENDIX I. (Continued)

TRIBUTARIES: H-1b

LOCATION		LENGTH	TOTAL AREA	SPAWNING AREA		PERCENT OF TOTAL SPAWNING AREA		SUBSTRATE COMPOSITION (%)								SURFACE WATER VELOCITY	
Reach	Section	(m)	(m^2)	(m^2)	(%)	Above Falls	Drainage	Bedrock	Large Boulder	Small Boulder	Large Cobble	Small Cobble	Coarse Gravel	Fine Gravel	Fines	P	R
1	1	150	684	103	15	<1	<1	0	0	0	0	0	10	50	40	90	10
	2	152	465	279	60	<1	<1	0	0	0	0	0	45	45	10	40	60
	3	165	503	302	60	<1	<1	0	0	0	0	5	55	35	5	40	60
REACH TOTAL		467	1,652	684	41	2	1	0	0	0	0	2	33	44	21	61	39
2	1	152	557	334	60	<1	<1	0	0	0	0	10	85	5	0	30	70
	2	164	599	270	45	<1	<1	0	0	0	0	50	41	3	5	55	45
	3	156	572	200	35	<1	<1	0	0	0	0	50	43	4	3	65	35
	4	172	524	314	60	<1	<1	0	0	0	0	50	42	4	4	40	60
REACH TOTAL		644	2,252	1118	50	3	2	0	0	0	0	40	53	4	3	48	52
3	1	157	478	96	20	<1	<1	0	0	0	0	0	82	15	3	80	20
	2	161	490	147	30	<1	<1	0	0	0	0	0	60	35	5	70	30
	3	178	543	54	10	<1	<1	0	0	0	0	0	70	28	2	90	10
	4	76	232	12	5	<1	<1	0	0	0	0	0	70	28	2	95	5
REACH TOTAL		572	1,743	309	18	<1	<1	0	0	0	0	0	71	26	3	82	18
TOTAL		1,683	5,647	2111	37	5	4	0	0	0	0	17	53	22	8	62	38

APPENDIX I. (Continued)

TRIBUTARIES: H-1c

LOCATION Section	LENGTH (m)	TOTAL AREA (m^2)	SPAWNING AREA (m^2)	SPAWNING AREA (%)	PERCENT OF TOTAL SPAWNING AREA: Above Falls	PERCENT OF TOTAL SPAWNING AREA: Drainage	SUBSTRATE COMPOSITION (%): Bedrock	Large Boulder	Small Boulder	Large Cobble	Small Cobble	Coarse Gravel	Fine Gravel	Fines	SURFACE WATER VELOCIT: P	R
1	85	207	0	0	0	0	0	0	0	0	0	80	10	10	95	5
2	124	302	0	0	0	0	0	0	0	0	10	60	10	20	100	0
3	94	287	0	0	0	0	0	0	0	0	20	70	10	0	100	0
4	148	158	0	0	0	0	0	0	0	0	15	80	5	0	100	0
5	74	67	0	0	0	0	0	0	0	0	10	80	10	0	100	0
6	109	199	0	0	0	0	0	0	0	0	10	80	10	0	100	0
7	48	44	0	0	0	0	0	0	0	0	60	30	5	5	100	0
8	215	656	0	0	0	0	0	0	0	0	40	50	10	0	90	10
9	189	170	0	0	0	0	0	0	0	40	65	5	0	0	80	20
REACH TOTAL	1,036	2,090	0	0	0	0	0	0	0	2	26	59	8	4	95	5
1	81	49	0	0	0	0	0	0	10	40	40	10	0	0	50	50
2	120	220	0	0	0	0	0	0	0	40	30	20	10	0	50	50
3	134	245	0	0	0	0	0	0	10	50	40	0	0	0	70	30
4	75	137	0	0	0	0	0	20	30	30	10	10	0	0	70	30
5	68	103	0	0	0	0	0	0	60	20	10	5	0	5	90	10
6	65	59	0	0	0	0	0	5	10	70	15	0	0	0	50	50
7	98	90	0	0	0	0	0	0	5	30	60	5	0	0	70	30
8	61	56	0	0	0	0	0	5	10	70	10	0	0	5	90	10
9	52	395	0	0	0	0	0	5	10	60	10	0	0	15	90	10
REACH TOTAL	754	1,354	0	0	0	0	0	4	14	47	23	5	2	5	73	27
1	107	813	0	0	0	0	0	0	0	0	0	20	20	60	100	0
2	183	279	0	0	0	0	0	0	0	0	0	20	20	60	100	0
3	213	325	0	0	0	0	0	0	0	0	0	50	30	20	90	10
4	183	279	0	0	0	0	0	0	0	0	20	40	20	20	100	0
5	91	56	0	0	0	0	0	0	0	5	60	5	5	25	70	30
6	152	116	0	0	0	0	0	0	0	0	50	20	10	20	95	5
7	105	80	0	0	0	0	0	0	0	15	60	20	5	0	85	15
8	99	75	0	0	0	0	0	0	0	5	50	20	20	5	98	2
9	24	7	0	0	0	0	0	0	0	5	90	5	0	0	90	10
10	31	19	0	0	0	0	0	0	0	0	10	80	10	0	98	2
REACH TOTAL	1,188	2,049	0	0	0	0	0	0	0	<1	12	28	20	40	87	3
TOTAL	2,978	5,493	0	0	0	0	0	1	3	13	20	33	11	19	90	10

APPENDIX ... (Continued)

TRIBUTARIES: H-2

LOCATION		LENGTH	TOTAL AREA	SPAWNING AREA		PERCENT OF TOTAL SPAWNING AREA		SUBSTRATE COMPOSITION (%)								SURFACE WATER VELOCITY	
Reach	Section	(m)	(m^2)	(m^2)	(%)	Above Falls	Drainage	Bedrock	Large Boulder	Small Boulder	Large Cobble	Small Cobble	Coarse Gravel	Fine Gravel	Fines	P	R
1	1	61	93	0	0	0	0	0	0	0	5	60	5	0	30	100	0
	2	61	56	0	0	0	0	0	0	0	10	50	40	0	0	60	40
	3	91	84	0	0	0	0	20	0	5	70	5	0	0	0	30	70
	4	76	186	0	0	0	0	60	0	5	0	5	30	0	0	50	50
	5	46	111	0	0	0	0	60	0	0	0	10	10	10	10	75	25
	6	354	4,311	0	0	0	0	0	0	0	0	5	0	0	95	100	0
TOTAL		683	4,841	0	0	0	0	4	0	<1	1	7	2	<1	85	96	4

TRIBUTARIES: H-3

1	1	55	67	0	0	0	0	0	0	0	0	5	80	10	5	100	0
	2	91	167	0	0	0	0	0	0	0	0	0	80	10	10	90	10
	3	30	37	0	0	0	0	0	0	0	0	10	50	30	10	100	0
	4	91	84	0	0	0	0	0	0	0	0	0	30	30	40	90	10
	5	91	84	0	0	0	0	0	0	0	0	30	35	15	20	95	5
	6	91	84	0	0	0	0	0	0	0	20	50	10	5	15	95	5
	7	91	84	0	0	0	0	0	0	0	20	10	60	10	0	95	5
	8	91	84	0	0	0	0	0	0	0	30	5	60	5	10	95	5
	9	91	70	0	0	0	0	0	0	0	10	60	10	10	10	100	0
	10	91	70	0	0	0	0	0	0	0	70	0	10	10	0	100	0
	11	91	56	0	0	0	0	0	0	0	70	10	20	0	0	100	0
	12	91	70	0	0	0	0	0	0	0	5	5	85	5	0	100	0
TOTAL		995	957	0	0	0	0	0	0	0	20	16	43	11	10	96	4

APPENDIX I. (Continued)

TRIBUTARIES: H-5

LOCATION		LENGTH	TOTAL AREA	SPAWNING AREA		PERCENT OF TOTAL SPAWNING AREA		SUBSTRATE COMPOSITION (%)								SURFACE WATER VELOCIT	
Reach	Section	(m)	(m^2)	(m^2)	(%)	Above Falls	Drainage	Bedrock	Large Boulder	Small Boulder	Large Cobble	Small Cobble	Coarse Gravel	Fine Gravel	Fines	P	R
1	1	87	106	42	40	<1	<1	0	0	0	0	10	80	5	5	25	75
	2	97	178	44	25	<1	<1	0	0	0	30	5	50	10	5	50	50
	3	131	240	12	5	<1	<1	0	0	0	0	10	80	10	0	96	4
REACH TOTAL		315	524	98	19	<1	<1	0	0	0	19	8	70	9	3	66	34
2	1	110	135	14	10	<1	<1	0	0	5	15	55	25	0	0	80	20
	2	26	47	2	5	<1	<1	0	0	5	30	60	5	0	0	80	20
	3	59	36	0	0	0	0	90	5	0	5	0	0	0	0	0	0
REACH TOTAL		195	218	16	7	<1	<1	15	<1	4	17	47	16	0	0	67	17
TOTAL		510	742	114	15	<1	<1	4	<1	1	12	20	54	6	2	66	29

APPENDIX I. (Continued)

TRIBUTARIES: H-7

LOCATION		LENGTH	TOTAL AREA	SPAWNING AREA		PERCENT OF TOTAL SPAWNING AREA		SUBSTRATE COMPOSITION (%)								SURFACE WATER VELOCIT	
Reach	Section	(m)	(m^2)	(m^2)	(%)	Above Falls	Drainage	Bedrock	Large Boulder	Small Boulder	Large Cobble	Small Cobble	Coarse Gravel	Fine Gravel	Fines	P	R
1	1	304	2,591	1555	60	4	3	0	0	0	0	20	60	20	0	25	75
	2	306	2,241	1569	70	4	3	0	0	0	0	15	60	20	5	20	80
	3	385	2,520	2112	60	5	4	0	0	0	0	15	60	20	5	30	70
	4	183	836	418	50	1	<1	0	0	0	5	15	60	10	10	20	80
	5	152	929	93	19	<1	<1	0	0	5	15	20	20	20	5	20	80
	6	152	929	139	15	<1	<1	0	3	7	15	30	35	5	5	50	50
	7	183	1,394	558	40	1	1	0	0	0	5	20	40	20	15	40	60
	8	297	1,808	1085	60	3	2	0	0	0	0	10	65	20	5	30	70
	9	205	1,124	562	50	1	1	0	0	0	0	15	60	20	5	35	65
	10	188	1,087	652	60	2	1	0	0	0	0	5	75	15	5	30	70
	11	292	1,600	1120	70	3	2	0	0	0	5	20	50	10	15	30	70
	12	145	798	399	50	1	<1	0	0	0	0	15	55	20	10	15	85
	13	185	901	360	40	<1	<1	0	0	0	0	10	65	15	10	20	80
	14	121	589	236	40	<1	<1	0	0	0	0	5	70	20	5	25	75
	15	134	655	197	30	<1	<1	0	0	0	0	5	70	20	5	20	80
	16	150	823	411	50	1	<1	0	0	0	0	5	80	10	5	20	80
	17	144	788	236	30	<1	<1	0	0	0	0	10	60	20	10	15	85
	18	106	582	116	20	<1	<1	0	0	0	0	20	60	20	5	10	90
	19	68	309	155	50	<1	<1	0	0	0	5	75	10	5	5	20	80
TOTAL		3,700	23,504	11973	51	30	23	0	<1	<1	2	16	58	17	6	27	73

APPENDIX I. (Continued)

TRIBUTARIES: H-7a

LOCATION Reach	Section	LENGTH (m)	TOTAL AREA (m^2)	SPAWNING AREA (m^2)	SPAWNING AREA (%)	PERCENT OF TOTAL SPAWNING AREA: Above Falls	PERCENT OF TOTAL SPAWNING AREA: Drainage	SUBSTRATE COMPOSITION (%): Bedrock	Large Boulder	Small Boulder	Large Cobble	Small Cobble	Coarse Gravel	Fine Gravel	Fines	SURFACE WATER VELOCITY: P	SURFACE WATER VELOCITY: R
1	1	120	511	77	15	<1	<1	0	0	0	10	75	5	5	5	20	80
	2	105	449	45	10	<1	<1	0	0	0	5	80	10	5	0	10	90
	3	155	711	71	10	<1	<1	0	0	0	20	60	10	5	5	20	80
	REACH TOTAL	380	1,671	193	11	<1	<1	0	0	0	13	70	8	5	4	17	83
2	1	110	502	25	5	<1	<1	0	0	15	45	20	15	5	0	20	60
	2	128	582	29	5	<1	<1	5	5	30	40	15	5	0	0	20	50
	3	434	1,456	0	0	0	0	0	5	20	40	20	15	0	0	34	33
	REACH TOTAL	672	2,543	54	2	<1	<1	1	4	21	41	19	13	1	0	23	42
	TOTAL	1,052	4,214	247	6	<1	<1	<1	2	13	30	39	11	3	2	24	58

TRIBUTARIES: H-8

1	1	76	163	82	50	<1	<1	0	0	0	0	5	85	5	5	40	60
	2	122	260	156	60	<1	<1	0	0	0	0	10	75	10	5	30	70
	3	152	697	383	55	1	<1	0	0	0	5	55	20	15	5	40	60
	4	152	557	223	40	<1	<1	0	0	1	15	20	60	4	0	30	70
	REACH TOTAL	502	1,677	844	50	2	2	0	0	1	7	31	48	10	3	35	65
	1	49	193	19	10	<1	<1	0	10	15	35	20	10	5	5	20	80
	2	24	111	0	0	0	0	60	0	0	20	10	5	5	0	20	20
	3	114	523	26	5	<1	<1	5	0	5	45	20	15	5	5	20	80
	4	152	465	70	15	<1	<1	0	0	10	60	10	10	5	5	50	50
	REACH TOTAL	339	1,292	115	9	<1	<1	7	1	8	47	15	12	5	5	31	64
	TOTAL	841	2,969	959	32	2	2	3	<1	4	24	24	32	8	4	33	65

APPENDIX II. Distribution of Rearing Areas Above the Falls in Hatchery Creek Drainage Summarized by Stream Reach and Section.

MAINSTEM: Segment I-b

LOCATION REACH	SECTION	TOTAL AREA (m^2)	POOL AREA (m^2)	POOL AREA (%)	PERCENTAGE OF TOTAL REARING AREA: ABOVE FALLS	PERCENTAGE OF TOTAL REARING AREA: DRAINAGE	QUALITY OF HABITAT FOR REARING	JUV. FISH SPECIES PER RELATIVE ABUNDANCE
1	1	7,358	2,207	30	1	1	Good	-0-
	2	4,548	1,364	30	1	< 1	Good	-0-
	3	10,347	3,621	35	3	2	Good	Coho/Moderate
	4	3,484	348	10	< 1	< 1	Good	Coho/Moderate
	5	12,207	1,221	10	< 1	< 1	Good	Coho/Moderate
	6	14,924	11,939	80	8	8	Excellent/Good	Coho/Moderate
	TOTAL	52,868	20,700	30	15	13	Good	Coho/Moderate

MAINSTEM: Segment II

1	1	18,156	18,156	100	13	12	Good	-0-
	REACH TOTAL	18,156	18,156	100	13	12	Good	None Observed
2	1	15,300	3,060	20	2	2	Good/Fair	-0-
	2a	1,948	584	30	< 1	< 1	Good	-0-
	2b	1,169	117	10	< 1	< 1	Fair	-0-
	3	4,515	3,161	70	2	2	Good	-0-
	REACH TOTAL	22,932	6,922	30	4	4	Good/Fair	None Observed
3	1	3,458	0	0	0	0	Fair	-0-
	2	2,634	527	20	< 1	< 1	Good/Fair	-0-
	3	2,256	0	0	0	0	Fair	-0-
	4	2,769	415	15	< 1	< 1	Fair	-0-
	5	2,370	0	0	0	0	----	-0-
	REACH TOTAL	13,487	942	7	< 1	< 1	Fair	None Observed
	TOTAL	54,575	26,020	48	18	17	Good/Fair	None Observed

APPENDIX II. (Continued)

MAINSTEM: Segment III

LOCATION REACH	SECTION	TOTAL AREA (m^2)	POOL (m^2)	AREA (%)	PERCENTAGE OF TOTAL REARING AREA: ABOVE FALLS	DRAINAGE	QUALITY OF HABITAT FOR REARING	JUV. FISH SPECIES PER RELATIVE ABUNDANCE
1	1	1,073	1,073	100	< 1	< 1	Good/Fair	Coho/Few
	2	1,397	1,257	90	< 1	< 1	Good/Fair	Coho/Few
	3	1,278	1,086	85	< 1	< 1	Good/Fair	Coho/Few
	4	1,421	1,137	80	< 1	< 1	Good/Fair	Coho/Few
	5	1,805	1,354	75	< 1	< 1	Good/Fair	Coho/Few
	6	1,095	657	60	< 1	< 1	Good/Fair	Coho/Few
	7	916	458	50	< 1	< 1	Good/Fair	Coho/Few
	REACH TOTAL	8,985	7.022	78	5	4	Good/Fair	Coho/Few
2	1	8,361	8,361	100	6	5	Good	Coho/Few
	2	5,769	4,327	75	3	3	Good	Coho/Few
	3	5,184	5,184	100	4	3	Good	None Observed
	4	2,861	2,861	100	2	2	Good	None Observed
	5	5,128	5,128	100	4	3	Good	None Observed
	6	2,787	2,787	100	2	2	Good	None Observed
	REACH TOTAL	30,090	28,648	95	20	18	Good	Coho/Few
	TOTAL	39,075	35,670	91	25	23	Good/Fair	Coho/Few

APPENDIX II. (Continued)

TRIBUTARIES: H-1

REACH	SECTION	TOTAL AREA (m^2)	POOL AREA (m^2)	POOL AREA (%)	PERCENTAGE OF TOTAL REARING AREA: ABOVE FALLS	PERCENTAGE OF TOTAL REARING AREA: DRAINAGE	QUALITY OF HABITAT FOR REARING	JUV. FISH SPECIES PER RELATIVE ABUNDANCE
1	1	13,935	13,935	100	10	9	Good	Coho/Few
	2	2,508	2,508	100	2	2	Good	Coho/Few
	3	2,601	2,601	100	2	2	Good	Coho/Few
	4	1,561	1,561	100	1	1	Good	Coho/Few
	5	569	558	98	< 1	< 1	Good	Coho/Few
	6	878	878	100	< 1	< 1	Good	Coho/Few
	7	1,301	1,301	100	< 1	< 1	Good	Coho/Few
	REACH TOTAL	23,353	23,342	100	16	15	Good	Coho/Few
2	1	1,108	1,053	95	< 1	< 1	Good	Coho/Moderate
	2	697	662	95	< 1	< 1	Good	Coho/Moderate
	3	418	376	90	< 1	< 1	Good	Coho/Moderate
	4	655	642	98	< 1	< 1	Good	Coho/Moderate
	5	957	670	70	< 1	< 1	Good	Coho/Moderate
	6	223	201	90	< 1	< 1	Good	Coho/Moderate
	7	397	318	80	< 1	< 1	Good	Coho/Moderate
	8	503	453	90	< 1	< 1	Good	Coho/Moderate
	9	149	119	80	< 1	< 1	Good	Coho/Moderate
	10	195	117	60	< 1	< 1	Good	Coho/Moderate
	11	223	178	80	< 1	< 1	Good	Coho/Moderate
	12	297	267	90	< 1	< 1	Good	Coho/Moderate
	REACH TOTAL	5,822	5,056	87	3	3	Good	Coho/Moderate

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APPENDIX II. (Continued)

TRIBUTARIES: H-1 (Continued)

LOCATION REACH	SECTION	TOTAL AREA (m^2)	POOL AREA (m^2)	POOL AREA (%)	PERCENTAGE OF TOTAL REARING AREA: ABOVE FALLS	PERCENTAGE OF TOTAL REARING AREA: DRAINAGE	QUALITY OF HABITAT FOR REARING	JUV. FISH SPECIES PER RELATIVE ABUNDANCE
3	1	172	69	40	< 1	< 1	Fair	Coho/Few
	2	279	279	100	< 1	< 1	Fair	Coho/Few
	3	244	122	50	< 1	< 1	Poor	0
	4	118	89	75	< 1	< 1	Poor	0
	5	137	55	40	< 1	< 1	Poor	Coho/Few
	6	10	0	0	0	0	Poor	0
	7	511	102	20	< 1	< 1	Fair/Poor	Coho/Few
	8	523	157	30	< 1	< 1	Fair/Poor	Coho/Few
	9	163	65	40	< 1	< 1	Poor	0
	10	251	151	60	< 1	< 1	Fair	Coho/Few
	REACH TOTAL	2,408	1,089	46	< 1	< 1	Fair/Poor	Coho/Few
4	1	657	493	75	< 1	< 1	Good	Coho/Moderate
	2	566	311	55	< 1	< 1	Good	Coho/Moderate
	3	429	279	65	< 1	< 1	Good	Coho/Moderate
	4	650	98	15	< 1	< 1	Good	Coho/Moderate
	5	351	281	80	< 1	< 1	Good	Coho/Moderate
	6	484	48	10	< 1	< 1	Good/Fair	Coho/Moderate
	7	940	188	20	< 1	< 1	Fair	Coho/Moderate
	8	658	263	40	< 1	< 1	Fair	Coho/Moderate
	9	1,784	89	5	< 1	< 1	Fair	Coho/Moderate
	10	1,087	163	15	< 1	< 1	Good/Fair	Coho/Moderate
	11	920	92	10	< 1	< 1	Good	Coho/Moderate
	12	1,676	1,006	60	< 1	< 1	Good/Fair	Coho/Moderate
	REACH TOTAL	10,202	3,311	32	2	2	Good/Fair	Coho/Moderate
	TOTAL	41,785	32,798	78	23	21	Good/Fair	Coho/Few to Moderate

APPENDIX II. (Continued)

TRIBUTARIES: H-1a

LOCATION REACH	LOCATION SECTION	TOTAL AREA (m^2)	POOL AREA (m^2)	POOL AREA (%)	PERCENTAGE OF TOTAL REARING AREA: ABOVE FALLS	PERCENTAGE OF TOTAL REARING AREA: DRAINAGE	QUALITY OF HABITAT FOR REARING	JUV. FISH SPECIES PER RELATIVE ABUNDANCE
1	1	488	439	90	< 1	< 1	Good	Coho/Moderate
	2	376	301	80	< 1	< 1	Good	Coho/Moderate
	3	163	130	80	< 1	< 1	Good	Coho/Moderate
	4	468	328	70	< 1	< 1	Excellent	Coho/Moderate
	5	632	442	70	< 1	< 1	Excellent	Coho/Moderate
	6	578	289	50	< 1	< 1	Good	Coho/Moderate
	REACH TOTAL	2,705	1,929	71	1	1	Excellent/Good	Coho/Moderate
2	1	557	56	10	< 1	< 1	Fair	Coho/Moderate
	2	320	64	20	< 1	< 1	Fair	Coho/Moderate
	3	418	167	40	< 1	< 1	Fair	Coho/Moderate
	4	557	111	20	< 1	< 1	Fair	Coho/Moderate
	REACH TOTAL	1,852	398	22	< 1	< 1	Fair	Coho/Moderate
3	1	28	0	0	0	0	Poor	0
	2	316	63	20	< 1	< 1	Fair	0
	REACH TOTAL	344	63	18	< 1	< 1	Fair/Poor	None Observed
	TOTAL	4,901	2,390	49	2	1	Good/Fair	Coho/Moderate

APPENDIX II. (Continued)

TRIBUTARIES: H-1b

LOCATION REACH	SECTION	TOTAL AREA (m^2)	POOL AREA (m^2)	POOL AREA (%)	PERCENTAGE OF TOTAL REARING AREA: ABOVE FALLS	PERCENTAGE OF TOTAL REARING AREA: DRAINAGE	QUALITY OF HABITAT FOR REARING	JUV. FISH SPECIES PER RELATIVE ABUNDANCE
1	1	684	616	90	<1	<1	Good	Coho/Abundant
	2	465	186	40	<1	<1	Excellent/Good	Coho/Abundant
	3	503	201	40	<1	<1	Excellent/Good	Coho/Abundant
	REACH TOTAL	1,652	1,003	61	<1	<1	Excellent/Good	Coho/Abundant
2	1	557	167	30	<1	<1	Good	Coho/Abundant
	2	599	329	55	<1	<1	Good	Coho/Abundant
	3	572	372	65	<1	<1	Good	Coho/Abundant
	4	524	210	40	<1	<1	Good	Coho/Abundant
	REACH TOTAL	2,252	1,078	48	<1	<1	Good	Coho/Abundant
3	1	478	382	80	<1	<1	Good	Coho/Abundant
	2	490	343	70	<1	<1	Excellent	Coho/Abundant
	3	543	489	90	<1	<1	Good	Coho/Few
	4	232	220	95	<1	<1	Good	Coho/Few
	REACH TOTAL	1,743	1,434	82	1	<1	Excellent/Good	Coho/Moderate
	TOTAL	5,647	3,515	62	2	2	Excellent/Good	Coho/Abundant

APPENDIX II. (Continued)

TRIBUTARIES H-1c

LOCATION REACH	SECTION	TOTAL AREA (m^2)	POOL AREA (m^2)	POOL AREA (%)	PERCENTAGE OF TOTAL REARING AREA: ABOVE FALLS	PERCENTAGE OF TOTAL REARING AREA: DRAINAGE	QUALITY OF HABITAT FOR REARING	JUV. FISH SPECIES PER RELATIVE ABUNDANCE
1	1	207	197	95	<1	<1	Good	Coho/Abundant
	2	302	302	100	<1	<1	Good	Coho/Abundant
	3	287	287	100	<1	<1	Good	Coho/Moderate
	4	158	158	100	<1	<1	Good	Coho/Abundant
	5	67	67	100	<1	<1	Good	Coho/Moderate
	6	199	199	100	<1	<1	Good	Coho/Moderate
	7	44	44	100	<1	<1	Fair	Coho/Moderate
	8	656	590	90	<1	<1	Good	Coho/Abundant
	9	170	136	80	<1	<1	Fair	Coho/Abundant
	REACH TOTAL	2,090	1,980	95	1	1	Good	Coho/Moderate Abundant
2	1	49	25	50	<1	<1	Fair	Coho/Moderate
	2	220	110	50	<1	<1	Fair	Coho/Abundant
	3	245	172	70	<1	<1	Fair	Coho/Moderate
	4	137	96	70	<1	<1	Fair	Coho/Moderate
	5	103	93	90	<1	<1	Fair	Coho/Moderate
	6	59	30	50	<1	<1	Fair	Coho/Moderate
	7	90	63	70	<1	<1	Fair	Coho/Moderate
	8	56	50	90	<1	<1	Fair	Coho/Moderate
	9	395	356	90	<1	<1	Fair	Coho/Moderate
	REACH TOTAL	1,354	995	73	<1	<1	Fair	Coho/Moderate
3	1	813	813	100	<1	<1	Good	Coho/Abundant
	2	279	279	100	<1	<1	Fair	Coho/Abundant
	3	325	293	90	<1	<1	Excellent	Coho/Abundant
	4	279	279	100	<1	<1	Excellent	Coho/Abundant
	5	56	39	70	<1	<1	Excellent	Coho/Abundant
	6	116	110	95	<1	<1	Fair	Coho/Abundant
	7	80	68	85	<1	<1	Fair	Coho/Abundant
	8	75	73	98	<1	<1	Excellent	Coho/Abundant
	9	7	6	90	<1	<1	Fair	Coho/Moderate
	10	19	19	98	<1	<1	Fair	Coho/Moderate
	REACH TOTAL	2,049	1,979	97	1	1	Good	Coho/Abundant
	TOTAL	5,493	4,954	90	3	3	Good/Fair	Coho/Moderate Abundant

APPENDIX II. (Continued)

TRIBUTARIES: H-2

REACH	SECTION	TOTAL AREA (m^2)	POOL AREA (m^2)	POOL AREA (%)	PERCENTAGE OF TOTAL REARING AREA: ABOVE FALLS	PERCENTAGE OF TOTAL REARING AREA: DRAINAGE	QUALITY OF HABITAT FOR REARING	JUV. FISH SPECIES PER RELATIVE ABUNDANCE
1	1	93	93	100	< 1	< 1	Good	0
	2	56	34	60	< 1	< 1	Good	Coho/Few
	3	84	25	30	< 1	< 1	Fair	Coho/Few
	4	186	93	50	< 1	< 1	Fair	Trout/Few
	5	111	83	75	< 1	< 1	Good	0
	6	4,311	4,311	100	3	3	Good	0
	TOTAL	4,841	4,639	96	3	3	Good/Fair	Coho/Few

TRIBUTARIES: H-3

REACH	SECTION	TOTAL AREA (m^2)	POOL AREA (m^2)	POOL AREA (%)	PERCENTAGE OF TOTAL REARING AREA: ABOVE FALLS	PERCENTAGE OF TOTAL REARING AREA: DRAINAGE	QUALITY OF HABITAT FOR REARING	JUV. FISH SPECIES PER RELATIVE ABUNDANCE
1	1	67	67	100	< 1	< 1	Good	Coho/Few
	2	167	150	90	< 1	< 1	Excellent	Coho/Few
	3	37	37	100	< 1	< 1	Fair	0
	4	84	76	90	< 1	< 1	Good	Coho/Few
	5	84	80	95	< 1	< 1	Excellent	Coho/Few
	6	84	80	95	< 1	< 1	Good	Coho/Few
	7	84	80	95	< 1	< 1	Fair	Coho/Few
	8	84	80	95	< 1	< 1	Good	0
	9	70	70	100	< 1	< 1	Good	0
	10	70	70	100	< 1	< 1	Good	0
	11	56	56	100	< 1	< 1	Good	0
	12	70	70	100	< 1	< 1	Excellent	0
	TOTAL	957	916	96	< 1	< 1	Good	Coho/Few

APPENDIX II. (Continued)

TRIBUTARIES: H-5

LOCATION REACH	SECTION	TOTAL AREA (m^2)	POOL AREA (m^2)	POOL AREA (%)	PERCENTAGE OF TOTAL REARING AREA: ABOVE FALLS	PERCENTAGE OF TOTAL REARING AREA: DRAINAGE	QUALITY OF HABITAT FOR REARING	JUV. FISH SPECIES PER RELATIVE ABUNDANCE
1	1	106	27	25	< 1	< 1	Good	Coho/Few
	2	178	89	50	< 1	< 1	Good	Coho/Few
	3	240	230	96	< 1	< 1	Good	Coho/Few
	REACH TOTAL	524	346	66	< 1	< 1	Good	Coho/Few
	4	135	108	80	< 1	< 1	Fair	Coho/Few
	5	47	38	80	< 1	< 1	Good	Coho/Few
	6	36	0	0	0	0	Poor	Coho/Few
	REACH TOTAL	218	146	67	< 1	< 1	Good/Fair	Coho/Few
	TOTAL	742	492	66	< 1	< 1	Good/Fair	Coho/Few

APPENDIX II. (Continued)

TRIBUTARIES: H-7

LOCATION REACH	SECTION	TOTAL AREA (m^2)	POOL AREA (m^2)	POOL AREA (%)	PERCENTAGE OF TOTAL REARING AREA: ABOVE FALLS	PERCENTAGE OF TOTAL REARING AREA: DRAINAGE	QUALITY OF HABITAT FOR REARING	JUV. FISH SPECIES PER RELATIVE ABUNDANCE
1	1	2,591	648	25	< 1	<1	Good/Fair	0
	2	2,241	448	20	< 1	<1	Good	0
	3	3,520	1,056	30	< 1	<1	Good/Fair	Coho/Few
	4	836	167	20	< 1	<1	Excellent	None Observed
	5	929	186	20	< 1	<1	Good	None Observed
	6	929	465	50	< 1	<1	Excellent	None Observed
	7	1,394	558	40	< 1	<1	Excellent	None Observed
	8	1,808	542	30	<1	<1	Good	None Observed
	9	1,124	393	35	<1	<1	Good	None Observed
	10	1,087	326	30	<1	<1	Good	None Observed
	11	1,600	480	30	<1	<1	Good	None Observed
	12	798	120	15	<1	<1	Good	None Observed
	13	901	180	20	<1	<1	Good	None Observed
	14	589	147	25	<1	<1	Good	None Observed
	15	655	131	20	<1	<1	Good	None Observed
	16	823	165	20	<1	<1	Good/Fair	None Observed
	17	788	118	15	<1	<1	Good/Fair	None Observed
	18	582	58	10	<1	<1	Fair	None Observed
	19	309	62	20	<1	<1	Good	Coho/Few
	TOTAL	23,504	6,250	27	4	4	Good	Coho/Very Few

APPENDIX II. (Continued)

TRIBUTARIES: H-7a

LOCATION REACH	LOCATION SECTION	TOTAL AREA (m^2)	POOL AREA (m^2)	POOL AREA (%)	PERCENTAGE OF TOTAL REARING AREA: ABOVE FALLS	PERCENTAGE OF TOTAL REARING AREA: DRAINAGE	QUALITY OF HABITAT FOR REARING	JUV. FISH SPECIES PER RELATIVE ABUNDANCE
1	1	511	102	20	< 1	< 1	Fair	0
	2	449	45	10	< 1	< 1	Fair	0
	3	711	142	20	< 1	< 1	Fair	Coho/Few
	REACH TOTAL	1,671	289	17	< 1	< 1	Fair	Coho/Few
2	1	502	100	20	< 1	< 1	Fair	0
	2	585	117	20	< 1	< 1	Poor	0
	3	1,456	495	34	< 1	< 1	Poor	0
	REACH TOTAL	2,543	712	28	< 1	< 1	Fair/Poor	None Observed
	TOTAL	4,214	1,001	24	< 1	< 1	Fair/Poor	Coho/Very Few

APPENDIX II. (Continued)

TRIBUTARIES: H-8

LOCATION REACH	SECTION	TOTAL AREA (m^2)	POOL AREA (m^2)	POOL AREA (%)	PERCENTAGE OF TOTAL REARING AREA: ABOVE FALLS	PERCENTAGE OF TOTAL REARING AREA: DRAINAGE	QUALITY OF HABITAT FOR REARING	JUV. FISH SPECIES PER RELATIVE ABUNDANCE
1	1	163	65	40	< 1	< 1	Excellent	0
	2	260	78	30	< 1	< 1	Excellent	0
	3	697	279	40	< 1	< 1	Excellent	Coho/Few
	4	557	167	30	< 1	< 1	Good	Coho/Few
	REACH TOTAL	1,677	589	35	< 1	< 1	Excellent/Good	Coho/Few
2	1	193	39	20	< 1	< 1	Fair	None Observed
	2	111	22	20	< 1	< 1	Poor	None Observed
	3	523	105	20	< 1	< 1	Good/Fair	None Observed
	4	465	232	50	< 1	< 1	Good	None Observed
	REACH TOTAL	1,292	398	31	< 1	< 1	Fair	None Observed
	TOTAL	2,969	987	33	< 1	< 1	Good/Fair	Coho/Very Few

TRIBUTARIES: H-12

1	1	873	262	30	< 1	< 1	Good/Fair	Coho/Moderate
	2	482	145	30	< 1	< 1	Good/Fair	Coho/Moderate
	3	873	349	40	< 1	< 1	Good	Coho/Moderate
	4	916	366	40	< 1	< 1	Good	Coho/Moderate
	5	279	140	50	< 1	< 1	Good	Coho/Moderate
	TOTAL	3,423	1,262	37	< 1	< 1	Good	Coho/Moderate