HABITAT QUALITY AND ANADROMOUS FISH PRODUCTION POTENTIAL

ON THE WARM SPRINGS INDIAN RESERVATION

Annual Report 1987

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ABSTRACT

In 1987, The Warm Springs Indian Reservation Anadromous Fish Production and Habitat Improvement Program was in the sixth year of a scheduled eleven year program. To date, 21 kilometers of reservation stream habitat have been enhanced for salmonid production benefits.

Unusual climatic conditions created a severe drought throughout the Warm Springs River Basin and Shitike Creek in 1987. Temperature extremes and low annual discharges ensued throughout reservation waters.

Study sites, located in the Warm Springs River Basin and Shitike Creek, continued to be monitored for physical and biological parameters. Post treatment evaluation of bioengineering work in Mill Creek (Strawberry Falls Project) was conducted. Despite low discharges, physical habitat parameters were improved and notable gains were observed in both spring chinook salmon (*Oncorhynchus tshawytscha*) and summer steelhead trout (*Salmo gairdneri*) abundance and biomass at post treatment sites.

Major bioengineering work was completed at the Mill Creek (Potter's Pond) Site. A total of 155 enhancement structures were built along 1.2. stream kilometers to improve salmonid spawning, rearing, and passage areas. Bank stabilization and pool development were also achieved through bioengineering. Preliminary qualitative biological evaluations indicated

increased salmonid usage within the site.

The Humphrey Scoop Trap at the Warm Springs River Mouth continued to monitor Warm Springs Basin anadromous juvenile salmonid out-migration. Estimates for the 1985 brood year were 74,326 spring chinook salmon outmigrants.

The 1987 Fin Clipping Program was instituted to distinguish Warm Springs National Fish Hatchery juvenile spring chinook salmon from wild stocks. Approximately 726,000 hatchery spring chinook salmon were marked with ventral clips. Mortality rates from the activity were minimal.

Four projects are proposed for fiscal year 1988. The Beaver Creek (Dahl Pine) and Mill Creek (Potter's Pond) Fencing Projects are designed to protect extant bioengineering structures and reduce substantial riparian habitat degradation resulting primarily from livestock overgrazing. The Lower Beaver Creek Juniper Rip-Rapping Project should improve physical habitat through bank stabilization and increase salmonid spawning and rearing areas. The Lower Shitike Creek Project consists of major bioengineering activity to enhance 3.2 stream kilometers for salmonid spawning, rearing and passage.

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ACKNOWLEDGEMENTS

Individuals from the Oregon Department of Fish and Wildlife (ODFW) and the United States Fish and Wildlife Service (USFWS) assisted in assembling technical information and gave critical advice in sampling techniques for this project. Specifically, thanks go to Kirk Schroeder and Bob Lindsay (ODFW) and Brian Cates (USFWS). Special thanks go to Louie Pitt, Jr., Tribal Fisheries Field Supervisor who provided assistance with annual report text and graphics, and the Natural Resources BPA Crew: Keith Moody, Jay Suppah and the summer youth crew. A note of thanks is given to Natural Resources Water Management for their help in obtaining technical data.

Additional acknowledgements are given to Sharlayne Garcia, Winona Spino and Raynele Palmer who typed this document, Terry Luther, Tribal Fish and Wildlife Supervisor, for his critical review of the projects and this report, and BPA Project Officer Jeff Gislason for his help and suggestions with the program development.

Finally, I would like to thank Mark Fritsch, Tribal Fisheries Biologist who not only designed, implemented and evaluated the projects but assisted me in the preparation and critique of this annual report as well.

INTRODUCTION

The Confederated Tribes of the Warm Springs Indian Reservation of Oregon, in conjunction with funding and assistance from the Bonneville Power Administration, have continued to survey and improve the anadromous fisheries resources on the reservation.

Completion of renovation and enhancement projects described in Phase III (Fritsch 1986) included the Mill Creek (Potter's Pond) and Beaver Creek (Dahl Pine) Projects. Pretreatment and post treatment[1] physical and biological habitat evaluation of the Strawberry Falls Passage and the Beaver Creek (Dahl Pine) Projects will be included in this report.

In fiscal year 1987, Phase II (Fritsch 1986) projects determined salmonid habitat potential, identified problem areas, suggested possible corrective actions, and examined potential benefits for salmonid populations. These included the Mill Creek (Potter's Pond) and Beaver Creek Fencing Projects, the Lower Beaver Creek Juniper Rip-Rapping Project, and the Lower Shitike Creek Habitat Improvement Project. Phase III or the proposed implementation and evaluation of these latter projects will occur during fiscal year (FY) 1988.

1 before and after project completion

STUDY AREA

The location, physical geography, associated hydrology, and past history of the Warm Springs River Basin and Shitike Creek (Figure 1) have been previously described in detail by Fritsch (1986) and CH2M Hill (1982).

In 1987, a major enhancement project was implemented and completed at the Potter's Pond site in Mill Creek (Figure 2). A maintenance project was conducted in the Reach A and B areas of Beaver Creek (Figure 3). Field sampling was conducted in, Shitike Creek, the Warm Springs River and itstributaries, Beaver and Mill Creeks (Figure 1). Monitoring site designations were consistent with those described in Fritsch (1986).

Four monitoring sites were located in Beaver Creek (Fritsch 1986) (Figure 3). Three sites, Reach A, Reach B Test and Reach B Control, were surveyed and documented for juvenile salmonid abundance, biomass and physical habitat parameters. Reach A and Reach B were considered post treatment areas after the completion of the FY 1986 Beaver Creek (Dahl Pine) Enhancement Project. The fourth site, Lower Island, also continued to be surveyed for juvenile salmonid abundance, biomass and physical habitat parameters. Lower Island was a pretreatment area prior to the initiation of the FY 1988 Lower Beaver Creek Juniper Rip-Rapping Project.

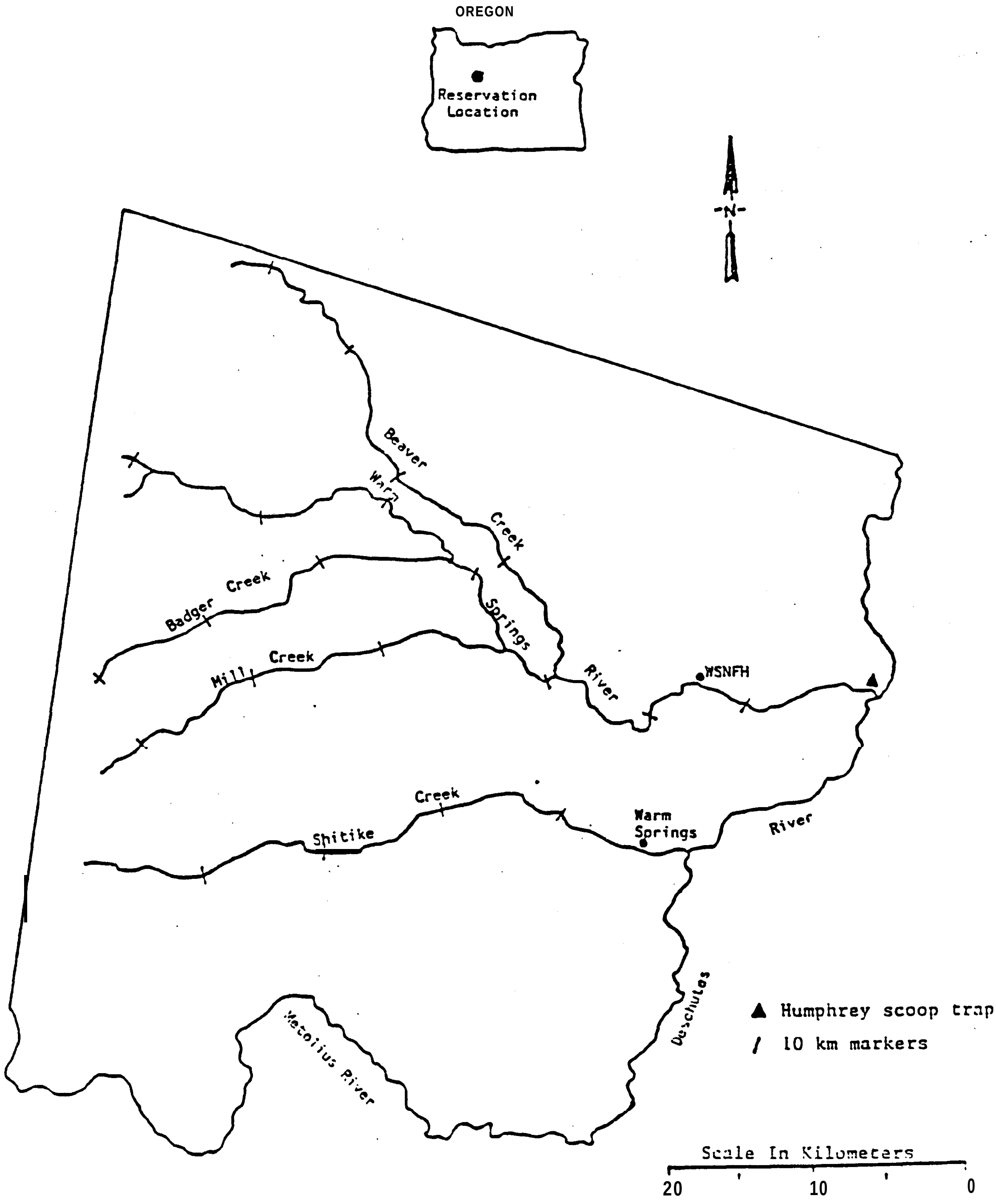


Figure 1. Map of the Warm Springs Indian Reservation.

Mill Creek monitoring sites included the B-241 Road Bridge, above and below Strawberry Falls and the Potter's Pond site (Fritsch 1986) (Figure 2). Potter's Pond was a pretreatment site prior to the completion of the FY 1987 Potter's Pond Project. The remaining three post treatment monitoring sites were primarily for evaluation of the Strawberry Falls Passage Project, implemented and completed in FY 1984. All Mill Creek sites were monitored for juvenile salmonid abundance and biomass, and Potter's Pond was assessed for insite physical habitat parameters.

Two monitoring sites, Headworks and Upper Crossing, were located in Shitike Creek (Fritsch 1986) (Figure 4). The sites were located above the proposed FY 1988 Lower Shitike Creek Project area. These continued to be assessed and documented for juvenile salmonid abundance, biomass, and physical habitat parameters.

The Humphrey Scoop Trap was operated at 0.6 Rkm above the confluence of the Warm Springs River with the Deschutes River (Figure 1), consistent with its previous location (Fritsch 1986).

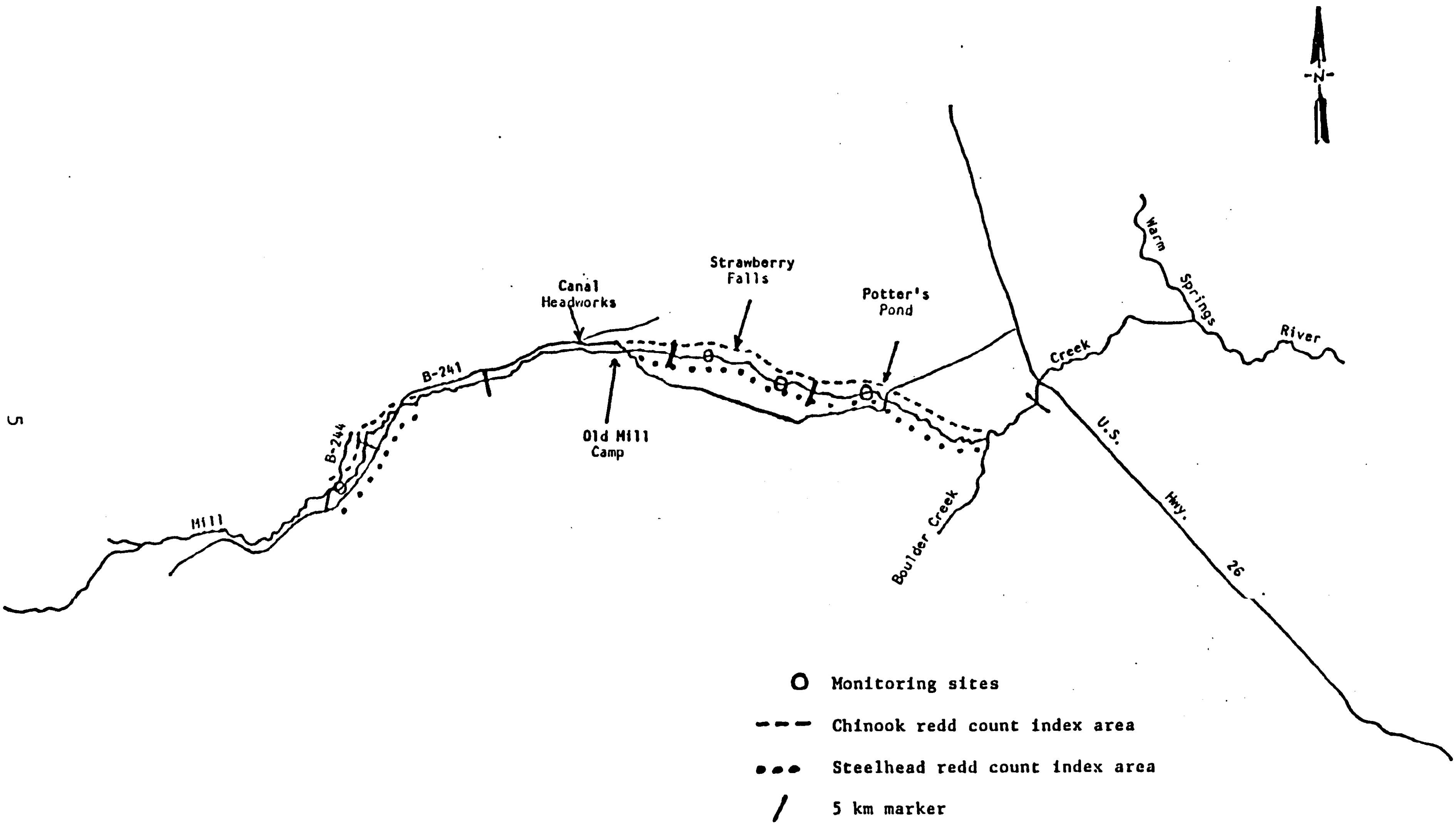


Figure 2 Study sites in the Mill Creek system.

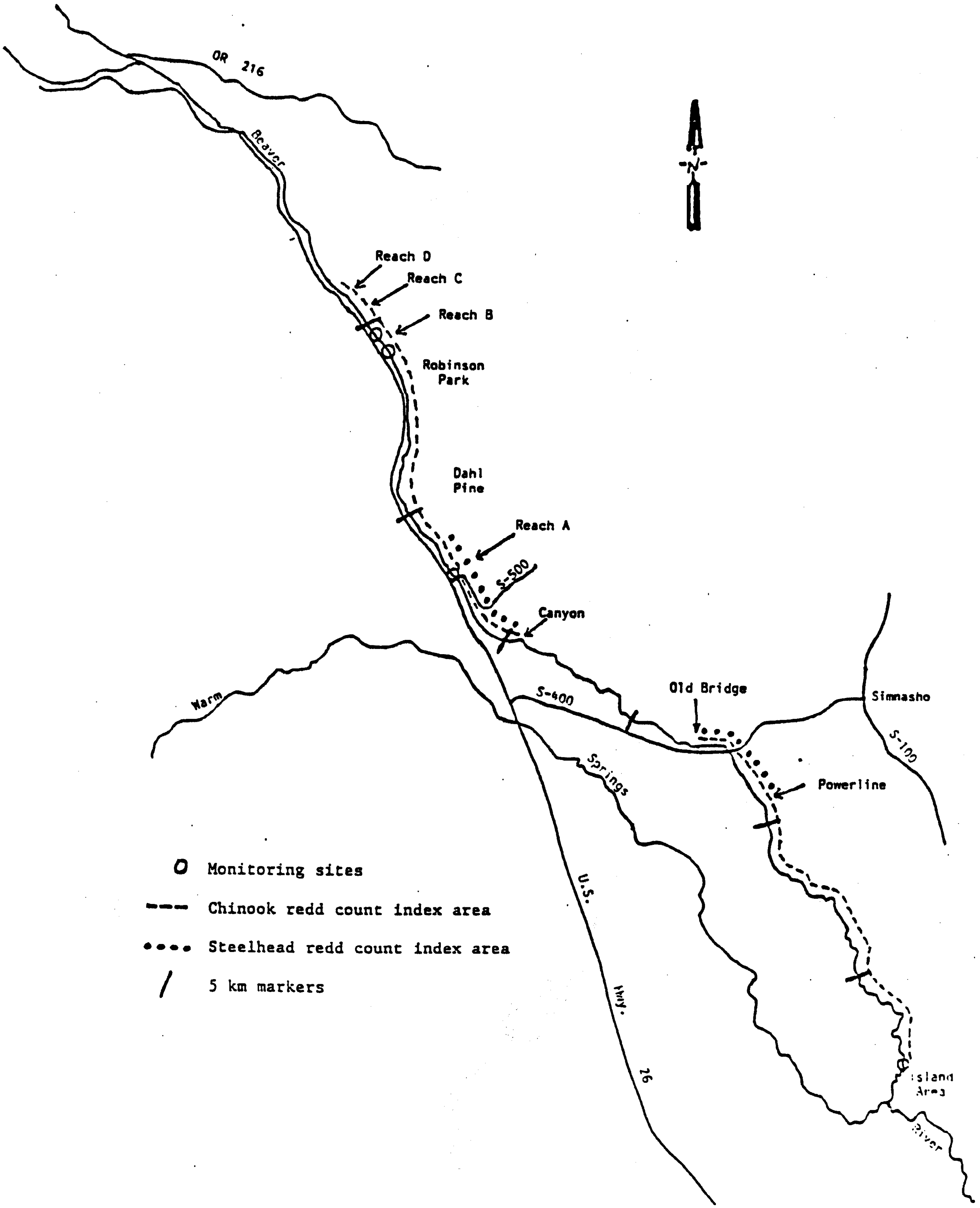


Figure 3. Study sites in the Beaver Creek system.

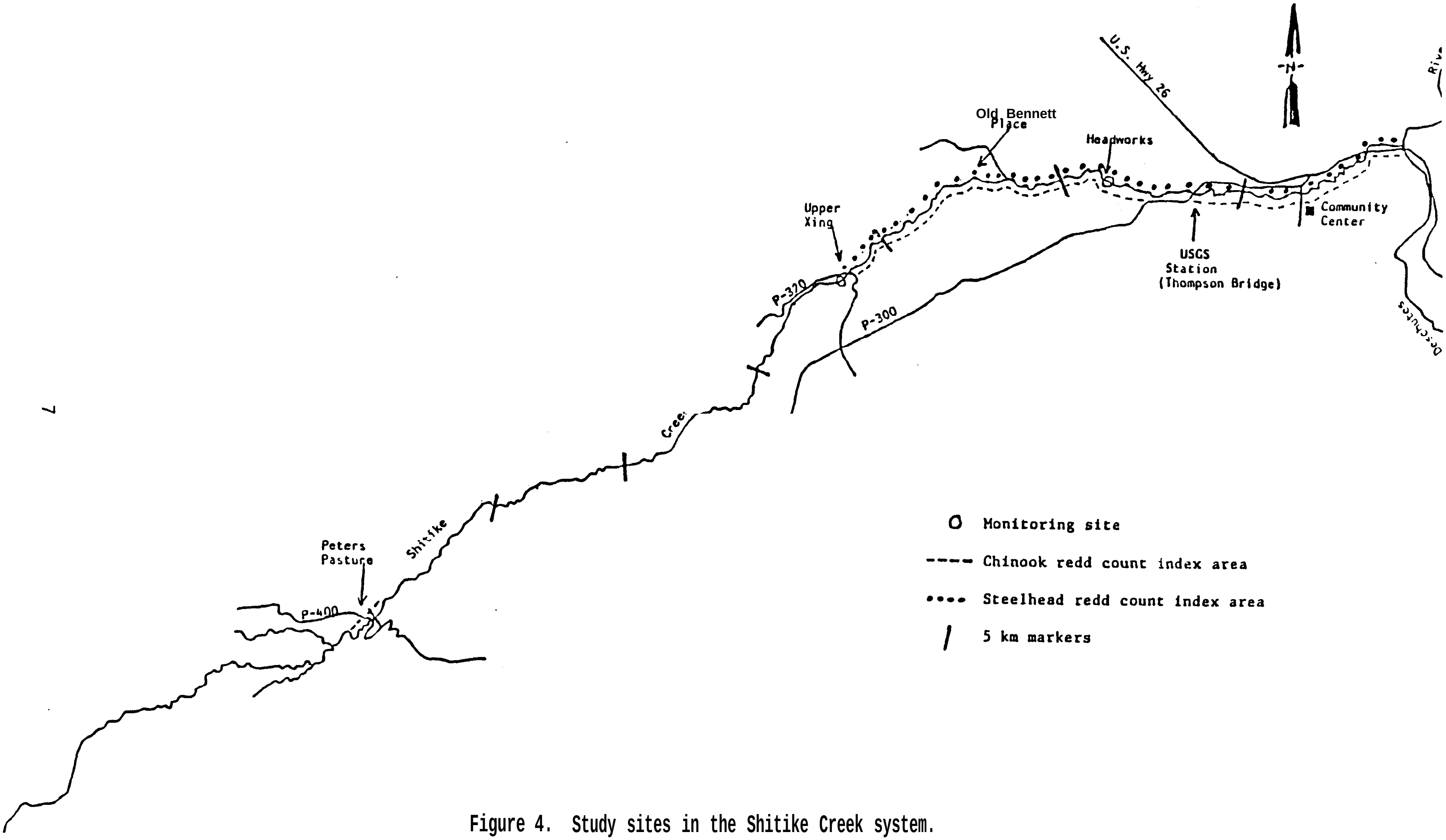


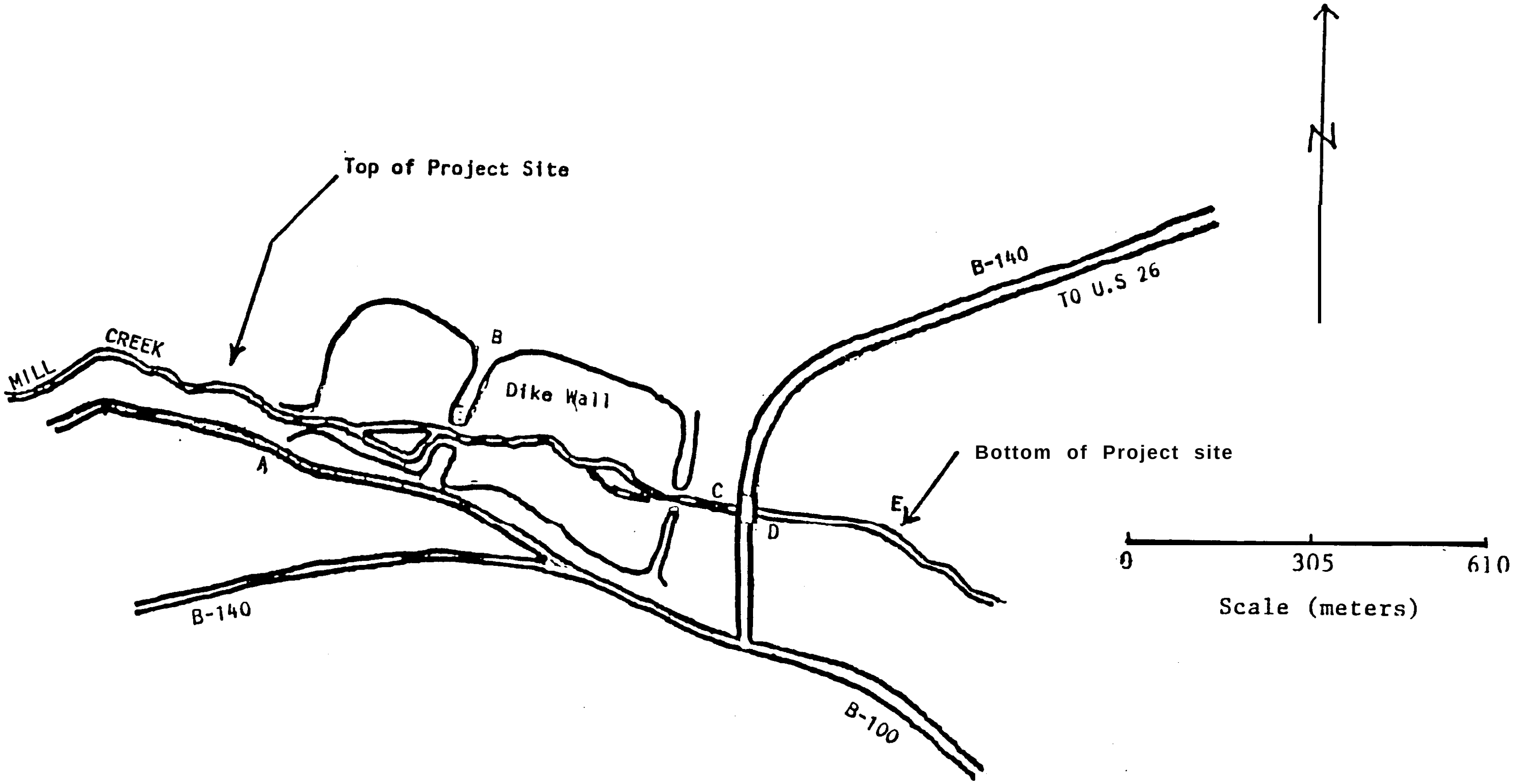
Figure 4. Study sites in the Shitike Creek system.

METHODS AND MATERIALS

Using techniques and procedures described by Fritsch (1986), fish abundance, biomass, migration and selected physical parameters were measured, compiled and compared to associative 1986 data at previously described study sites. Major instream enhancement work was initiated and completed in Mill Creek (Potter's Pond) (Figure 5), and instream maintenance was implemented in Reach A and Reach B areas of Beaver Creek. Most of the biological and physical habitat sampling was restricted to a three week period from July 21, 1987 to August 20, 1987 to create a more consistent timeline in future work. Pretreatment project data were collected from sites on Mill Creek (Potter's Pond) and Beaver Creek (Lower Island). Redd counts, temperature and discharge baseline data continued to be obtained from the Warm Springs River. First year post-treatment data were acquired from Beaver Creek (Reach A and Reach B). Second year post treatment data were collected above and below Strawberry Falls on Mill Creek. Photopoints were taken within all pretreatment and post treatment project boundaries for visual evaluation of project areas.

Fish Abundance, Biomass and Migration

Salmonid populations were measured at all monitoring sites following electroshocking techniques and procedures described in Fritsch (1986). Evaluations of adult salmonid passage and upstream utilization were determined by spawning ground surveys (Fritsch 1986) and these were primarily applied to the Strawberry Falls Passage and the proposed Lower Shitike Creek Projects.



(A) Access Road to project site

(B) Dike Wall sloping'& terracing

(C) B-140 Bridge

(D) Soil distributed

(E) Water Hole Turnaround

Figure 5. Site Map of the Potter's Pond Enhancement Project, 1987.

The Humphrey Scoop Trap continued to be maintained and operational data was collected and evaluated as described in Fritsch (1986). In May, 1987, approximately 726,000 1986 brood spring chinook salmon were fin marked with ventral clips at the Warm Springs National Fish Hatchery. This procedure enabled biologists to distinguish hatchery from wild stock migrants at the trap and in the same manner, to differentiate returning adults at the hatchery. Hatchery adults were also identified in creel samples conducted at Sherars Falls on the Deschutes River (Rkm 70.4). Combining adult return information with juvenile outmigration data will provide Warm Springs River Basin escapement and production estimates.

Physical Habitat Parameters

Physical stream parameters including surface area, water volume, discharge, and temperature were recorded at select monitoring sites using techniques described in Fritsch (1986). Similarly, cover, substrate, pool-riffle ratio, depth and width data were collected. Site mean monthly averages for water temperature and discharge were computed, graphically recorded, and compared with 1986 data. Post treatment stream habitat data were obtained and assessed on Reach A and Reach B in Beaver Creek. Pretreatment data were collected and assessed for Potter's Pond and the Beaver Creek Lower Island area. Data included cover, substrate, pool-riffle ratio, depth and width. Percentage comparisons between 1986 and 1987 data were tabulated.

Photopoints

For visual evaluation of pretreatment and post treatment project sites, photopoints established taken within two project sites, Beaver Creek and Mill Creek (Potter's Pond), during 1986 and 1987. Additional photopoints will be established in the proposed FY 1988 Beaver Creek (Lower Island) and Lower Shitike Creek Projects. Photos taken at these points will be utilized as a primary tool for future project evaluations.

Beaver Creek Maintenance Project

From June to September 1987, a maintenance project along Reach A and B was designed to supplement and assure FY 1986 Beaver Creek Enhancement Project benefits. The project was implemented because 1987 spring high water flows had reshaped previously built structures. In Reach A, 40 cubic meters of rip-rap were incorporated into the 500 cubic meters of material placed in site the previous year. The maintenance material was primarily used to slope terminal ends of the existing rip-rap structure. In Reach A and Reach B, 10 and 30 boulders, respectively, were placed into clusters, jetties and singular positions to protect the seven log weirs that were previously constructed. In Reach B, one boulder berm was built to slow water velocities near a vulnerable cut bank.

Potter's Pond Enhancement Project (Mill Creek)

Primary project objectives were streambank enhancement and the creation of beneficial instream rock structures which would assist adult salmonid passage, egg incubation and juvenile rearing. The project, begun July 28, 1987, was completed October 22, 1987. Major equipment used included a Hitachi backhoe with an electric thumb, a Hough skidder modified with a bucket, and two dump trucks. The project was implemented from upstream to downstream. This enabled project leaders and the backhoe operator to monitor streamflow changes.

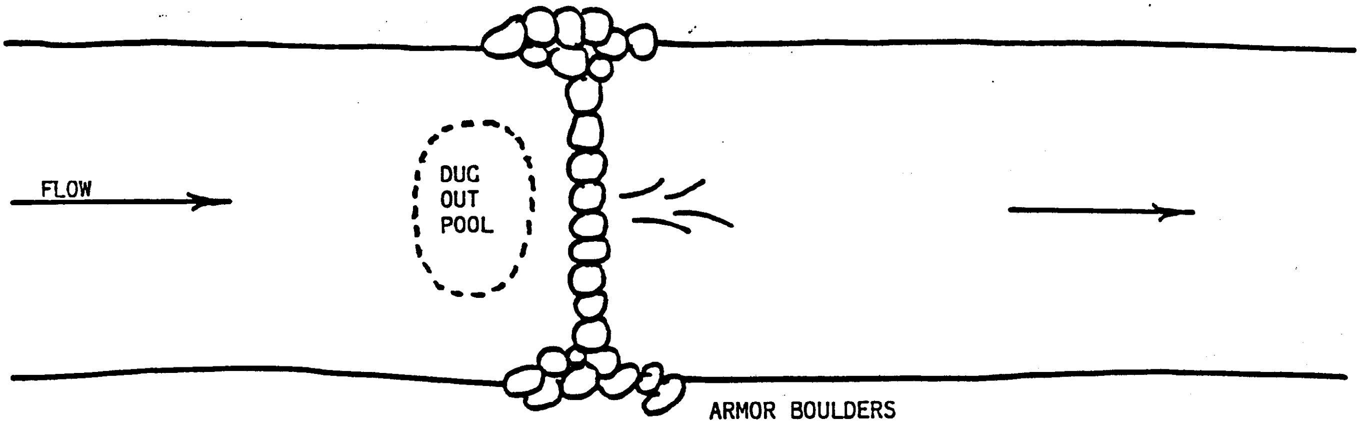
Approximately 700 boulders were stockpiled near the project site. From these stockpiles the skidder transported the boulders to site-specific locations. Designated haul roads, located away from the stream, were required to minimize impact upon existing riparian vegetation. Environmentally sensitive places, such as spawning gravels and wetlands, were flagged for protection. To minimize instream backhoe movement, stream crossings were specific and limited, and boulders were piled in certain key areas near the streambank. Although some silt and mud was disturbed and entered the stream, minimal backhoe movement resulted in limited substrate compaction, reduced disturbance of aquatic vegetation, and the protection of existing riparian vegetation.

A variety of instream structure shapes and configurations were used (Table 1). Rock weir dams (Figure 6) were designed to create salmonid resting pools and increase stream depth. Dams and boulder wings (Figure 7) were keyed into streambanks for security. Armoring, (Figure 7) utilized to support eroding streambanks, was constructed by using the backhoe to push boulders into soft bank areas. Rock clusters (Figure 8) were layered along stream channels to provide salmonid cover, create scour pools, and trap gravel. Turning rock clusters (Figure 9), created salmonid habitat diversity by (1) dividing the water flow into smaller streams, (2) causing more flow to turn away from the outside bank and (3) causing energy loss which reduces bank scour. Dike wall sloping (Figure 10) and terracing was incorporated along streambanks to reduce erosion, turbidity, and sedimentation. Some shallow stream sections were deepened and narrowed. Excess substrate material, resulting from channelization, was used to secure boulders in bank armoring. Due to the seasonal stream level fluctuation, enhancement structures were placed at varying heights to accommodate low, medium and high water levels.

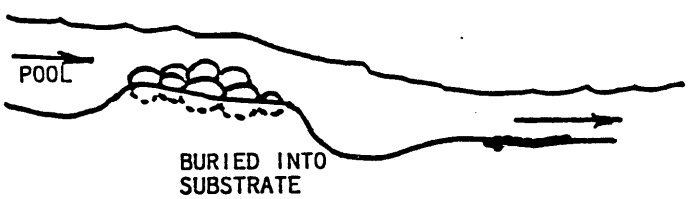
Subsequent to instream and streambank structure placement, a wheat grass, orchard grass and domestic grass mix was broadcast on disturbed bank areas at a rate of 20 lbs/acre. Straw mulch and a 16-20-o fertilizer mix was also added to these areas at a rate of 200 lbs/acre. Chicken-wire mesh was incorporated into terraced dike walls to help support loose earth, and areas

Table 1. Summary of structure types and material used in the FY 1987 Potters Pond Enhancement Project.

TYPE	STRUCTURE (%)	# OF BOULDERS (m^2)
Rock Weir (Dams)	6 (3.9)	160
Double Wing (s)	16 (10.3)	90
Single Wing (s)	40 (25.8)	230
Armor	60 (38.7)	134
Single	22 (14.2)	22
Turning Rocks	4 (2.6)	40
Clusters	7 (4.5)	25
	155 (100.0)	701



Profile.



Cross section of Rock Weir Dam. Bulk of flow through middle of structure.

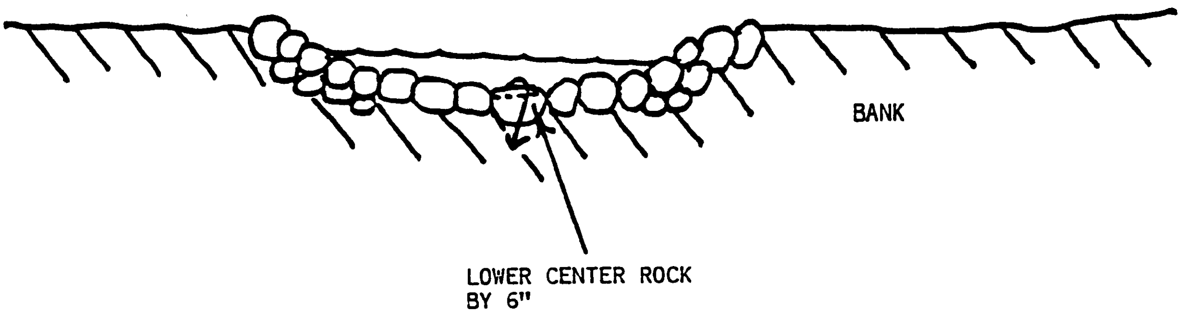


Figure 6. Illustration of Rock Weir Dam. For controlling water surface elevation and stabilizing bed. Potters Pond Enhancement Project, 1987.

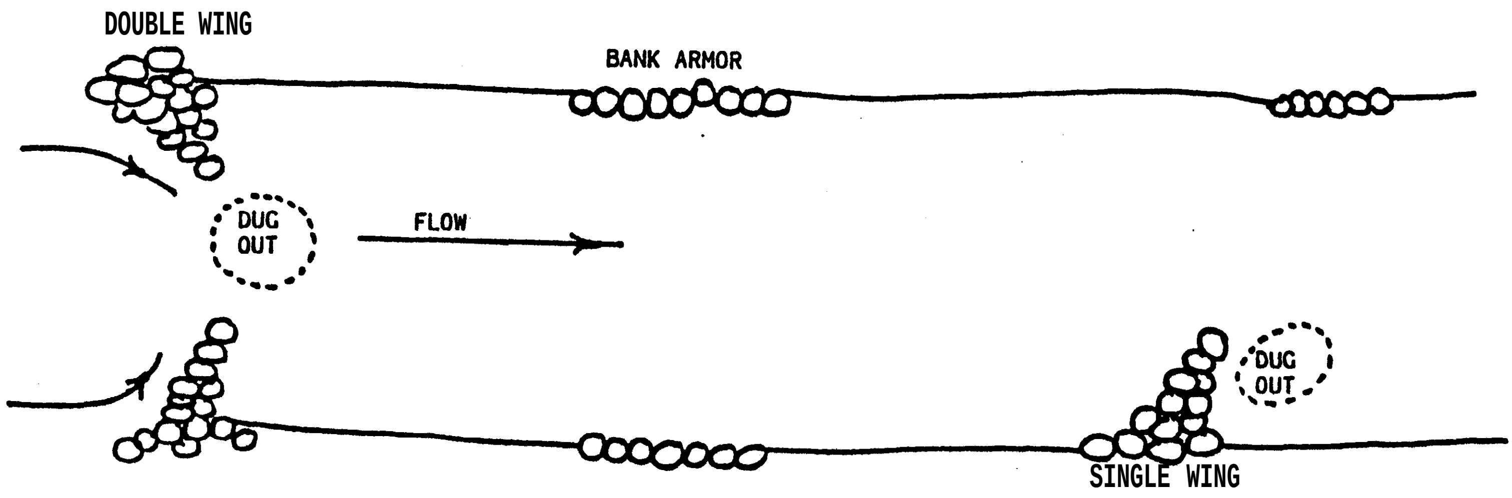


Figure 7. Illustration of Rock Structures used in the Potters Pond Enhancement Project, 1987.

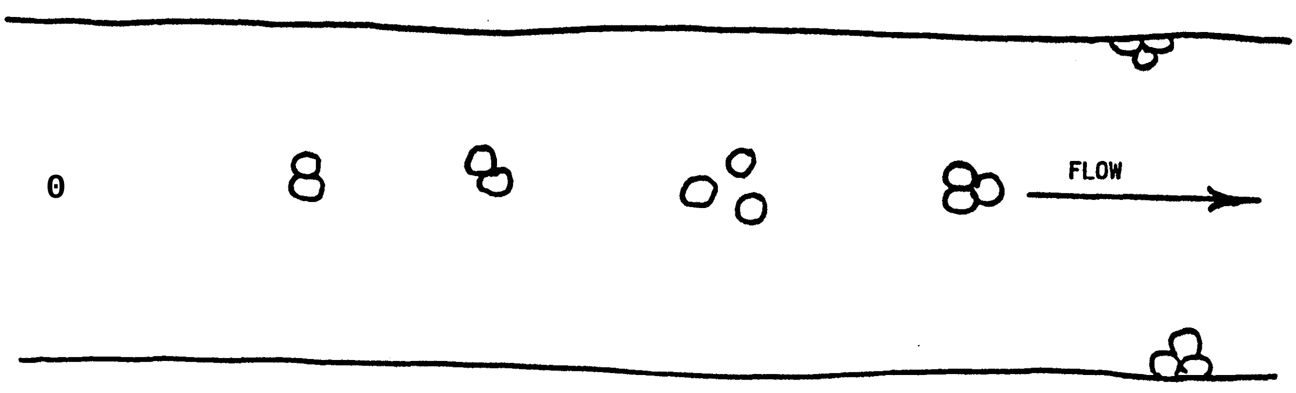


Figure 8. Illustration of Rock Clusters used in the Potters Pond Enhancement Project, 1987.

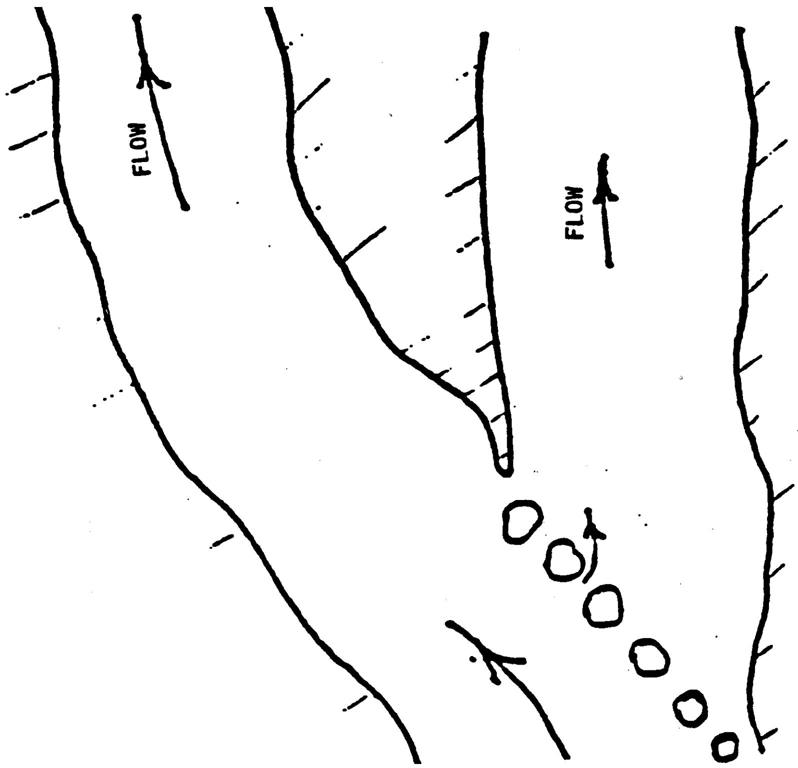


Figure 9. Illustration of Turning Rock Clusters used in the Potters Pond Project, 1987.

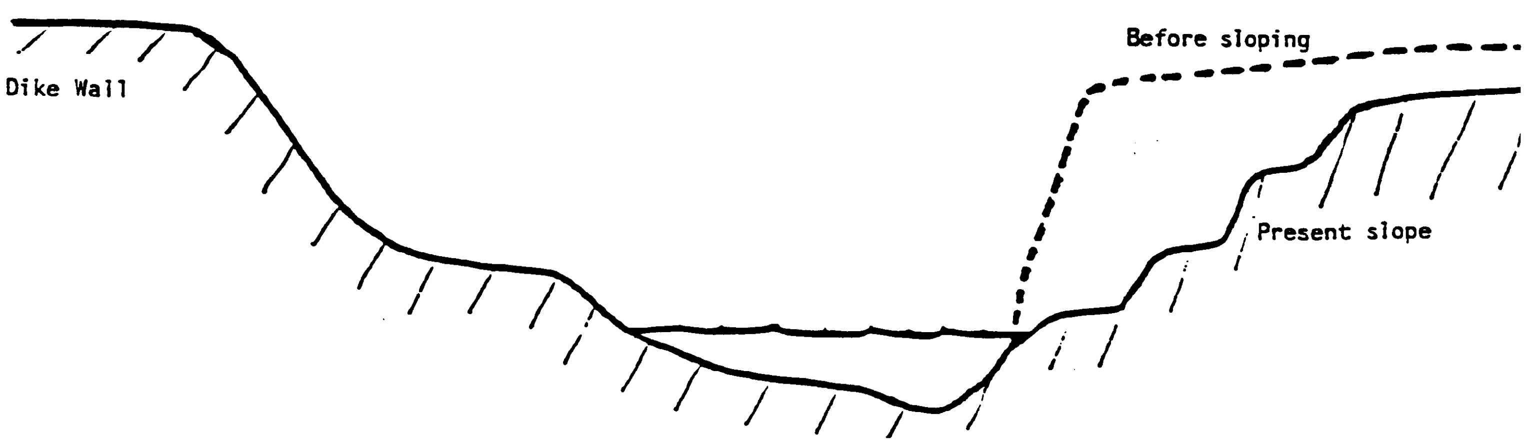


Figure 10. Illustration of cross section of dike wall sloping in the Potters Pond Project, 1987. Terracing was implemented for streambank stabilization.

planted with grass seed were periodically watered until the seed germinated. Bank erosion control will be provided by planted short term grasses until they are eventually replaced by native grasses. Soil was transported to the project site and placed on the cobbled south bank below the B-140 bridge. Finally, grass seed, fertilizer, and mulch were distributed over the imported soil.

At the project's downstream boundary, location of a weir dam was coordinated with the Bureau of Indian Affairs (B.I.A.) Roads Department and Fire Control. The weir provided a deep pool for . salmonid habitat which could also be utilized for fire control purposes. On the streambank above the weir, a road turnaround was implemented by the BIA Roads Department. Here several boulders were placed above the road turnaround to provide streambank protection in the event of high water flows.

RESULTS

Biological and physical habitat parameters differed among instream monitoring sites in 1986 and 1987. Principal reasons for differences included completion of specific bioengineering projects, irrigation practices and variable environmental factors. Overall, during 1987, lower stream discharges prevailed due to dry climatic conditions (Figures 11-15) and subsequently these lower discharges reduced usable salmonid habitat throughout the Warm Springs River Basin and Shitike Creek. The 1986 and 1987 site mean monthly temperatures are compared in Figures 16-23. Warm Springs River mouth 1987 mean monthly temperatures are summarized in Figure 24.

Beaver Creek

Juvenile salmonid sampling data is summarized in Table 2. Summer steelhead spawning surveys for all index areas are indicated in Table 3. The Reach D (top) to Robinson Park area was added to the surveys to provide a more complete data base. Spawning ground counts for spring chinook salmon are exhibited in Table 4. A yearly comparison of spring chinook redd counts in historical index areas is provided in Table 5.

Physical habitat parameters were measured for the first year post-treatment sites, Reach A and Reach B Test. Surveys on these sites indicated favorable changes in general habitat parameters including increases in usable pool and riffle areas (Tables 6 and

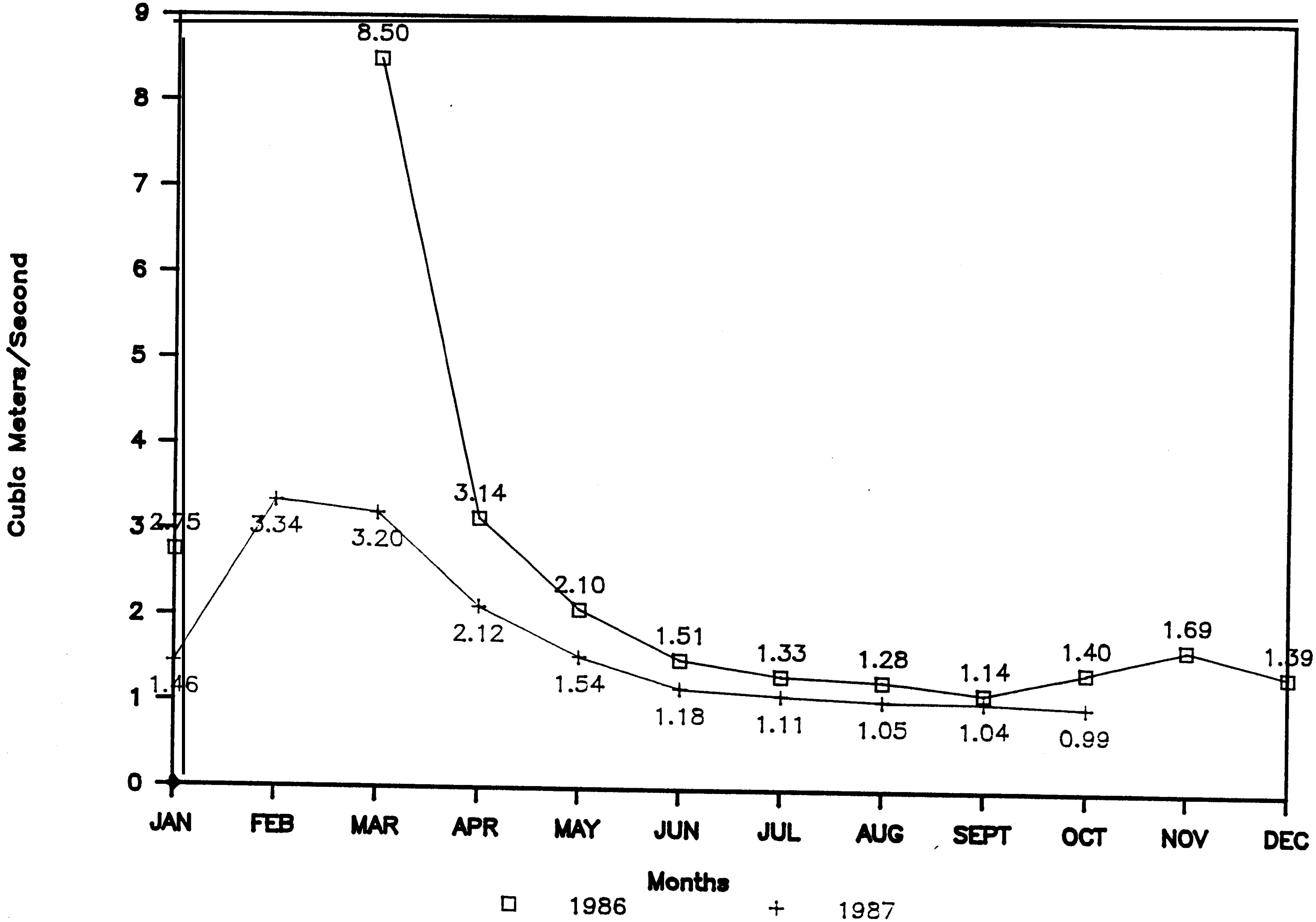


Figure 11. Beaver Creek
1986/1987 Discharges

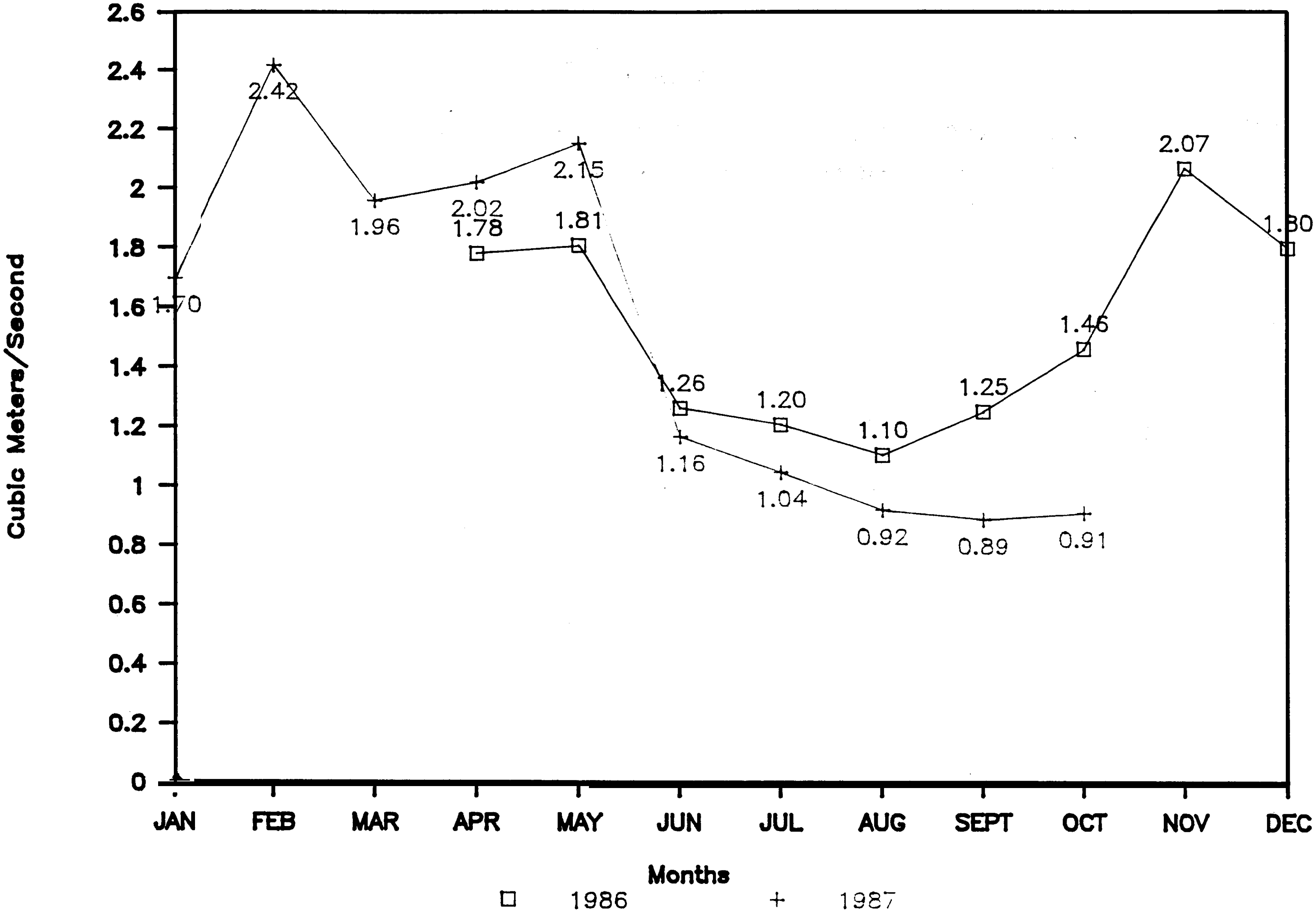


Figure 12. Mill Creek (Potter's Pond)
1986/1987 Discharges.

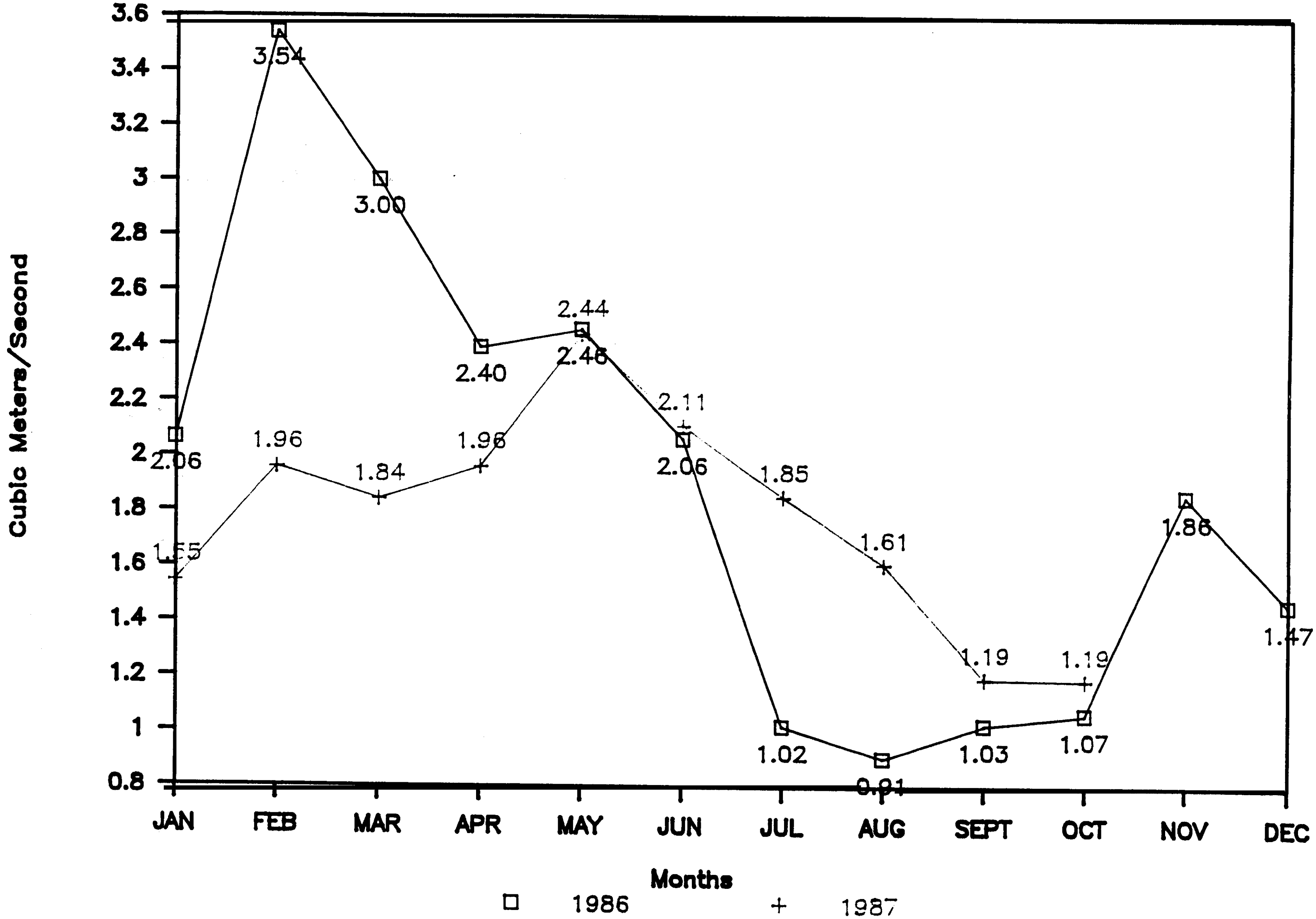


Figure 13. Mill Creek (B-241 Bridge)
1986/1987 Discharges.

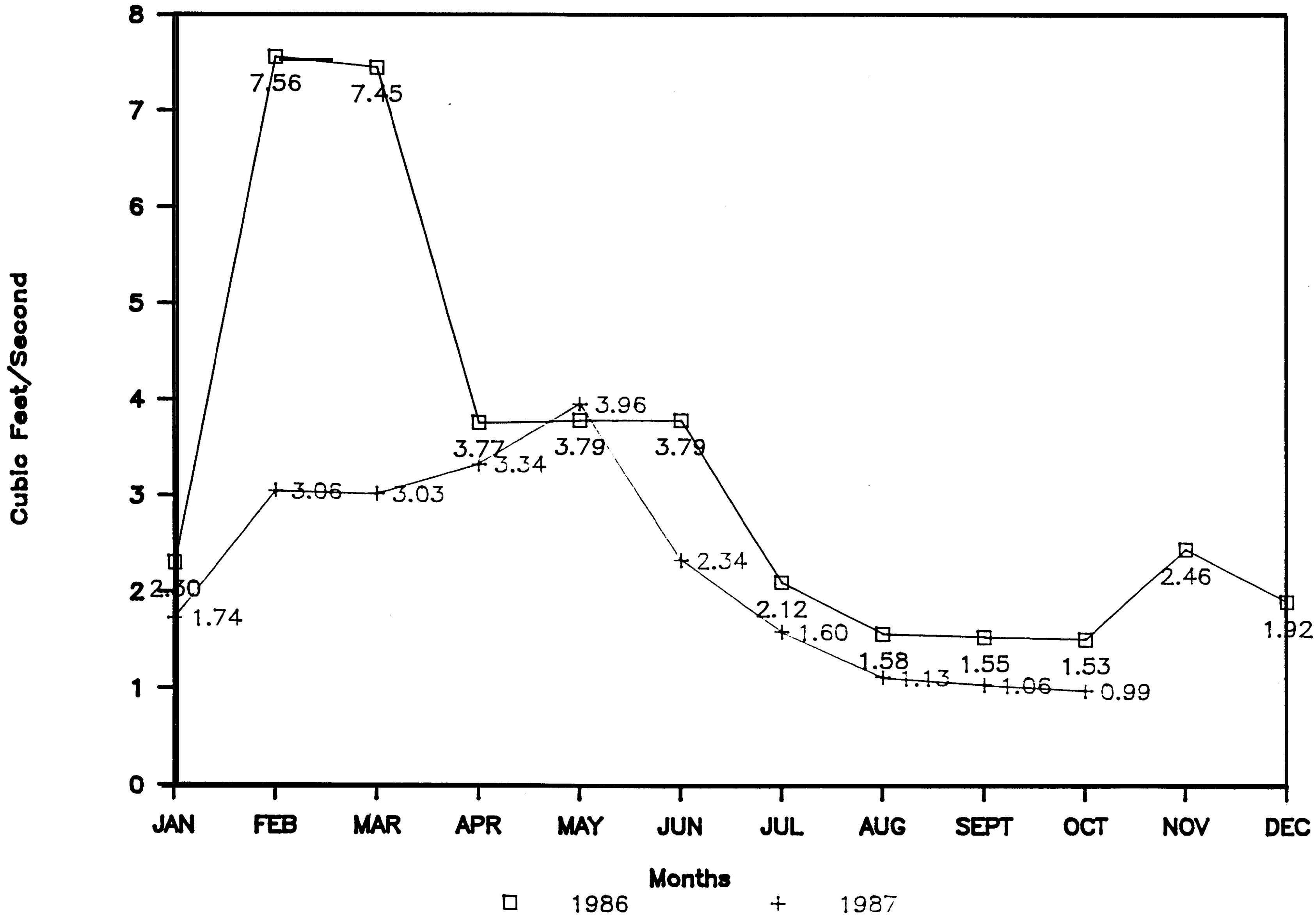


Figure 14. Shitike Creek
1986/1987 Discharges.

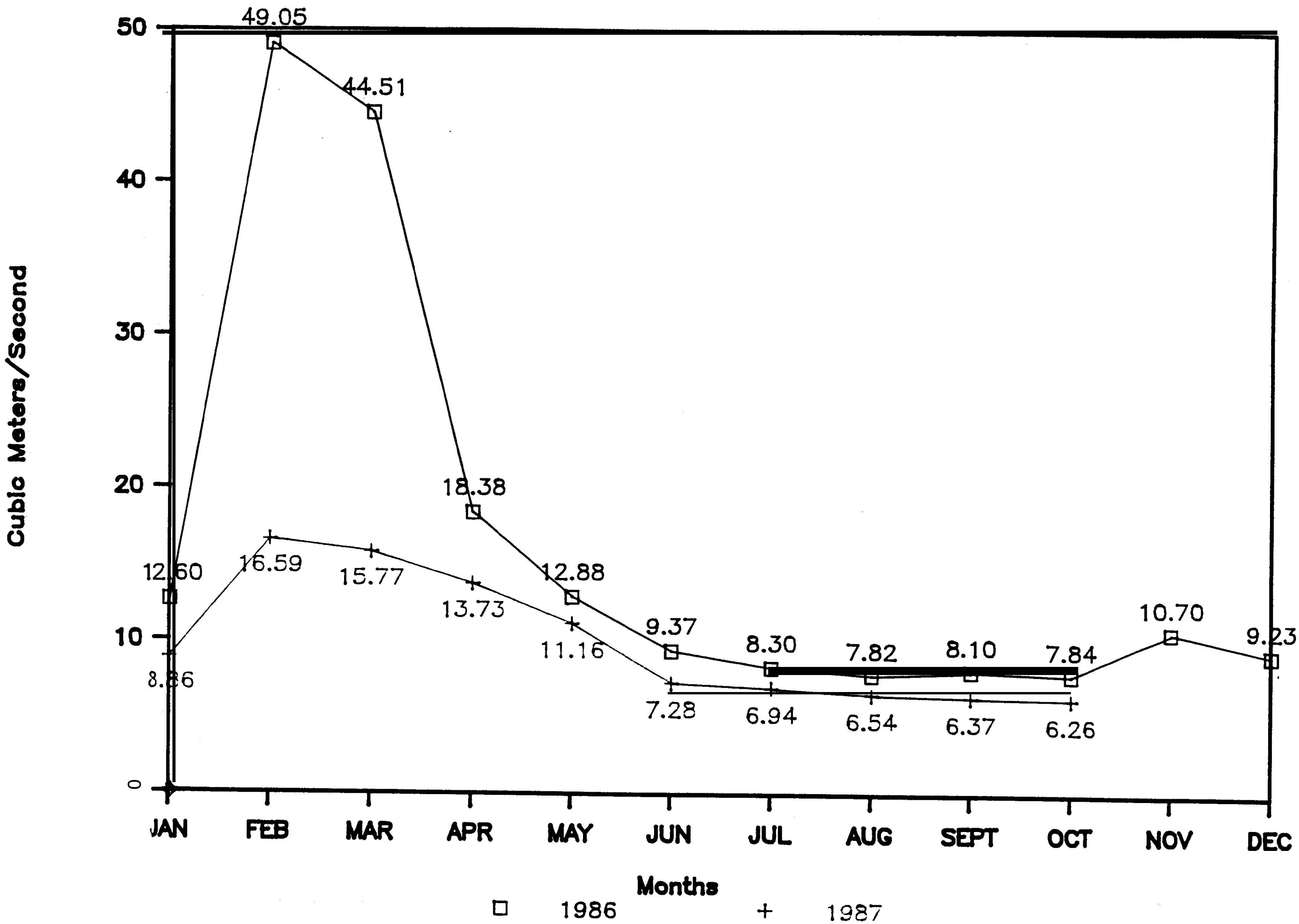


Figure 15. Warm Springs River Mouth
1986/1987 Discharges.

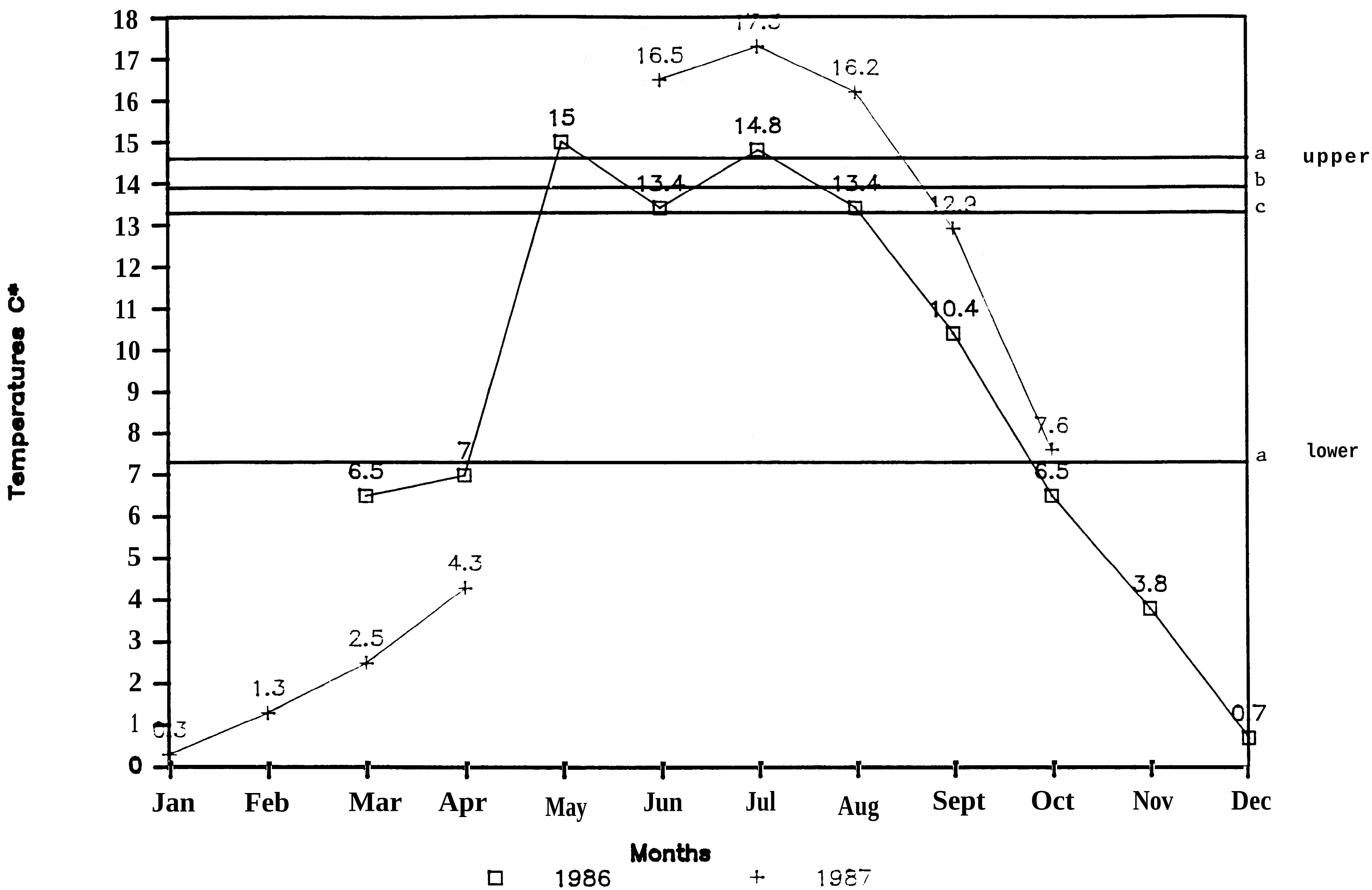


Figure 16. Beaver Creek (Dahl Pine) 1986/1987 Mean monthly temperatures in relationship to critical salmonid temperatures.

NOTE: May 1987 data point is missing due to equipment malfunction

From Reiser and Bjornn (1979)
a] Spring chinook, summer steelhead, preferred temperature range, 7.3-14.6°C.
b] Spring chinook, upper range for spawning, 13.9°C.
c] Spring chinook, upper range for upstream migration, 13.3°C.

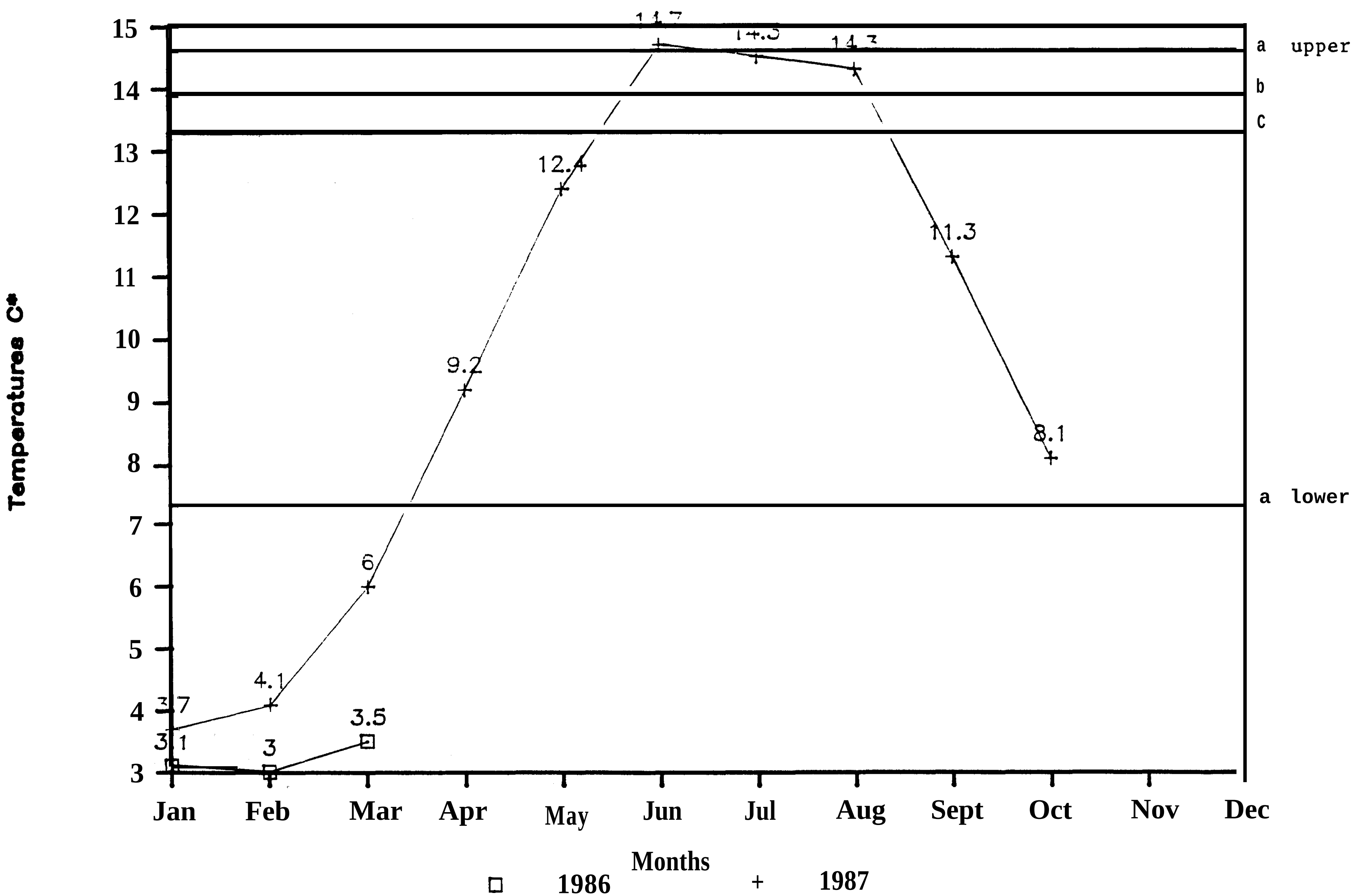


Figure 17. Beaver Creek (Quartz Creek) 1986/1997 Mean monthly temperatures in relationship to critical salmonid temperatures.

From Reiser and Bjornn (1979)
a] Spring chinook, summer steelhead, preferred temperature range, 7.3-14.6°C.
b] Spring chinook, upper range for spawning, 13.9°C.
c] Spring chinook, upper range for upstream migration, 13.3°C.

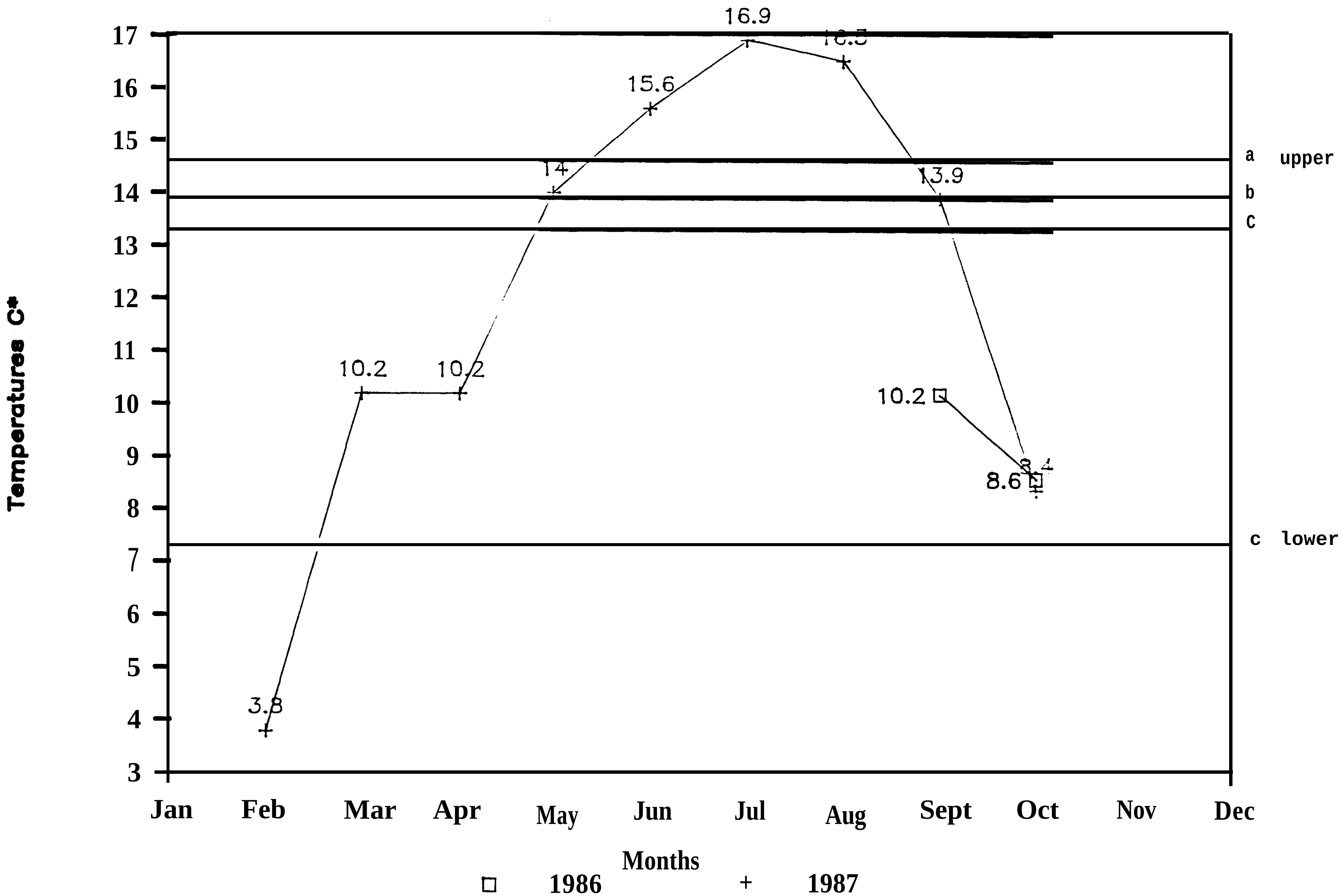


Figure 18. Beaver Creek (Lower Island) 1966/1987 Mean monthly temperatures in relationship to critical salmonid temperatures.

From Reiser and Bjornn (1979)
a] Spring chinook, summer steelhead, preferred temperature range, 7.3-14.6°C.
b] Spring chinook, upper range for spawning, 13.9°C.
c] Spring chinook, upper range for upstream migration, 13.3°C.

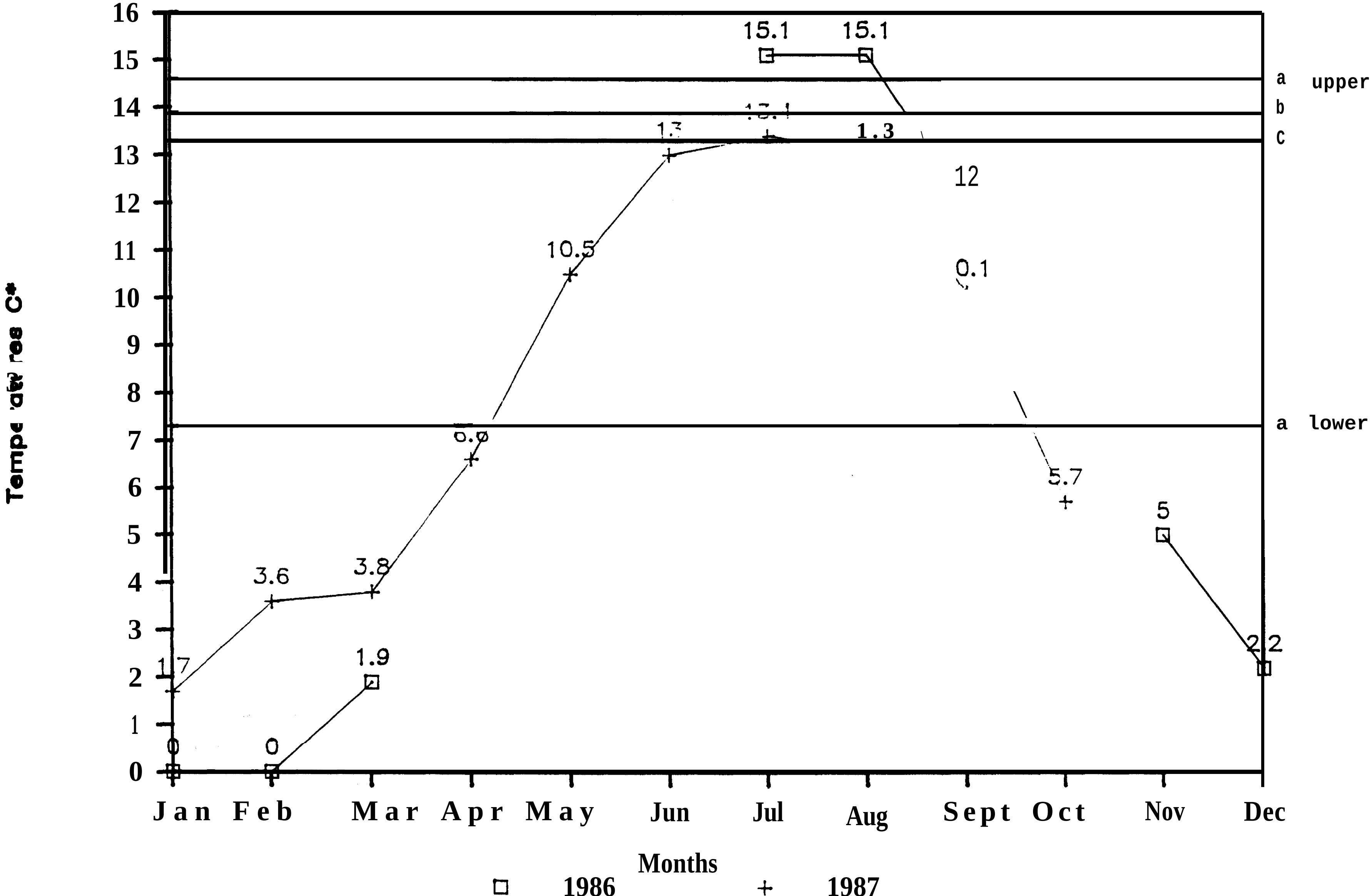


Figure 19. Mill Creek (Potter's Pond)
1985/1987 Mean monthly temperatures in relationship to critical salmonid temperatures.

From Reiser and Bjornn (1979)
a] Spring chinook, summer steelhead, preferred temperature range, 7.3-14.6°C.
b] Spring chinook, upper range for spawning, 13.9°C.
c] Spring chinook, upper range for upstream migration, 13.3°C.

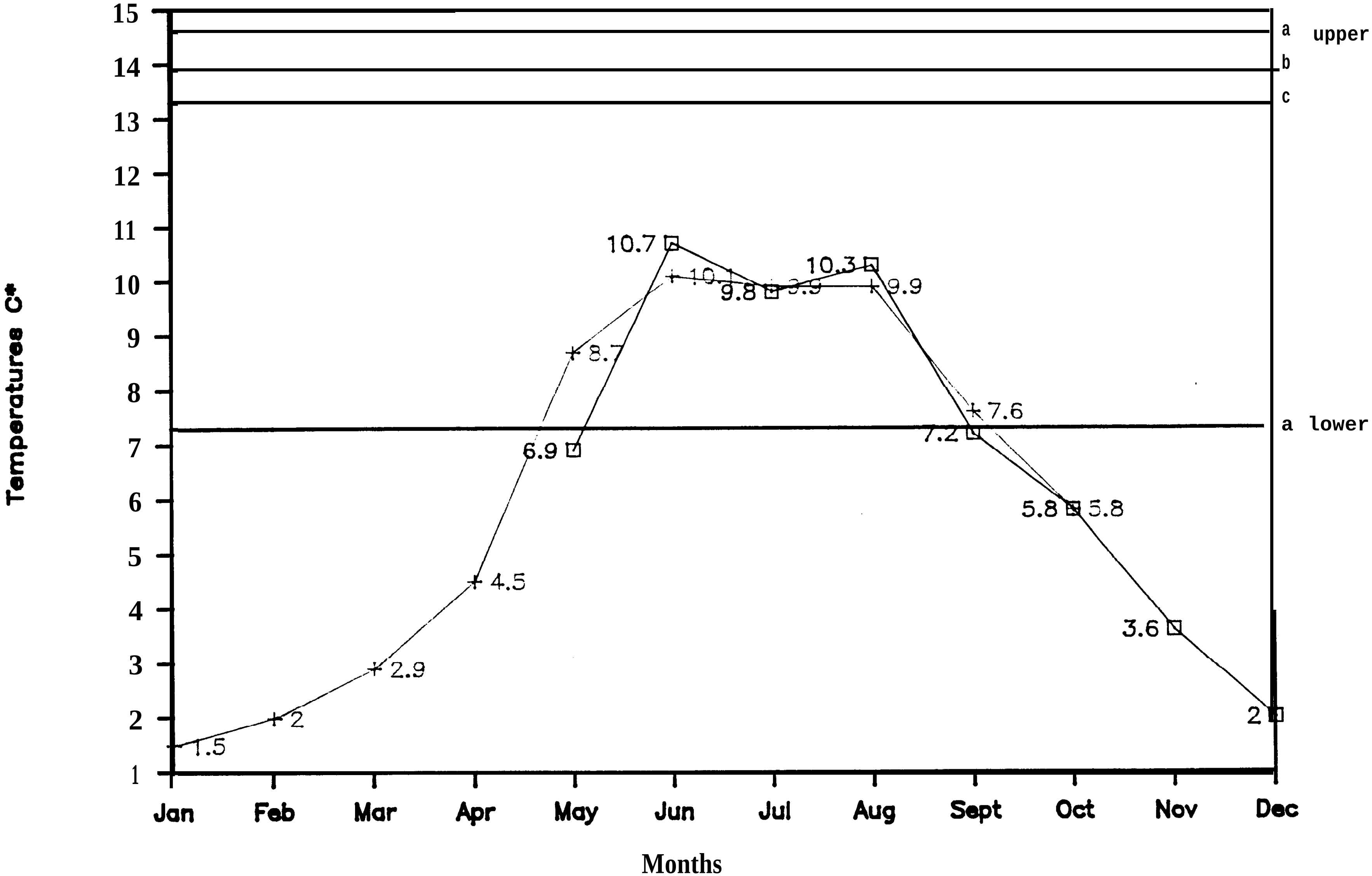


Figure 20. Mill Creek (B-241)
1986/1987 Mean monthly
temperatures in Relationship
to Critical Salmonid Temperatures.

From Reiser and Bjornn (1979)
a] Spring chinook, summer steelhead, preferred temperature range, 7.3-14.6°C.
b] Spring chinook, upper range for spawning, 13.9°C.
c] Spring chinook, upper range for upstream migration, 13.3°C.

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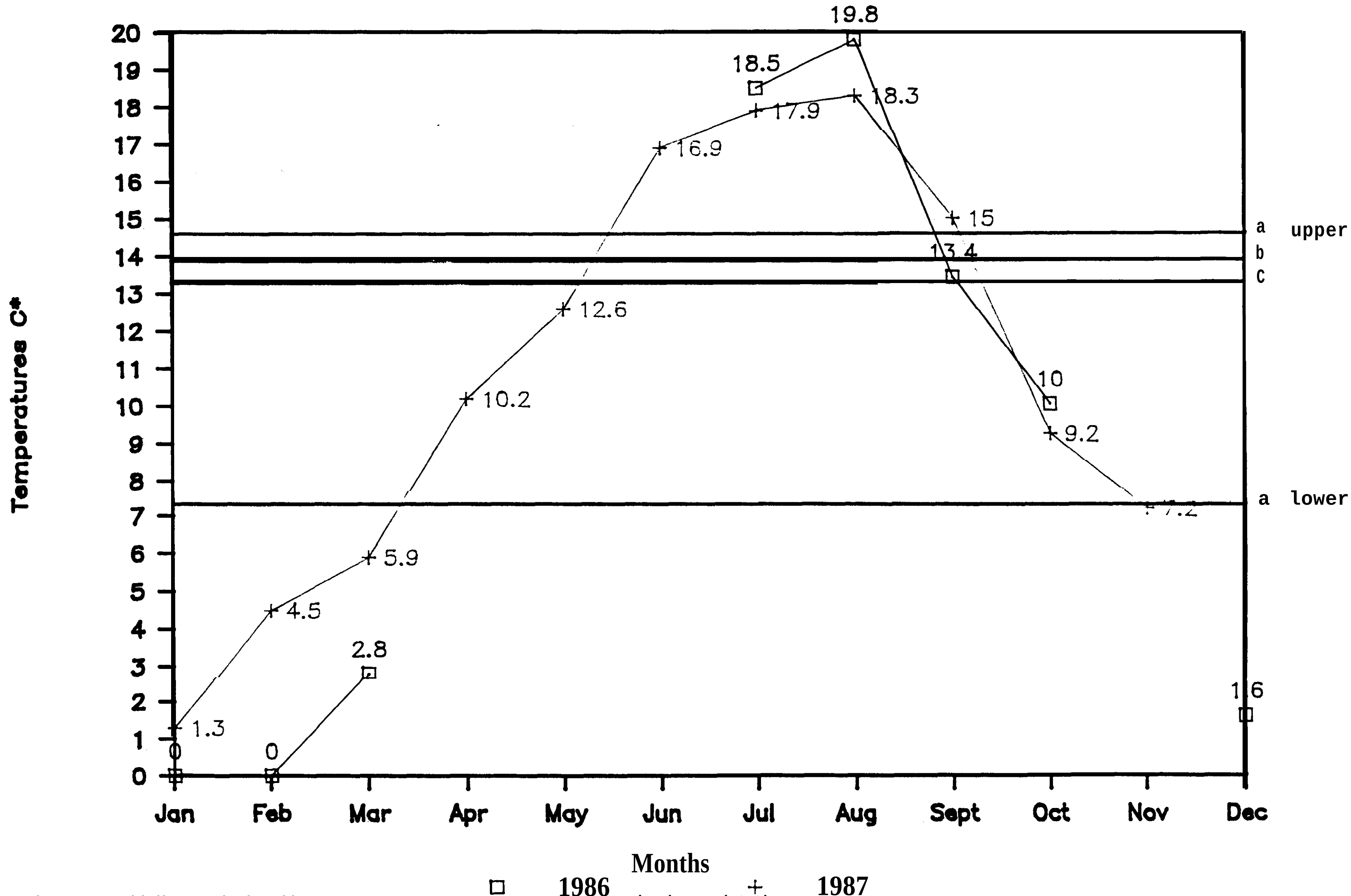

Figure 21. Shitike Creek (Mouth)
1986/1987 Mean monthly
temperatures in relationship
to critical salmonid temperatures.

From Reiser and Bjornn (1979)
a] Spring chinook, summer steelhead, preferred temperature range, 7.3-14.6°C.
b] Spring chinook, upper range for spawning, 13.9°C.
c] Spring chinook, upper range for upstream migration, 13.3°C.

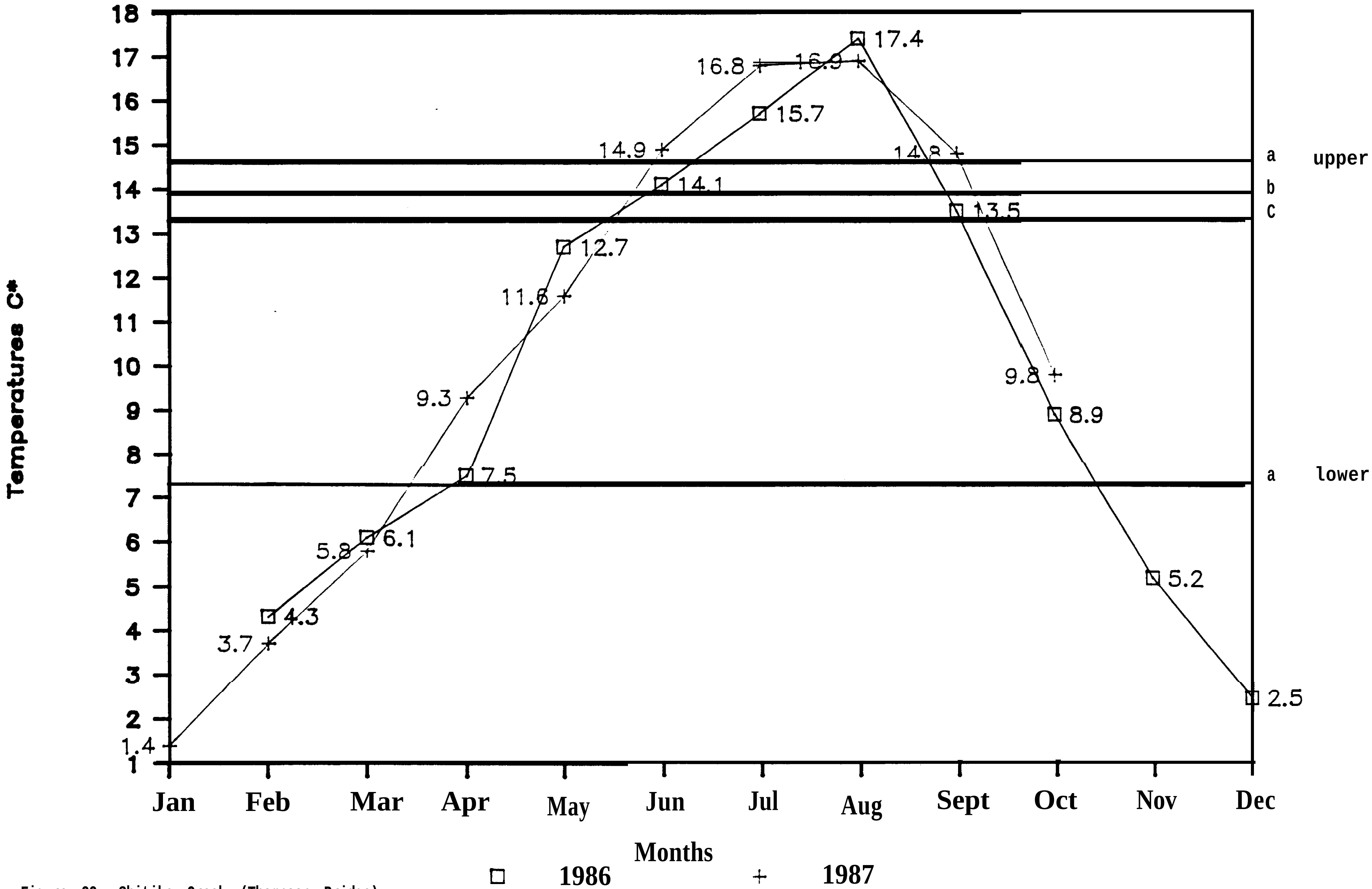

Figure 22. Shitike Creek (Thompson Bridge) 1986/1987 Mean monthly temperatures in relationship to critical salmonid temperatures.

From Reiser and Bjornn (1979)
a] Spring chinook, summer steelhead preferred temperature range, 7.3-14.6°C.
b] Spring chinook, upper range for spawning, 13.9°C.
c] Spring chinook, upper range for upstream migration, 13.3°C.

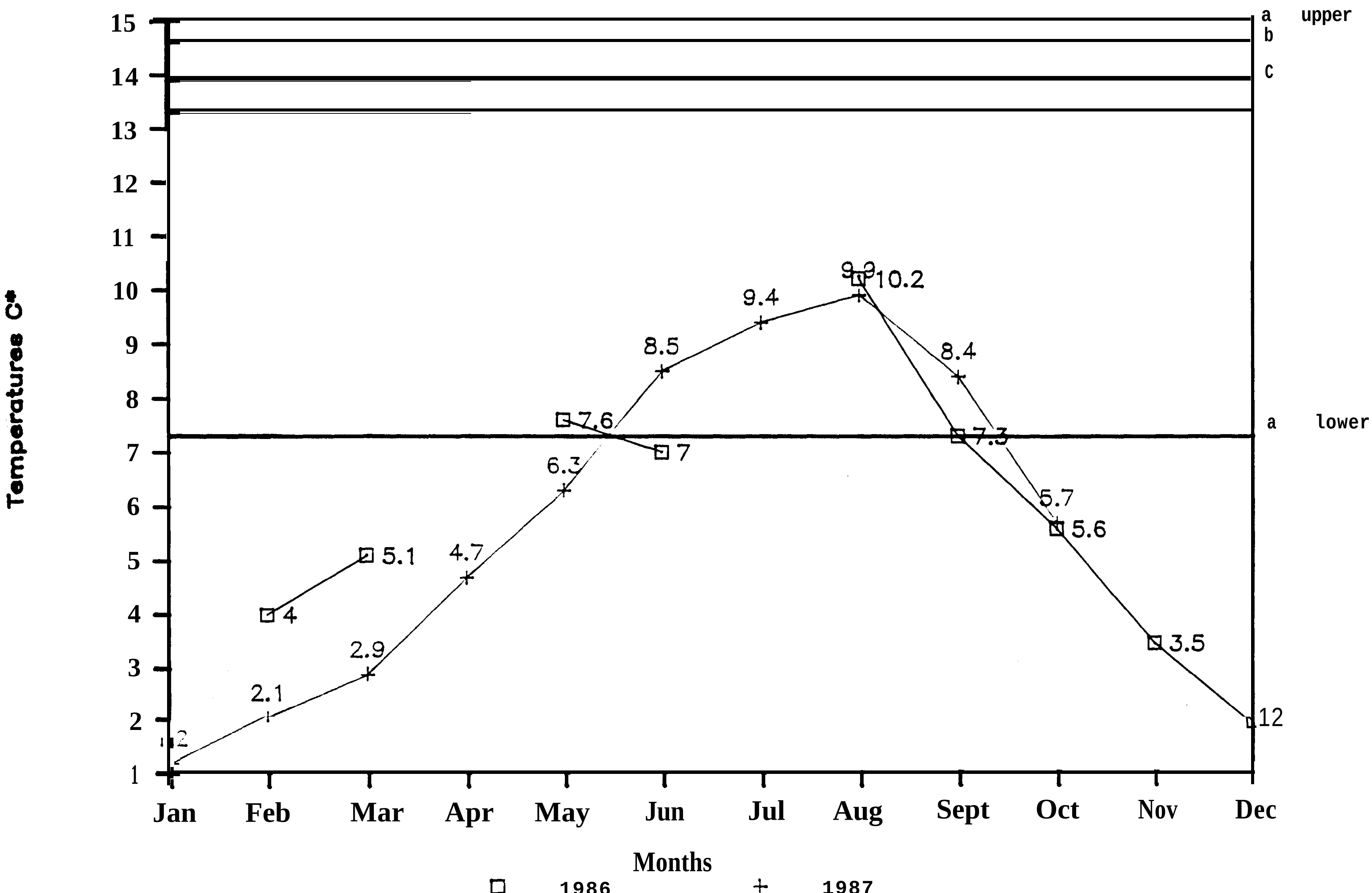

Figure 23. Shitike Creek (Peter's Pasture)
1986/1987 Mean monthly temperatures
in relationship to critical salmonid
temperatures.

From Reiser and Bjornn (1979)
a] Spring chinook, summer steelhead, preferred temperature range, 7.3-14.6°C.
b] Spring chinook, upper range for spawning, 13.9°C.
c] Spring chinook, upper range for upstream migration, 13.3°C.

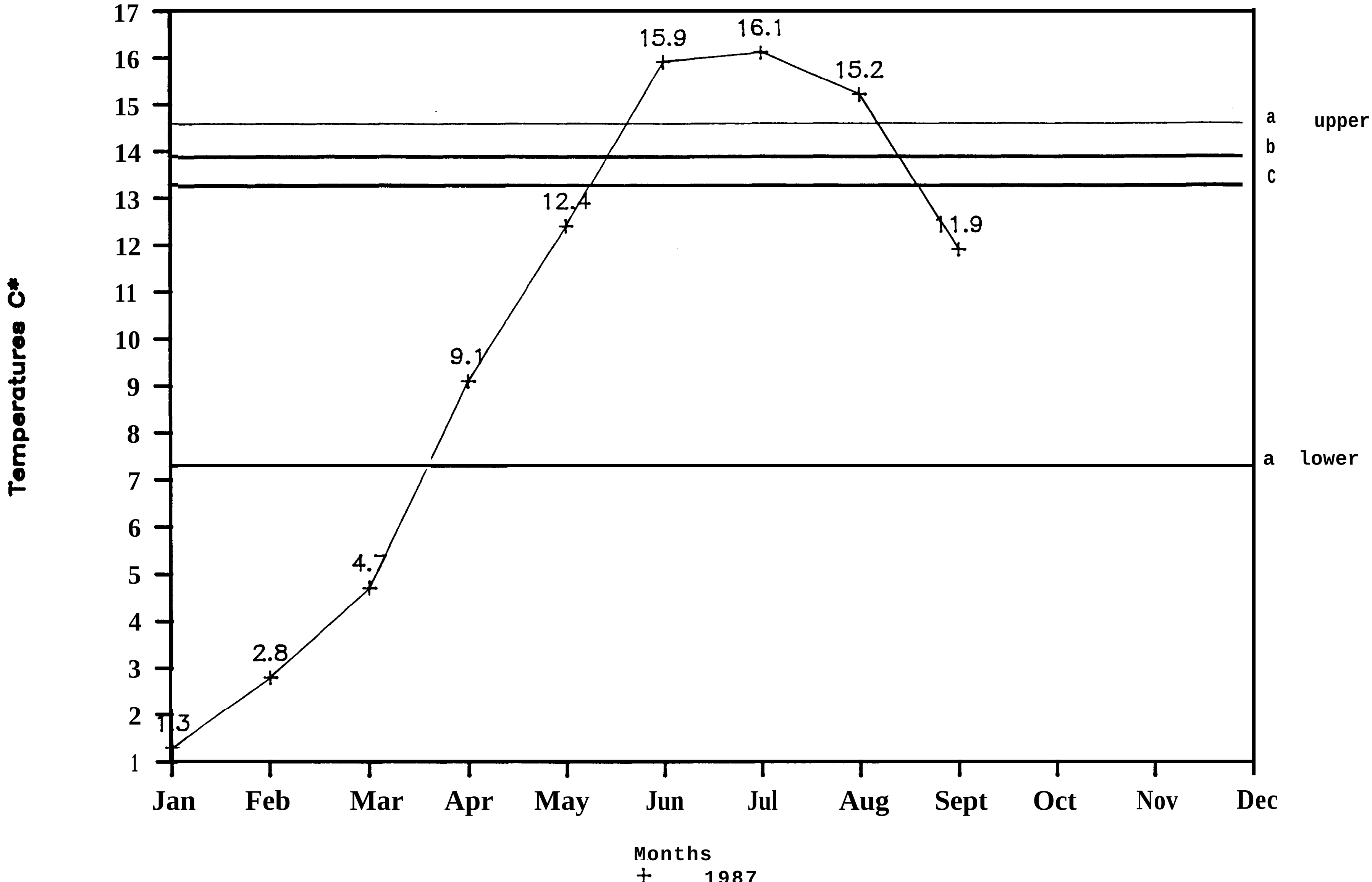

Figure 24. Warm Springs River Mouth
1987 Mean monthly temperatures
in relationship to critical salmonid
temperatures.

From Reiser and Bjornn (1979)
a] Spring chinook, summer steelhead, preferred temperature range, 7.3-14.6°C.
b] Spring chinook, upper range for spawning, 13.9°C.
c] Spring chinook, upper range for upstream migration, 13.3°C.

Table 2. Estimated abundance and biomass of salmonids in sample sites in the Warm Springs River Basin and Shitike Creek, 1987

Stream	Site (km)	Surface Area (m^2)	Chinook Salmon No.	95% CL (%)	Fish /m^2	Biomass	Gm/m^2	Rainbow Trout No.	95% CL (%)	Fish /m^2	Biomass	Gm/m^2	Brook Trout No.	95% CL (%)	Fish /m^2	Biomass	Gm/m^2	Dolly Varden No.	95% CL (%)	Fish /m^2	Biomass	Gm/m^2	Total Salmonids No.	95% CL (%)	Fish /m^2	Biomass	Gm/m^2
Beavcr Cr.	Lower Island (1.6)	634.9	1	0	.002	5.5	.009	26	7	.041	156	.246	-	-	-	-	-	-	-	-	-	-	26	-	0.43	161.5	.255
*	Reach A Test (24.1)	416.2	7	11	.161	254.6	.612	29	9	.070	272.6	.655	-	-	-	-	-	-	-	-	-	-	96	-	.231	527.2	1.267
*	Reach 8 Test (29.0	399.8	138	3	.345	607.2	1.520	121	8	.303	1415.7	3.540	-	-	-	-	-	-	-	-	-	-	259	-	.648	2022.9	5.060
*	Reach 8 Control (29.8)	294.1	59	0	.201	271.4	.923	86	14	.293	619.2	2.106	-	-	-	-	-	-	-	-	-	-	145	-	.494	890.6	3.029
Mill Cr.	Potters Pond (8.8)	787.6	43	5	.055	154.8	.197	217	391	.276	434	.551	-	-	-	-	-	-	-	-	-	-	260	-	.331	588.8	.748
	Below Straw. Falls (11.3)	653.1	75	114	.115	274.5	.420	43	13	.066	289.4	.443	-	-	-	-	-	-	-	-	-	-	118	-	.181	563.9	.863
@	Above Straw. Falls (14.2)	1,087.2	93	2	.086	279.0	.257	113	26	.104	632.8	.582	2	0	.002	91.0	.084	-	-	-	-	-	208	-	.192	1002.8	.923
	B-241 Road (26.5)	894.0	-	-	-	-	-	1	0	.001	3.5	.004	5	39	.006	88.5	.099	-	-	-	-	-	6	-	.007	92.0	.103
Shitike Cr.	Head works (8.0)	757.2	2	0	.003	9.6	.013	95	17	.126	351.5	.477	-	-	-	-	-	-	-	-	-	-	97	-	.129	361.1	.490
	Upper Xing (16.1)	825.1	34	11	.041	170.0	.206	56	46	.068	546.6	.662	-	-	-	-	-	1	0	.001	47.0	.057	91	-	.110	763.6	.925

* First year post treatment areas

@ Second year post treatment area

Table 3. Summer Steelhead redd counts by index area in the Warm Springs River basin and Shitike Creek, 1982-1987.

Index Area	Stream KM	YEAR 1982	1983	1984	1985	1986	1987
Warm Springs River System:							
Beaver Creek							
Reach D (top) to Robinson Park	2.4	-	-	-	.	-	6
Robinson Park to Dahl Pine	7.0	2	-	-	.	-	31
Dahl Pine to Canyon	2.7	3	-	-	.	1	12
Old Bridge to Powerline	1.4	1	-	-	.	3	5
Island Area	0.8	0	-	-			12
Mill Creek							
8-241 Road Bridge Area	2.7	-	-	-		0	2
Old Mill to Strawberry Falls	2.9	-	-	-	.	4	7
Strawberry Falls to Potters Pond	4.2	3	-	-	.	3	2
Potters to Boulder Confl .	3.0	10	-	-	.	2	5
Warm Springs River							
Bunchgrass to Schoolie	6.4	13	-	-	-	-	-
Schoolie to He-He	10.6	6	-	-	-	-	-
He-He to McKinley Arthur Place	3.0	0	-	-	-	-	-
WSNFH to Culpus Bridge	8.0	5	-	-	-	-	-
TOTAL FOR W.S.R. System		43	-	-	2	13	82
Shitike Creek							
Peter's Pasture Area	1.1	-	-	-	-	0	2
Upper Xing to Bennet Place	4.5	12	2	4	19	6	7
Bennet Place to Headworks	2.7	1	4	13	7	2	3
Headworks to USGS Station 1;2	3.0	22				3	9
(Thompsons Bridge)			>8	>13	>17		
USGS to Community Center	3.2	21				>31	5
Community Center to Mouth	3.2	8	1	9	10		28
TOTAL		64	15	39	53	42	54

1 In 1983-1985 the Headworks to U.S.G.S. Station (Thompson Bridge) and the U.S.G.S. Station to the Community Center were combined into one index area.

2 In 1986 one index area was surveyed from the Headworks to the Shitike Creek Mouth.

Table 4. Spring chinook redd counts by index areas in the Warm Springs River basin and Shitike Creek 1982-1987.

Index Area	KM surveyed	1982	1983	1984	1985	1986	1987
Warm Springs River Basin							
Beaver Creek:							
Reach D(top) to Robinson Park [a]	2.4	-	-	-	-	1	0
Robinson Park to Dahl Pine	7.0	15	59	91	42	38	46
Dahl Pine to Canyon	2.7	23	24	7	17	13	27
Old Bridge to Powerline	1.4	26	12	12	14	8	11
Powerline to Island [a]	0.8	-		18	13	26	14
Island Area		8	9	18	8	7	3
Mill Creek:							
B-241 road bridge area [a] [b]	2.7	15	3	16	17	0	0
Old Mill to Strawberry Falls [a]	2.9	-	-	0	1	7	2
Strawberry Falls to Potters Pond	4.2	11	7	5	5	19	12
Potters Pond to Boulder Creek	3.0	14	15	9	10	6	9
Warm Springs River:							
Bunchgrass to Schoolie	6.4	140	112	93	123	120	143
Schoolie to He-He	10.6	133	135	97	90	129	142
He-He to McKinley Arthur Place	3.0	36	40	21	23	43	40
McKinley Arthur to Badger Creek [a]	8.0	-	17	28	14	0	29
WSNFH to Culpus Bridge		12	5	14	21	11	6
TOTALS FOR WARM SPRINGS BASIN		433	438	429	398	428	484
Adults arriving at WSNFH		2303	1878	1981	2202	1808	2284 [d]
Jacks arriving at WSNFH		67	34	301	62	240	241
TOTAL		2370	1912	2282	2264	2048	2525
Adults sent upstream		1587	1251	1322	1264	1211	1550
Jacks sent upstream		46	34	164	56	55	86
TOTAL		1633	1285	1486	1320	1266	1636
Redds in area above WSNFH		421	433	415	377	417	478
Total fish per redd		3.9	3.0	3.6	3.5	3.0	3.4
Adult fish per redd		3.8	2.9	3.2	3.4	2.9	3.2
Shitike Creek:							
Peters Pasture [a] [c]	0.7	-	-	2	2	3	0
Upper Xing to Old Bennett Place [a]	2.8	-	2	10	3	4	0
Old Bennet Place to Headworks [a]	1.7	-	4	6	4	2	1
Headworks to USGS Station(Thompson Br.)	1.9	9	6	2	10	6	0
USGS Station to Community Center	2.0	7	2	0	3	3	6
Community Center to Mouth	2.0	0	1	3	2	2	6
TOTAL		16	15	23	24	20	13

[a] Historically a non index area
[b] Adult chinook released at B-241 bridge (1982-1985)
1982 - 47 adult spring chinook: 23 females, 24 males; 9 wild, 38 hatchery
1983 - 10 adult spring chinook: 3 females, 7 males; all wild
1984 - 40 adult spring chinook: 20 females, 20 males; 24 wild, 16 hatchery
1985 - 42 adult spring chinook: 21 females, 21 males; (26 wild, 16 hatchery: Preliminary breakdown)
[c] Possible Dolly Varden Redds
[d] Preliminary breakdown

Table 5. Spring chinook redd counts in historical index areas in the Warm Springs River Basin, 1969-1987.

YEAR	WARM SPRINGS RIVER Below WSNFH KM 8.0	Above WSNFH KM 20.0	BEAVER CREEK KM 12.0	MILL CREEK KM 7.2	TOTAL	TOTAL ABOVE WSNFH
1969	No survey	205	39	20		264
1970	No survey	119	41	12		172
1971	No survey	152	15	6		173
1972	No survey	75	12	0		87
1973	No survey	396	154	34		584
1974	No survey	172	31	13		216
1975	No survey	560	162	86		808
1976	No survey	834	161	71		1066
1977	201	390	73	35	699	498
1978	8	620	119	49	796	788
1979	2	253	97	7	359	357
1980	3	86	22	6	117	114
1981	10	131	9	7	157	147
1982	12	309	72	40(25) a/	433(418)	421
1983	5	304(287)	104	25(22) b/	438(418)	433(413)
1984	14	239(211)	146(128)	30(14) c/e/	429(367)	415(353)
1985	21	250(236)	94(81)	33(15) d/	398(353)	377(332)
1986	11	292	66	25	394	383
1987	6	325	87	21	439	433

( ) Adjusted redd counts to account for historical index redd counts

Adult chinook released at B-241 Bridge (a thru d), (Non-historical index area)

a/ 47 adult spring chinook: 23 females, 24 males; 9 wild, 38 hatchery

b/ 10 adult spring chinook: 3 females, 7 males; all wild

c/ 40 adult spring chinook: 20 females, 20 males; 24 wild, 16 hatchery

d/ 42 adult spring chinook: 21 females, 21 males; (26 wild, 16 hatchery; Preliminary breakdown)

e/ Strawberry Fails passage project completed

Table 6. Habitat summary of sample sites in the Warm Springs River basin and Shitike Creek, 1987

Stream		Site	Rkm	Site Length(m)	Area (m^2) a/ P	R	BW	SC	Total	Mean depth(m)	Mean width(m)	Volume (m^3)
Beaver Creek		Lower Island	1.6	43.6	169	446	20	-	635	.23	14.6	146.0
	*	Reach A-Test	24.1	48.3	305	111	0	-	416	.24	7.8	99.9
	*	Reach B-Test	29.0	49.5	162	238	-	-	400	.13	8.1	52.0
	*	Reach B-Control	29.8	48.3	90	201	3	-	294	.17	6.1	50.0
Mill Creek		Potters Pond	8.8	90.4	69	719	0	-	788	.19	9.2	149.7
		Below Str. Falls	11.3	65.7	-	-	-	-	653	.27	9.9	177.5
	@	Above Str. Falls	14.2	116.4	-	-	-	-	1087	.19	9.3	206.6
		B-241 Road	26.5	110.1	-	-	-	-	894	.42	8.1	375.5
Shitike Creek		Headworks	8.0	50	270	483	4	-	757	.23	15.4	206.0
		Upper Xing	16.1	57.8	316	509	0	-	825	.29	13.9	237.6

a/ P-pool; R-riffle; BW-backwater; SC-side channel

* First year post treatment areas

@ Second year post treatment area:

7). Riffle substrate composition by rank percentage is exhibited in Table 8. Site mean cover data is compiled in Table 9. Pretreatment data was collected in the Lower Island Site (Tables 6, 7, 8 and 9) and data evaluation was conducted.

Mill Creek

Estimated juvenile salmonid abundance and biomass for all Mill Creek Sites are summarized in Table 2. Summer steelhead and spring chinook spawning ground counts are compiled in Tables 3 and 4 respectively. Data for 1987 spring chinook redd counts in historical index areas is exhibited in Table 5.

Because Potter's Pond was the only Mill Creek pretreatment area, measurements of physical habitat parameters were limited to this site. Parameters are summarized in Tables 6, 7 and 8.

Shitike Creek

Pretreatment biological data was collected at the Headworks and Upper Crossing sites for the proposed 1988 Lower Shitike Creek Project and are summarized in Tables 2, 3 and 4. A yearly comparison of spring chinook redd counts in historical index areas is provided in Table 5.

Physical habitat parameters were measured and recorded for the two pretreatment sites; these are summarized in Tables 6, 7 and 8.

Table 7. Summary of 0.15m area, usable pool area and undercut banks In sample sites In Beaver Creek and Hill Creek, 1987.

				Area (m2)					Volume(m3)	
Stream	Site	Rkm	Area(m^2)	< 0.15m(%)	≥ 0.15m(%)	Pool ≥ 0.15m(%)	Pool ≥ 1.0m(%)	Usable Pool 1.0m≤ P≥ 0.15m(%)	Site	Undercut Bank
Beaver Creek	Lower Island	1.6	634.9	299.8(47.2)	335.2(52.8)	63.2(10.0)	0.0(0.0)	63.2(10.0)	146.0	1.85(1.3)
	* Reach A-Test	24.1	416.2	134.0 (32.2)	282.2 (67.8)	244.6 (58.8)	0.0 (0.0)	244.6 (58.8)	99.9	0.11 (0.1)
	* Reach B-Test	29.0	399.8	135.1 (33.8)	264.7 (66.2)	45.26 (11.3)	0.0 (0.0)	45.26 (11.3)	52.0	0.01 (0.002)
Hill Creek	Potters Pond	8.8	787.6	180.8(23.0)	606.8(77.0)	0.0(0.0)	0.0(0.0)	0.0(0.0)	149.7	0.23(0.2)

* First year post treatment areas

Table 8. Composition of riffle substrate in sample sites in Beaver Creek and Mill Creek, 1987

Stream	Site	Rkm	Mean substrate Rank a/	% Substrate composition by rank (%) (a/)							
				1	2	3	4	5	6	7	8
Beaver Creek	Lower-Island	1.6	4.0	4.0	9.3	16.0	32	28.0	10.7	-	-
	* Reach A-Test	24.1	5.1	4.0	1.3	2.7	16.0	34.7	32.0	9.3	-
	* Reach B-Test	29.0	6.0	1.3	2.7	1.3	5.3	20.0	30.7	36.0	4.0
Mill Creek	Potters Pond	8.8	6.5	-	-	-	1.3	14.7	34.7	36.0	13.3

a/ Substrate ranks:

1 - organic cover
2 - < 2mm (sand)
3 - 2-5mm (pea gravel)
4 - 5-25mm (small gravel)
5 - 25-50mm (large gravel)
6 - 50-100mm (small cobble)
7 - 100-250mm (large cobble)
8 - > 250mm (boulder)

* First year post treatment areas

Table 9. Summary of fish cover measurements in sample sites in Beaver Creek, 1987.

Stream	Site	Rkm	Site Mean Cover %	Cover type (%) a/ 1	2	3	4	5	6
Beaver Creek	Lower-Island	1.6	4.82	2.2	-	16.1	18.6	6.5	56.6
	* Reach A-Test	24.1	2.24	33.8	7.3	46.3	1.9	9.4	1.3
	* Reach B-Test		5.54	19.0	20.4	44.2	-	16.1	-

a/ Cover Types

1 - Logs, boulders, debris below water surface
2 - Logs, boulders, debris above water surface
3 - Overhanging vegetation < 0.3mm above water surface
4 - Aquatic vegetation
5 - Undercut banks
6 - Depth with surface turbulence

* First year post treatment areas

Warm Springs Basin Production

The floating Humphrey Scoop Trap operated during 68.8% of the sample period from September 29, 1986 to December 13, 1986. The trap operated during 70% of the sample period from March 18, 1987 to June 15, 1987. A complete summary of daily trap data is provided in Appendix A, Table 1.1. The out-migrant estimate for the 1985 brood year was 74,326 spring chinook salmon (Table 10). During the 1986 fall and 1987 spring sampling periods, estimated scoop trap efficiency was 13.0 % and 13.3% respectively (Table 11).

Table 10. Spring chinook brood year redd counts and out-migration estimates for the Warm Springs River basin, 1975 to 1987.

Broad Year	Above W.S.N.F.H Adults	Above W.S.N.F.H Redds	Above W.S.N.F.H Adults/Redd	Total No. redds in WSR basin	No. fall out-migrants	No. spring out-migrants	Total No. out-migrants
1975	N/A	N/A	N/A	808	25,795	43,250	69,045
1976	N/A	N/A	N/A	1,066	47,041	26,043	73,084
1977	1,505	498	3.0	699	25,125	25,204	50,329
1978	1,808	788	2.4	796	74,727	57,216	131,943
1979	906	357	2.5	359	24,930	25,628	50,558
1980	651	114	5.7	117	20,579	14,656	35,235
1981	1,014	147	6.9	157	29,238	14,647	43,885
1982	1,587	421	3.8	433	67,719	30,594	98,313
1983	1,251	433	2.9	438	89,396	31,101	120,497
1984	1,322	415	3.2	429	61,970	34,827	96,797
1985	1,264	377	3.4	398	35,991	38,335	74,326
1986	1,211	417	2.9	428	47,125	N/A	N/A
1987	1,550	478	3.2	484	N/A	N/A	N/A

Table 11. Percentage of out-migrating spring chinook juveniles captured in the Humphrey scoop trap at the mouth of the Warm Springs River, 1979 to 1987.

Year	Spring	Fall
1979	-	15.8
1980	11.1	22.4
1981	15.7	18.3
1982	9.0	12.6
1983	19.3	12.2
1984	6.5	4.0
1985	7.1	10.5
1986	6.0	13.0
1987	13.3	20.8

DISCUSSION

Within the Warm Springs River Basin and Shitike Creek, less rainfall and mountain snowpack occurred in 1987 than 1986, resulting in lower stream discharges (Figures 11-15) and in most sites, higher instream temperatures (Figures 16-24). Collectively, these conditions may have contributed to reductions of 1987 salmonid biomass and abundance in certain sites (Table 2 and Fritsch 1986). Despite temporary detrimental influences on stream physical habitat, completion of Beaver Creek bioengineering work seemed to have contributed to salmonid biomass and production increases.

Project bioengineering evaluation using photopoints will be continued for several years until notable change occurs in riparian vegetation.

In 1987, data gained statistical soundness due to more accurate and consistent collection, more effective equipment, and a more experienced crew. In the following tables, however, it must be noted that figures are subjective to the variables of dynamically changing ecosystems and the possibilities of human error. Depending on area and volumetric changes, percentage comparisons may inflate actual changes in biological and habitat parameters.

Beaver Creek Biological Parameters

In Reach A, rainbow trout and spring chinook salmon estimates indicated biomass increases from 1986 (pre-treatment) to 1987 (post-treatment) (Table 12). Salmonid numbers remained approximately the same (Table 2 and Fritsch 1986). Variation in Reach A salmonid abundance may be attributed to fish size and increases in site surface area (Table 12). Fewer small rainbow trout were found in Reach A after bioengineering work. This may indicate a correlation between the volumetric increase of quality pool areas and the increase of fish size as suggested by Thompson (1972) and Reiser and Bjornn (1979). Changes in habitat, including increased depth and width of rearing areas, may have caused increased fry and juvenile predation, fry displacement; and intraspecific competition between species. In Reach A and B Test, post treatment numerical gains in spring chinook and summer steelhead redds occurred (Tables 3 and 4). In Reach A, three spring chinook redds, which were not previously found in this section, were observed and associated with project bioengineering. For Reach B Test, 1986 to 1987 rainbow trout densities remained approximately the same, but chinook salmon abundance and density increased dramatically (Tables 12 and 2; Fritsch 1986).

In 1987 it is suspected that low flow conditions contributed to decreased spring chinook redds in the Lower Island Area (Table 4). Although this reach was not previously surveyed, summer steelhead redds were abundant in the area in 1987 (Table 3).

Table 12 1986/1987 Percentage change of estimated salmonid abundance and biomass in Post Treatment Beaver Creak Sites.

Stream	Site	Rkm	Surface Area (m2)	Chinook Salmon Fish/m2	Chinook Salmon Gm/m2	Rainbow Trout Fish/m2	Rainbow Trout Gm/m2
Beaver Creek							
	Reach A-Test	24.1	+18.7	+ .06	+16.6	-28.6	+79.1
	Reach B-Test	29.0	- 0.8	+98.6	+99.1	+28.7	+16.0

Beaver Creek Physical Parameters

In both Reach A and B Test sites, post treatment usable pool area increased significantly (Tables 13 and 14). In Reach A, major bioengineering structures such as log weirs (Fritsch 1986) caused more pool increases (+96%) than in the Reach B Test Site (+79.5%). Although there was a loss in total Reach B Test Site volume due to low flow conditions (Figure 16), increases in usable pool occurred and were directly correlated with boulder placement and subsequent pocket water development.

Bioengineering also contributed to the increase of fines (<5mm) and small gravels to the Reach A Site (Table 15). Structures caused alteration and change of hydrological forces which resulted in particle deposition along the stream edge. Increasing stream edge deposition should promote proliferation of streamside vegetation and a deepening of the stream channel, both important components of improved salmonid habitat (Bottom et. al. 1985; Reiser and Bjornn 1979). In Reach B, an increase in large cobbles and boulders (Table 15) should contribute to successful egg incubation, and fry survival (Armour and Platts 1983; Bottom et al. 1985).

Reach A showed a favorable increase in mean site fish cover (+90%; Table 16) consistent with results reported by Bottom el. al. (1985). Temporary loss of aquatic vegetation and undercut banks can be attributed to instream construction processes. Through natural ecological forces, cover should increase over

Table 13 1986/1987 Percentage Change of surface area, 0.15m area, usable pool area and undercut bank area in Post Treatment Beaver Creek Sites.

Stream	Site	Rkm	Area(m^2)	Area (m2)				Volume (m3)	
				< 0.15m(%)	≥ 0.15m(%)	Pool ≥ 0.15m(%)	Usable Pool 1.0m ≤ P ≥ 0.15m(%)	Site	Undercut Bank
Beaver Creek									
	Reach A-Test	24.1	+18.7	+25.3	+15.6	+96.0	+96.0	-146.2	+99.9
	Reach B-Test	29.0	- 0.8	- 5.5	-3.8	+79.5	+79.5	-23.4	-96.0

Table 14 1986/1987 Percentage change of Instream Habitat Parameters in Post Treatment Beaver Creek Sites.

Stream	Site	Rkm	Site Length(m)	Area (m2) a/ P	R	BW	Total	depth(m)	width(m)	Volume (m3)
Beaver Creek										
	Reach A-Test	24.1	0.0	+87.2	-41.0	-100.0	-18.7	+34.0	+10.1	44.8
	Reach B-Test	29.0	0.0	+87.7	-38.1	-	- 0.09	-23.5	- 0.05	-24.1

a/ P-pool; R-riffle; BW-backwater

Table 15 1986/1967 Percentage Difference In composition of Riffle Substrate in Post Treatment Beaver Creek Sites.

Stream	Site	Rkm	Mean substrate Rank a/	(%) (a/) and % difference from 1986							
				1	2	3	4	S	6	7	8
Beaver Creek											
	Reach A-Test	24.1	0.0	+32.5	0.0	-49.0	-30.0	+61.0	-21.2	-13.1	0.0
	Reach B-Test	29.0	+8.4	0.0	+52.0	-77.5	-64.2	-21.0	+17.6	+30.0	+32.5

c/ Substrate ranks:

1 - organic cover
2 - < 2mm (sand)
3 - 2-5mm (pea gravel)
4 - 5-25mm (small gravel)
5 - 25-50mm (large gravel)
6 - 50-100mm (small cobble)
7 - 100-250mm (large cobble)
8 - > 250mm (boulder)

Table 16 1986/1987 Percentage Change of fish cover measurements in Post Treatment Beaver Creek Sites.

Stream	Site	Rkm	Site Mean Cover %	Cover type a/ 1	2	3	4	5	6
Beaver Creek									
	Reach A-Test	24.1	+90.2	+ 9.6	+100.0	+80.0	-84.2	-45.7	-94.6
	Reach B-Test	29.0	-34.9	+100.0	+100.0	-10.7	0.0	-58.0	0.0

a/ Cover Types

1 - Logs, boulders,. debris below water surface
2 - Logs, boulders, debris above water surface
3 - Overhanging vegetation $\leq$ 0.3m above water surface
4 - Aquatic vegetation
5 - Undercut banks
6 - Depth with surface turbulence

time. In Reach B Test, site mean cover decreased chiefly due to lower discharges (Figure 11). Despite mean cover decreases, specific cover types such as logs, boulders, and debris above and below the water surface, showed significant gains (+100.0%). These components were included by Giger (1973) and Reiser and Bjornn (1979) as those which would allow salmonids 1) to avoid predation and 2) resting areas while they wait to spawn.

Lower flows seemed to have contributed to higher instream temperatures in both Reach A and Reach B Test Sites (Figure 16). Usually spring chinook spawning occurs from mid-August through September (CH2M Hill 1982), and in 1987 there was no appreciable change in spawning time due to warmer instream temperatures. Overall, the September mean monthly temperature (12.9 C) was within critical spawning temperature ranges (Reiser and Bjornn 1979).

The Lower Island Area continued to exhibit a lack of riparian cover (Table 9), an abundance of streambed fines (<5mm) (Table 8; Fritsch 1986), and shallow areas particularly subseptible to seasonal low flows and associated critical high and low instream temperatures (Figure 18).

Mill Creek (Potter's Pond)

Preliminary observations on Potter's Pond post treatment bioengineering work indicate significant gains in salmonid utilization. During August and September 1987, four redds were observed in the project area and several adult chinook salmon were seen resting in pools below boulder berms. In the previous year, only two chinook salmon redds were observed in the pre-treatment project area. Due to irrigation withdrawals and low annual discharge above the project site, flows were significantly lower in 1987 than 1986 (Figure 12).

Mill Creek (Strawberry Falls)

The reduction in spring chinook redds above Potter's Pond (Table 4) can most likely be attributed to two factors. First, low flow conditions caused by irrigation withdrawals and climatic conditions possibly impeded salmonid passage above and below Strawberry Falls. Secondly, there was a low number of 1983 adult outplants compared to previous years, resulting in fewer returning progeny.

Humphrey Scoop Trap

In 1987, extensive migrant trap repairs advanced operational efficiency. Consistent collection of trap data will provide a reliable data base of Warm Springs River Basin salmonid production estimates for development of an anadromous fish output model.

SUMMARY AND CONCLUSIONS

Beaver Creek

Results of first year post treatment evaluation in 1987 Reach A and Reach B Test Sites indicate significant salmonid habitat improvements despite the limiting factors of low discharge and associated critical high and low instream temperatures (D.W. Chapman, personal communication, November 30, 1987. Don Chapman Consultants, 3180 Airport Way, Boise, Idaho; J. Griffith, personal communication, December 3, 1987. Department of Biology, Idaho State University, Pocatello, Idaho). Severe overgrazing practices in the riparian zone (Fritsch 1986; CH2M Hill 1982) necessitate the proposed FY 1988 Beaver Creek (Dahl Pine) Fencing Project. Project objectives include improvement of water quality, stabilization of stream morphology, and protection of existing bioengineering structures. The project's goal is reestablishment of riparian vegetation, the key to a productive and sustaining fishery (Platts, 1985).

In FY 1988, instream structures may require periodic maintenance to assure maximum effectiveness. Continued physical and biological project monitoring will insure accurate evaluation of riparian habitat and accomplishment of long term management goals (Platts et. al. 1987).

In the Lower Island Area, past grazing practices have resulted in 1) degradation of riparian vegetation 2) increased temperature extremes, 3) streambank erosion, 4) reduced channel stability and 5) excess stream turbidity (Fritsch 1986; CH2M Hill 1982). The proposed FY 1988 Lower Beaver Creek Juniper Rip-Rapping Project will stabilize upper and lower streambanks which have excessive cutting or sloughing. Long term effects of rip-rapping should also help control livestock access to the riparian area. In turn, this will contribute to increased vegetation, lower instream sedimentation rates, and a moderation of instream temperatures, all critical to salmonid holding, spawning and rearing (Platts 1983).

Mill Creek

Preliminary estimates indicate salmonid resting and spawning areas have already been significantly improved. Poor grazing practices have resulted in water temperature extremes, increases in stream width, and loss of stream depth and riparian cover. These remain the fisheries' major problems. The proposed 1988 Potter's Pond Fencing Project will restrict livestock access to the riparian zone and alleviate these problems over time. Irrigation withdrawals above the project site should be moderated to increase stream discharge and usable salmonid habitat. Continued maintenance and long term post treatment monitoring of bioengineering work is recommended for accurate and complete project evaluation. Subsequently, proper long term management goals can be realized.

Spring chinook and summer steelhead redd counts, conducted above Strawberry Falls, increased in both 1985 and 1986 indicating salmonids had acquired passage past the falls (Tables 3 and 4; Fritsch 1986). However, in 1987, salmonid redd counts decreased in the area, probably due to diminished discharges. Continued long term project monitoring and evaluation will ascertain salmonid passage to spawning sites above the falls and reveal site specific contributions to overall salmonid production in the Mill Creek system.

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APPENDIX A

Table 1.1 September 1986 to June 1987
Daily Data Summary for the
Humphrey Scoop Trap at the
Warm Springs River Mouth.

DATE	USGS Water C.F.S.	ChS 1+ Numbers	ChS Mean Length	ChS "0" Numbers	Hat	Rb	Co	Su	Da	WhF	Sq	Cottid	Dv	RsS
28-Sep-86														
29-Sep-86	300.3	23	84.5		0	7	0	6	3	1	0	0	0	8
30-Sep-86	300.3	12	79.3		0	6	0	3	7	0	0	0	0	15
01-Oct-86	291.7	26	87.1		0	3	0	2	11	0	0	0	0	4
02-Oct-06														
03-Oct-86														
04-Oct-86														
05-Oct-06	283.1													
06-Oct-86	283.1	39	91.2		1854	9	0	6	28	1	0	0	0	10
07-Oct-86	283.1													
08-Oct-86	287.4	29	90.3		1800	4	0	6	18	0	2	0	0	0
09-Oct-86														
10-Oct-86														
11-Oct-86														
12-Oct-86	300.3													
13-Oct-06	300.3	257	92.7		267	15	0	15	1	0	0	0	0	0
14-Oct-86	300.3	340	95.0		104	8	0	12	3	0	0	0	0	0
15-Oct-86	300.3													
16-Oct-86	300.3	102	91.8		10	10	0	7	0	0	0	0	0	5
17-Oct-86	300.3	65	92.3		10	4	0	3	2	0	0	0	0	1
18-Oct-66														
19-Oct-86														
20-Oct-86	300.3	33	91.4		1	1	0	1	0	0	0	0	0	0
21-Oct-86	300.3	30	90.3		7	1	0	4	1	2	0	0	0	2
22-Oct-86	300.3	65	89.9		1	1	0	0	5	2	0	0	0	2
23-Oct-06	300.3	42	88.5		2	0	0	6	1	1	0	0	0	3
24-Oct-86	291.7	87	88.0		0	1	0	3	4	0	0	0	0	1
25-Oct-86														
26-Oct-86														
27-Oct-86	283.1	65	90.4		10	3	0	41	3	2	0	0	0	26
2&Oct-86	291.7	72	87.9		3	1	0	5	3	3	0	0	0	2
29-Oct-86	291.7	147	86.9		0	1	0	9	1	2	0	0	0	1
30-Oct-86	309.0	85	88.5		2	3	0	9	0	5	1	0	0	0
31-Oct-86	348.7	104	89.7		1	5	0	9	1	5	1	0	0	0
01-Nov-86														
02-Nov-86														
03-Nov-86	283.1	140	87.5		1	6	0	15	5	10	0	0	0	0
04-Nov-86	278.8	61	89.3		1	2	0	5	0	5	0	0	0	0
05-Nov-86	278.7	118	90.5		1	1	0	8	0	12	0	0	0	0
06-Nov-86	287.4	106	89.6		4	4	0	1	0	7	0	0	0	0
07-Nov-86	291.7	52	87.0		3	2	0	3	0	4	0	0	0	0
08-Nov-86														
09-Nov-86														
10-Nov-86	296.0													
11-Nov-86														
12-Nov-86	283.1	170	93.3		5	3	0	0	0	9	0	0	0	0
13-Nov-86	283.1	24	95.5		2	3	0	7	0	6	0	0	0	0
14-Nov-86	287.4	15	91.6		0	3	0	0	0	3	0	0	0	0

Table 1.1 (continued)

DATE	USGS Water C.F.S.	ChS 1+ Numbers	ChS Mean Length	ChS "0" Numbers	Hat	Rb	Co	Su	Da	WhF	Sa	Cottid	Dv	RsS
15-Nov-86														
16-Nov-86	326.6													
17-Nov-86	326.6													
18-Nov-86	348.7	6	93.3		3	0	0	2	0	0	0	0	0	0
19-Nov-86	380.2	24	94.5		2	3	0	11	1	3	0	0	0	0
20-Nov-86	300.2	31	92.6		1	4	0	3	0	2	1	0	0	1
21-Nov-86	463.1	25	06.9		1	0	0	5	0	3	0	0	0	1
22-Nov-86	353.2													
23-Nov-86	353.2													
24-Nov-86	491.3	393	93.4		31	24	0	46	0	19	0	0	0	4
25-Nov-86	519.9	62	90.9		3	2	0	9	0	2	2	0	0	0
26-Nov-86	481.9	81	92.9		5	4	0	9	0	9	0	0	0	0
27-Nov-86														
20-Nov-86														
29-Nov-86														
30-Nov-86														
01-Dec-86	510.3													
02-Dec-86	458.4	87	91.3		12	7	0	2	0	2	0	0	0	0
03-Dec-86	425.9	26	93.7		2	1	0	1	0	2	0	0	0	0
04-Dec-86	407.5	20	09.7		0	3	0	0	0	0	0	0	0	0
05-Dec-86	402.9	10	94.7		0	0	0	0	0	1	0	0	0	0
06-Dec-86	353.2													
07-Dec-86	353.2													
08-Dec-86	357.7	87	93.0		16	9	0	1	0	6	0	0	1	1
~~09-Dec-86~~	344.3	0	91.5		0	1	0	0	0	0	0	0	0	0
10-Dec-86	309.0	10	96.0		0	3	0	0	0	1	0	0	0	0
11-Dec-86	322.2	33	96.4		10	2	0	0	0	2	0	0	0	0
12-Dec-86	326.6	7	94.4		4	1	0	1	0	3	0	0	2	0
13-Dec-86														
14-Dec-86	335.4													
15-Dec-86	326.6	5	97.0		0	1	0	0	0	0	0	0	0	0
16-Dec-86	322.2	2	95.0		1	0	0	0	0	1	0	0	0	0
17-Dec-86	304.7	3	94.0		0	2	0	0	0	0	0	0	0	0
18-Dec-86	300.3	6	106.5		0	0	0	0	0	5	1	0	0	0
19-Dec-86	309.0													
20-Dec-86														
21-Dec-86														
22-Dec-86	300.3	6	94.2		0	1	0	0	0	11	1	0	0	0
23-Dec-86	344.3	7	94.6		0	0	0	0						
24-Dec-86	339.8	4	95.0		0	0	0	0	0	1	0	0	0	0
25-Dec-86														
26-Dec-86	322.2	11	91.8		1	1	0	1	0	3	0	0	0	0
27-Dec-86														
28-Dec-86														
29-Dec-86	344.3	7	89.0		0	3	0	2	0	6	0	0	0	0
30-Dec-86	335.4	14	93.0		0	0	0	2	0	0	0	0	0	0
31-Dec-86	322.2	5	95.2		0	0	0	0	0	1	0	0	0	0
01-Jan-87														

Table 1.1 (continued)

DATE	USGS Water C.F.S.	ChS 1+ Numbers	ChS Mean Length	ChS "0" Numbers	Hat	Rb	Co	Su	Da	WhF	Sq	Cottid	Dv	RsS
01-Jan-87	353.2	8	93.3		2	0	0	1	0	0	0	0	0	0
03-Jan-87														
04-Jan-87														
05-Jan-87	335.4	32	98.4		0	0	0	1	0	3	0	0	0	0
06-Jan-87	331.0	8	102.4		2	0	0	1	0	0	0	0	0	0
07-Jan-87	317.8	4	100.5		0	0	0	0	0	0	0	0	0	0
08-Jan-87	309.0	1	88.0		0	0	0	0	0	0	0	0	0	0
09-Jan-87	283.1	2	97.0		0	0	0	1	0	0	0	0	0	0
10-Jan-87														
11-Jan-87														
12-Jan-87	296.0	1	94.0		1	0	0	1	0	0	0	0	0	0
13-Jan-87	304.7													
14-Jan-87	313.4	2	91.5		0	0	0	1	0	0	0	0	0	0
15-Jan-87	317.8	1	94.0		0	0	0	1	0	2	0	0	0	0
16-Jan-87	304.7	0			0	2	0	1	0	1	0	0	0	0

Other Species: Rb, Co, Su, Da, WhF, Sq, Cottid, Dv, RsS

Table 1.1 (continued)

DATE	USGS Water C.F.S.	ChS 1+ Numbers	ChS Mean Length	ChS "0" Numbers	Hat	Rb	Co	Su	Da	WhF	Sq	Cottid	Dv	RsS	Clm
18-Mar-87	711.8	56	101.7	0	2	8	0	0	0	0	0	0	0	0	0
19-Mar-87	671.6	86	101.7	0	2	5	0	0	2	0	0	0	0	0	0
20-Mar-87	626.8	64	101.9	0	0	2	0	0	0	0	0	0	0	0	0
21-Mar-87															
22-Mar-87															
23-Mar-87	558.3	39	101.4	0	1	1	0	0	0	0	0	0	0	1	0
24-Mar-87	548.7	36	99.8	0	2	2	0	1	0	0	0	0	0	0	0
25-Mar-87	529.4	91	99.5	0	3	3	0	0	0	0	0	0	0	0	0
26-Mar-87	510.3	74	99.3	0	1	3	0	0	0	0	0	0	0	0	0
27-Mar-87	496.0	71	99.7	0	1	2	0	0	0	0	0	0	0	0	0
28-Mar-87															
29-Mar-87															
30-Mar-87	458.4	224	101.1	0	4	11	0	1	0	0	0	0	0	1	0
31-Mar-87	458.4	65	102.0	0	1	2	0	0	0	0	0	0	0	0	0
01-Mar-87	458.4	34	104.9	0	0	5	0	4	0	0	0	0	0	1	0
02-Mar-87	463.1	32	110.0	0	13	11	0	0	7	0	0	0	0	0	0
03-Mar-87	472 4	26	106.6	0	7	12	0	0	5	0	0	0	0	0	0
04-Mar-87															
05-Mar-87															
06-Mar-87	486.6	92	108.7	0	7	24	0	1	3	0	0	0	0	0	0
07-Mar-87	486.6	15	112.9	0	4	9	0	0	0	0	0	0	0	0	0
08-Mar-87	481.9	5	113.0	0	6	1	0	0	0	0	0	0	0	0	0
09-Mar-87	539.0	21	112.1	0	6	9	0	1	1	0	1	0	0	0	0
10-Apr-87															
11-Apr-87															
12-Apr-87															
13-Apr-87															
14-Apr-87															
15-Apr-87															
16-Apr-87															
17-Apr-87	548.7	55	114.7	0	19	19	0	0	19	0	0	0	0	0	0
18-Apr-87															
19-Apr-87															
20-Apr-87	519.9	362	110.7	0	42	116	0	0	12	0	1	0	0	0	0
21-Apr-87	519.9	98	111.9	0	11	29	0	1	3	0	1	0	0	1	0
22-Apr-87	510.3	64	115.0	0	9	24	0	0	4	0	0	0	0	0	0
23-Apr-87	505.5	93	115.9	0	22	45	0	6	16	0	1	0	0	0	0
24-Apr-87	510.3	113	116.9	0	23	10	0	2	23	0	0	0	0	1	0
25-Apr-87															
26-Apr-87															
27-Apr-87	500.8	41	115.5	0	10	27	0	1	19	0	0	0	0	1	0
26-Apr-87	519.9	169	115.7	0	26	53	0	5	43	1	0	0	0	0	0
29-Apr-87	548.7	180	115.7	0	6	22	0	5	20	1	0	1	0	0	0
30-Apr-87	568.0	224	116.6	0	8	40	0	5	29	0	0	0	0	1	0
01-May-87	597.3	64	117.1	0	0	42	0	0	12	0	0	0	0	0	0
02-May-87															
03-May-87															
04-May-87	510.3	34	116.6	1	132		0	1	19	0	0	0	0	0	0
05-May-87	496.0	156	117.2	3	19	45	0	0	32	0	0	0	0	0	0
06-May-87	486.6	158	116.2	3	11	51	0	0	68	2	0	0	0	1	0
07-May-87	481.9	135	115.8	1	10	54	0	0	85	1	0	0	0	3	0
08-May-87	491.3	87	115.6	0	826		0	0	103	2	0	0	0	5	0
09-May-87															

Table 1.1 (continued)

DATE	USGS Water C.F.S.	ChS 1+ Numbers	ChS Mean Length	ChS "0" Numbers	Other Species Hat	Rb	Co	Su	Da	WhF	Sq	Cottid	Dv	RsS	Clm
10-May-87															
11-May-87	458.4	71	113.6	2	4	15	1	1	103	2	0	0	0	1	0
12-May-87	463.1	43	110.8	0	2	9	0	1	126	1	0	0	0	2	0
13-May-87	534.2	37	115.5	0	2	19	0	0	84	1	0	0	0	0	0
14-May-87	500.8	46	112.8	0	2	25	0	0	148	1	0	0	0	1	0
15-May-87	463.1	52	112.9	11	0	19	0	0	271	8	0	0	0	0	0
16-May-87															
17-May-87															
18-May-87	398.3	17	110.3	10	0	6	0	1	110	5	0	0	0	0	0
19-May-87	371.1	13	106.4	9	3	18	0	0	69	0	0	0	0	0	0
20-May-87	371.1	21	109.5	S	0	16	0	0	75	0	0	0	0	0	0
21-May-87	371.1	12	109.6	.19	0	16	0	0	56	0	0	0	0	0	0
22-May-87	371.1	16	103.9	8	0	9	0	0	52	0	0	0	0	0	0
23-May-87															
24-May-87															
25-May-87															
26-May-87															
27-May-87	335.4	13	99.4	12	0	13	0	5	100	4	0	0	0	1	0
28-May-87	331.0	31	100.2	20	0	24	0	2	93	5	1	2	0	0	1
29-May-87	326.6	36	100.3	25	1	11	0	2	163	7	0	2	0	0	1
30-May-87															
31-May-87															
01-Jun-87	344.3	7	109.9	47	0	23	0	3	79	2	0	0	0	0	0
02-Jun-87	335.4	6	102.5	41	0	9	0	1	58	1	0	0	0	2	0
03-Jun-87	331.0	10	103.2	64	0	15	0	5	100	5	0	1	0	1	0
04-Jun-87	317.8	11	105.5	112	2	5	0	0	145	5	3	0	0	0	0
05-Jun-87	317.8	34	104.4	233	1	5	0	2	223	7	0	0	0	1	0
06-Jun-87															
07-Jun-87															
08-Jun-87	313.4	4	102.5	38	0	2	0	0	133	4	2	0	0	2	0
09-Jun-87	304.7	10	105.0	41	0	4	0	1	98	1	0	0	0	2	0
10-Jun-87	291.7	3	104.0	29	10	0	0	0	86	4	0	0	0	3	1
11-Jun-87	283.1	2	104.0	33	0	3	0	1	78	1	0	1	0	2	1
12-Jun-87	203.1	6	105.7	37	1	1	0	0	102	1	0	0	0	2	1
13-Jun-87															
14-Jun-87															
15-Jun-87	283.1	4	102.8	36	0	0	0	0	248	14	0	0	0	1	1
16-Jun-87	283.1	2	104.0	11	0	0	0	4	46	3	1	0	0	2	2
17-Jun-87	274.5	1	101.0	18	0	3	0	2	83	0	0	0	0	2	0
18-Jun-87	270.8	2	102.5	4	0	1	0	3	15	0	0	1	0	1	0
19-Jun-87	278.8	4	112.8	10	0	4	0	0	69	2	1	2	0	0	0
20-Jun-87															
21-Jun-87															
22-Jun-87	278.8	5	107.2	24	0	1	0	4	285	5	0	0	0	1	1
23-Jun-87	274.5	0	0.0	3	0	3	0	1	27	1	0	1	0	1	1
24-Jun-87															
25-Jun-87	274.5	1	104.0	6	0	1	0	1	51	0	0	0	0	1	0
26-Jun-87	251.5	2	106.0	4	0	0	0	0	44	4	0	1	0	1	

Table 1.1 (continued)

DATE	USGS Water C.F.S	ChS 1 Numbrs	ChS Mean Length	ChS "O" Numbers	ChS Hat	Other Species Rb	Co	Su	Da	WhF	Sq	Cottid	Dv	RsS	Clm
18-Mar-87	711.8	56	101.7	0	2	8	0	0	0	0	0	0	0	0	0
19-Mar-87	671.6	86	101.7	0	2	5	0	0	2	0	0	0	0	0	0
20-Mar-87	626.8	64	101.9	0	0	2	0	0	0	0	0	0	0	0	0
21-Mar-87															
22-Mar-87															
23-Mar-87	558.3	39	101.4	0	1	1	0	0	0	0	0	0	0	1	0
24-Mar-87	548.7	36	99.8	0	2	2	0	1	0	0	0	0	0	0	0
25-Mar-87	529.4	91	99.5	0	3	3	0	0	0	0	0	0	0	0	0
26-Mar-87	510.3	74	99.3	0	1	3	0	0	0	0	0	0	0	0	0
27-Mar-87	496.0	71	99.7	0	1	2	0	0	0	0	0	0	0	0	0
28-Mar-87															
29-Mar-87															
30-Mar-87	458.4	224	101.1	0	4	11	0	1	0	0	0	0	0	1	0
31-Mar-87	458.4	65	102.0	0	1	2	0	0	0	0	0	0	0	0	0
01-Apr-87	458.4	34	104.9	0	0	5	0	4	0	0	0	0	0	1	0
02-Apr-87	463.1	32	110.0	0	13	11	0	0	7	0	0	0	0	0	0
03-Apr-87	472.4	26	106.6	0	7	12	0	0	5	0	0	0	0	0	0
04-Apr-87															
05-Apr-87															
06-Apr-87	486.6	92	108.7	0	7	24	0	1	3	0	0	0	0	0	0
07-Apr-87	486.6	15	112.9	0	4	9	0	0	0	0	0	0	0	0	0
08-Apr-87	481.9	5	113.0	0	6	1	0	0	0	0	0	0	0	0	0
09-Apr-87	539.0	21	112.1	0	6	9	0	1	1	0	1	0	0	0	0
10-Apr-87															
11-Apr-87															
12-Apr-87															
13-Apr-87															
14-Apr-87															
15-Apr-87															
16-Apr-87															
17-Apr-87	548.7	55	114.7	0	19	19	0	0	19	0	0	0	0	0	0
18-Apr-87															
19-Apr-87															
20-Apr-87	519.9	362	110.7	0	42	116	0	0	12	0	1	0	0	0	0
21-Apr-87	519.9	98	111.9	0	11	29	0	1	3	0	1	0	0	1	0
22-Apr-87	510.3	64	115.0	0	9	24	0	0	4	0	0	0	0	0	0
23-Apr-87	505.5	93	115.9	0	22	45	0	6	16	0	1	0	0	0	0
24-Apr-87	510.3	113	116.9	0	23	10	0	2	23	0	0	0	0	1	0
25-Apr-87															
26-Apr-87															
27-Apr-87	500.8	41	115.5	0	10	27	0	1	19	0	0	0	0	1	0
28-Apr-87	519.9	169	115.7	0	26	53	0	5	43	1	0	0	0	0	0
29-Apr-87	548.7	180	115.7	0	6	22	0	5	20	1	0	1	0	0	0
30-Apr-87	568.0	224	116.6	0	8	40	0	5	29	0	0	0	0	1	@
01-May-87	597.3	64	117.1	0	0	42	0	0	12	0	0	0	0	0	0
02-May-87															
03-May-87															
04-May-87	510.3	34	116.6	1	1	32	0	1	19	0	0	0	0	0	0
05-May-87	496.0	156	117.2	3	19	45	0	0	32	0	0	0	0	0	0

Table 1.1 (continued)

DATE	USGS Water C.F.S	ChS 1 Numbrs	ChS Mean Length	ChS "0" Numbers	Hat	Rb	Co	Su	Da	WhF	Sq	Cottid	Dv	RsS	Clm
06-May-87	486.6.	158	116.2	3	11	51	0	0	68	2	0	0	0	1	0
07-May-87	481.9	135 *	115.8	1	10	54	0	0	85	1	0	0	0	3	0
08-May-87	491.3	87	115.6	0	8	26	0	0	103	2	0	0	0	5	0
09-May-87															
10-May-87															
11-May-87	458.4	71	113.6	2	4	15	1	1	103	2	0	0	0	1	0
12-May-87	463.1	43	110.8	0	2	9	0	1	126	1	0	0	0	2	0
13-May-87	534.2	37	115.5	0	2	19	0	0	84	1	0	0	0	0	0
14-May-87	500.8	46	112.8	0	2	25	0	0	148	1	0	0	0	1	0
15-May-87	463.1	52	112.9	11	0	19	0	0	271	8	0	0	0	0	0
16-May-87															
17-May-87															
18-May-87	398.3	17	110.3	10	0	6	0	1	110	5	0	0	0	0	0
19-May-87	371.1	13	106.4	9	3	18	0	0	69	0	0	0	0	0	0
20-May-87	371.1	21	109.5	5	0	16	0	0	75	0	0	0	0	0	0
21-May-87	371.1	12	109.6	19	0	16	0	0	58	0	0	0	0	0	0
22-May-87	371.1	16	103.9	8	0	9	0	0	52	0	0	0	0	0	0
23-May-87															
24-May-87															
25-May-87															
26-May-87															
27-May-87	335.4	13	99.4	12	0	13	0	5	100	4	0	0	0	1	0
28-May-87	331.0	31	100.2	20	0	24	0	2	93	5	1	2	0	0	1
29-May-87	326.6	36	100.3	25	1	11	0	2	163	7	0	2	0	0	1
30-May-87															
31-May-87															
01-Jun-87	344.3	7	109.9	47	0	23	0	3	79	2	0	0	0	0	0
02-Jun-87	335.4	6	102.5	41	0	9	0	1	58	1	0	0	0	2	0
03-Jun-87	331.0	10	103.2	64	0	15	0	5	100	5	0	1	0	1	0
04-Jun-87	317.8	11	105.5	112	2	5	0	0	145	5	3	0	0	0	0
05-Jun-87	317.8	34	104.4	233	1	5	0	2	223	7	0	0	0	1	0
06-Jun-87															
07-Jun-87															
08-Jun-87	313.4	4	102.5	38	0	2	0	0	133	4	2	0	0	2	0
09-Jun-87	304.7	10	105.0	41	0	4	0	1	98	1	0	0	0	2	0
10-Jun-87	291.7	3	104.0	29	1	0	0	0	86	4	0	0	0	3	1
11-Jun-87	283.1	2	104.0	33	0	3	0	1	78	1	0	1	0	2	1
12-Jun-87	283.1	6	105.7	37	1	1	0	0	102	1	0	0	0	2	1
13-Jun-87															
14-Jun-87															
15-Jun-87	283.1	4	102.8	36	0	0	0	0	248	14	0	0	0	1	1
16-Jun-87	283.1	2	104.0	11	0	0	0	4	46	3	1	0	0	2	2
17-Jun-87	274.5	1	101.0	18	0	3	0	2	83	0	0	0	0	2	0
18-Jun-87	278.8	2	102.5	4	0	1	0	3	15	0	0	1	0	1	0
19-Jun-87	278.8	4	112.8	10	0	4	0	0	69	2	1	2	0	0	0
20-Jun-87															
21-Jun-87															
22-Jun-87	278.8	5	107.2	24	0	1	0	4	285	5	0	0	0	1	1
23-Jun-87	274.5	0	0.0	3	0	3	0	1	27	1	0	1	0	1	1

Table 1.1 (continued)

DATE	USGS Water C.F.S	ChS 1 Numbrs	ChS Mean Length	ChS "0" Numbers	Hat	Other Species Rb	Co	Su	Da	WhF	Sq	Cottid	Dv	RsS	Clm
24-Jun-87															
25-Jun-87	274.5	1	104.0	6	0	1	0	1	51	0	0	0	0	1	0
26-Jun-87	257.5	2	106.0	4	0	0	0	0	44	4	0	1	0	1	

Table 1.1 (continued)

DATE	USGS Water C.F.S.	ChS 1+ Nos.	ChS Mean Length	ChS "0" Nos.	Hat	Rb	Co	Su	Da	WhF	Sq	Cottid	Dv	RsS	Clm
					NUMBERS										
26-Aug-87															
27-Aug-87															
28-Aug-87	215.9	2	66.0	0	0	2	0	0	42	0	0	0	0	0	1
29-Aug-87															
30-Aug-87															
31-Aug-87	220.0	3	66.7	0	0	0	0	1	53	0	0	0	0	0	5
01-Sep-87															
02-Sep-87															
03-Sep-87	215.9	5	81.2	0	0	4	0	0	33	1	2	1	0	0	0
04-Sep-87	224.1	1	108.0	0	1	2	0	0	8	0	0	0	0	0	0
05-Sep-87															
06-Sep-87															
07-Sep-87															
08-Sep-87	215.9	3	90.0	0	0	1	0	0	14	0	1	0	0	2	3
09-Sep-87	215.9	2	77.0	0	0	1	0	0	5	1	0	0	0	1	0
10-Sep-87															
11-Sep-87	220.0	5	66.8	0	0	3	0	0	18	1	0	0	0	1	0
12-Sep-87															
13-Sep-87															
14-Sep-87	220.0	8	87.6	0	2	1	0	1	41	0	0	1	0	4	2
15-Sep-87															
16-Sep-87	232.4	9	85.0	0	3	6	0	0	15	0	0	0	0	0	2
17-Sep-87	224.1	17	81.8	0	0	3	0	2	8	0	0	0	0	1	1
18-Sep-87	224.1	16	79.2	0	0	6	0	6	13	0	0	0	0	0	4
19-Sep-87															
20-Sep-87															
21-Sep-87	220.0	33	81.5	0	7	9	0	1	79	0	1	1	0	2	9
22-Sep-87	220.0	7	83.9	0	0	1	0	0	15	0	0	0	0	0	0
23-Sep-87															
24-Sep-87	215.9	10	74.6	0	5	5	0	0	38	0	2	1	0	0	0
25-Sep-87	215.9	1	92.0	0	2	0	0	0	22	0	0	0	0	0	2
26-Sep-87.															
27-Sep-87															
28-Sep-87	224.1	18	79.1	0	11	6	0	3	37	3	2	2	0	1	1
29-Sep-87	215.9	27	80.3	0	1	6	0	1	3	1	0	1	0	0	1
30-Sep-87	215.9	8	86.6	0	1	2	1	0	18	1	0	1	0	0	1
01-Oct-87															
02-Oct-87															
03-Oct-87															
04-Oct-87															
05-Oct-87															
06-Oct-87															
07-Oct-87															
08-Oct-87															
09-Oct-87															
10-Oct-87															
11-Oct-87															
12-Oct-87	215.9	118	85.6	0	205	3	0	3	6	0	0	0	0	0	0

Table 1.1 (continued)

DATE	USGS Water C.F.S.	ChS 1+ Nos.	ChS Mean Length	ChS "O" Nos.	Hat	Rb	Co	Su	Da	WhF	Sq	Cottid	Dv	RsS	Clm
					NUMBERS										
13-Oct-87	224.1	150	88.6	0	483	20	0	8	9	1	0	0	0	2	1
14-Oct-87	215.9	264	87.5	0	165	8	0	2	18	0	0	0	0	0	0
15-Oct-87	232.4	303	87.0	0	97	16	0	7	5	0	0	0	0	0	0
16-Oct-87	232.4	378	87.7	0	197	21	0	3	8	0	0	0	1	0	0'
17-Oct-87															
18-Oct-87															
19-Oct-87	232.4	333	88.0	0	161	25	0	7	7	0	0	0	0	0	0
20-Oct-87	224.1	394	87.6	0	165	16	0	7	6	2	0	0	0	0	0
21-Oct-87	224.1	289	89.5	0	208	12	0	12	6	2	0	0	0	0	0
22-Oct-87	224.1	271	88.3	0	1808	10	0	7	5	0	0	0	0	0	0
23-Oct-87															
24-Oct-87															
25-Oct-87															
26-Oct-87	215.9	85	88.4	0	27	9	0	1	3	1	0	0	0	0	0
27-Oct-87	224.1	101	85.7	0	22	2	0	1	11	0	0	0	0	1	0
28-Oct-87	224.1	88	85.9	0	16	2	0	0	5	2	0	0	0	0	0
29-Oct-87	224.1	124	86.1	0	19	4	0	12	4	3	0	0	0	0	0
30-Oct-87	224.1	74	96.8	0	9	2	0	5	5	0	0	0	0	0	1
31-Oct-87															
01-Nov-87															
02-Nov-87	240.7	156	93.2	0	52	8	0	2	10	1	0	1	0	2	0
03-Nov-87	232.4	110	88.2	0	1	3	0	5	4	0	0	0	0	1	0
04-Nov-87	224.1	184	89.1	0	8	1	0	7	0	1	0	0	0	0	0
05-Nov-87	224.1	160	90.6	0	7	3	0	4	1	0	0	0	0	1	0
06-Nov-87	224.1	167	90.6	0	10	5	0	2	4	0	0	0	0	4	1
07-Nov-87															
08-Nov-87															
09-Nov-87															
10-Nov-87	224.1	84	92.7	0	4	0	0	3	0	1	1	0	0	0	0
11-Nov-87	224.1	62	93.0	0	5	2	0	2	1	0	1	0	0	1	1
12-Nov-87	249.1	52	90.8	0	1	0	0	1	0	0	0	0	0	1	0
13-Nov-87															
14-Nov-87															
15-Nov-87															
16-Nov-87	240.7	113	88.0	0	1	1	0	7	0	0	0	0	0	0	0
17-Nov-87	240.7	256	89.3	0	6	3	0	23	2	0	0	0	0	0	0
18-Nov-87	236.5	241	88.9	0	8	3	0	4	0	0	1	0	0	0	0
19-Nov-87	236.5	248	89.0	0	5	1	0	2	0	1	0	0	0	0	0
20-Nov-87	232.4	84	94.0	0	0	2	0	12	0	0	0	0	0	0	0
21-Nov-87															
22-Nov-87															
23-Nov-87	236.5														
24-Nov-87	232.4	100	90.6	0	1	1	0	37	0	2	0	0	0	0	0
25-Nov-87	240.7	111	90.8	0	0	4	0	27	0	0	0	0	0	0	0
26-Nov-87															
27-Nov-87															
28-Nov-87															
29-Nov-87															

Table 1.1 (continued)

DATE	USGS Water C.F.S.	ChS 1+ Nos.	ChS Mean Length	ChS "O" Nos.	Hat	Rb	Co	Su	Da	WhF	Sq	Cottid	Dv	RsS	Clm
					Other Species NUMBERS										
30-Nov-87															
01-Dec-87	236.5	42	92.1	0	4	3	0	6	0	1	0	0	0	0	0
02-Dec-87	477.1	780	92.9	0	15	8	0	70	1	3	0	0	0	0	0
03-Dec-87	412.1	358	92.4	0	5	11	0	43	0	2	0	0	0	0	0
04-Dec-87	425.9	183	91.0.	0	1	13	0	41	1	0	0	0	0	0	0
05-Dec-87															
06-Dec-87															
07-Dec-87	339.8	69	93.0	0	0	5	0	7	0	0	1	0	0	0	0
08-Dec-87	240.7	59	93.7	0	0	2	0	111	1	0	0	0	0	0	0
09-Dec-87	362.1	115	94.5	0	1	8	0	65	0	1	0	0	0	0	0

SUMMARY OF EXPENDITURES

Major Expenditures in 1987

Date	Item	No.	Total Cost
7/17/84	Power Sonic Ault Battery Charger	1	$ 75.00
7/17/87	Gel Cell U-l Batteries	3	$172.50