Distribution of fish species in tributaries of the lower Klamath River:

An interim report, FY 1996

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Technical Report No. 3
March 1998

YUROK TRIBAL FISHERIES PROGRAM

March 23, 1998

TO: Interested Parties

FROM: Dan Gale, Sr. Fisheries Biologist

SUBJECT: 1996 Fish Species Presence/Distribution in the Lower Klamath Basin

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Enclosed is a copy of the Yurok Tribal Fisheries Program (YTFP) report entitled "Distribution of fish species in tributaries of the lower Klamath River: An interim report, FY 1996." This report documents 1996 electrofishing and snorkel surveys, and 1996 outmigrant fish trap efforts that were undertaken in lower Klamath tributaries. In addition, a compendium of historical fish species and distribution information in each tributary is included.

The 1996 investigations, the first of a three year effort, are an integral component of YTFP's on-going Lower Klamath River Watershed Assessment. This assessment encompasses biological monitoring in conjunction with aquatic/riparian habitat and upslope/road network inventories in order to 1) identify factors limiting salmonid production within each basin and 2) provide prioritized restoration prescriptions.

If you have any questions concerning this document or YTFP's watershed assessment activities in general, please feel free to contact Hans Voight or myself at (707) 482-2841.

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Acknowledgments

The Yurok Tribal Fisheries Program acknowledges excellence in field assistance by YTFP technicians Peter Lara, Frank Erickson, Dale Sanderson, Jr., Richard Meyers II, Robert Jackson, John Logan III, and Mark Sanderson. We wish to thank Dale Miller and Simpson Timber Company for access to private lands, and Lowell Diller of Simpson for use of road maps. We are grateful to Dave McLeod and Mike Wallace of California Department of Fish and Game for allowing us access to Klamath River tributary stream files. And finally, we'd like to thank Dr. Peter Craig, Dr. Bret Harvey, Dave Hillemeier, and Lawrence Voight for insightful (and much needed) comments during the editing process.

Introduction

The Klamath River is synonymous with the Yurok People- its waters that foster a diversity of anadromous fish is their lifeblood. Salmon (especially spring and fall-run chinook salmon, *Oncorhynchus tshawytscha*) are integral to Yurok culture and economy. "Nepui[i]," the Yurok word for salmon, literally means “that which is eaten” (Waterman 1920).

Today, only a fraction of historic salmon runs return to spawn in the Klamath River and its tributaries. In the early 1900’s, the total catch and escapement of Klamath River chinook was estimated at 300,000 to 400,000 fish (Rankel 1978, as cited in Trihey 1996). Between the years of 1978-1995, the average annual fall chinook escapement had declined to an estimated 59,000 fish (including hatchery fish) (CDFG 1996). In 1991, only 18,133 adult chinook returned to the Klamath and Trinity Rivers (CDFG 1996).

Klamath River coho salmon (*0. kisutch*) and steelhead trout stocks (*0. mykiss*) are also reduced relative to past abundance. The National Marine Fisheries Service (NMFS) has recently conducted status reviews for both species under the federal Endangered Species Act (ESA) (Busby et al. 1994; Weitkamp et al. 1996). As a result, coho are now listed as “threatened”, and steelhead are proposed for listing as “threatened.” NMFS is currently conducting similar status reviews for sea-run cutthroat trout (0. *clarkiclarki*) and chinook salmon, due to be completed in 1998.

Although many factors have contributed to these declines in native fish runs, degradation of freshwater habitats has been pervasive in the Klamath River basin. Chronic streambed sedimentation has been documented throughout the lower Klamath River tributaries (Balance Hydrologies Inc. 1995; Lintz and Kisanuki 1992; Lintz and Noble 1992; Noble and Lintz 1990; Payne and Associates 1989; USFWS 1979a). Human activities (e.g., intensive logging, roads construction, dam building, and mainstem water diversions), as well as natural conditions (e.g., highly erodible soils, steep slopes, and large flood events) have been implicated to varying degrees.

The widespread loss of salmonid habitat diversity/complexity in many lower river tributaries is partly attributable to long-term cumulative impacts of timber harvesting. Rankel(l982) observed that logging and associated road building have had “considerable” and “unquantifiable” negative impacts on anadromous salmonids in the Klamath River. Potential negative effects include increased sedimentation rates, reduction of instream cover, loss of pool habitat, changes in hydraulic complexity, decreased channel stability, and altered streamflow/runoff (Hicks et al. 1991; Kier 1991; Rankel 1982). Habitat degradation through simplification limits the diversity of salmonid assemblages (Karr and Schlosser 1978; Reeves et a1.1993).

In order to reverse downward trends of important salmonid populations, the Yurok Tribal Fisheries Program (YTFP) has initiated a long-term restoration program in the lower Klamath River. A first step is the assessment of current physical and biological

conditions of anadromous fish-bearing tributaries entering the lower Klamath River. Historical fish species presence and distribution data vary by stream, and for many tributaries, biological data are sparse. Therefore, YTFP's ongoing survey efforts provide necessary documentation of current fish presence in lower river tributaries.

Surveys conducted between May and September 1996 detailed fish species presence and distribution within 23 lower Klamath River tributary basins and sub-basins. Outmigrant traps operated on three important lower river chinook tributaries provided additional species presence data. Future surveys will address streams not initially investigated and revisit tributaries that had only cursory efforts in 1996.

Objectives of this report are three-fold: 1) to present 1996 findings on fish species presence and their distribution patterns within sampled tributaries, 2) to compile historical fish presence data for lower Klamath streams, and, 3) to identify trends in fish species presence and distribution.

Study Area

The Klamath River basin drains approximately 15,600 mi^2 in southwestern Oregon and northwestern California (Fig. I), including over 8,000 mi^2 downstream of Iron Gate Dam (USFWS 1979a). Iron Gate Dam, located at river mile (n-n) 191, is the upstream extent for anadromous fish in the mainstem Klamath. For the purposes of this report "lower Klamath River tributaries" refers to those streams that enter the Klamath River within the boundaries of the Yurok Indian Reservation downstream of the Trinity River confluence (rm 44) (Table 1, Fig. 2).

Table 1. Lower Klamath River tributaries sampled for fish species presence/distribution in 1996.

Hunter Creek	Bear Creek	Blue Creek and tributaries
Mynot Creek	Surpur Creek	Pularvasar Creek
Hoppaw Creek	Little Surpur Creek	"One Mile" Creek
Saugep Creek	Tectah Creek	West Fork Blue
Terwer Creek	Johnsons Creek	Slide Creek
McGarvey Creek	Roaches Creek	Nickowitz Creek
Tarup Creek	Morek Creek	Crescent City Fork Blue
Omagaar Creek	Tully Creek	

Lower Klamath tributaries are located mainly within the "North Coast Ranges" geologic province (Kier 1991). Coast range lithologies include Franciscan formation graywhackes, melanges, ocean floor peridotites, and dunites (Bond 1997). Kier (1991) states that "in the North Coast Ranges, landslides and soil slips are common due to the combination of sheared rocks, shallow soil profile development, steep slopes, and heavy seasonal precipitation," Average annual precipitation ranges from approximately 50 -inches along the Pacific Coast to over 100 inches in upper Blue Creek (Helley and LaMarche 1973).

General location and physical data for streams investigated in 1996 are summarized in Table 2. The column "Perennial Flow?" refers to year-round streamflow, from the headwaters to the mouth. Seasonal intermittence at summer low-flow conditions is the most common pattern observed in the lower Klamath tributaries. Most creeks dry up beginning at the mouth and go subsurface progressively moving upstream. In most tributaries investigated, the date of the first rains in autumn becomes crucial for salmonid spawners attempting to gain access (Fig. 3).

Water temperature records for eight of the study streams during the study period indicate that daily average stream temperatures did not approach upper lethal limits for indigenous salmonids(>73"F) (App. Figs. A-l, A-2) (Bjornn and Reiser 1991).

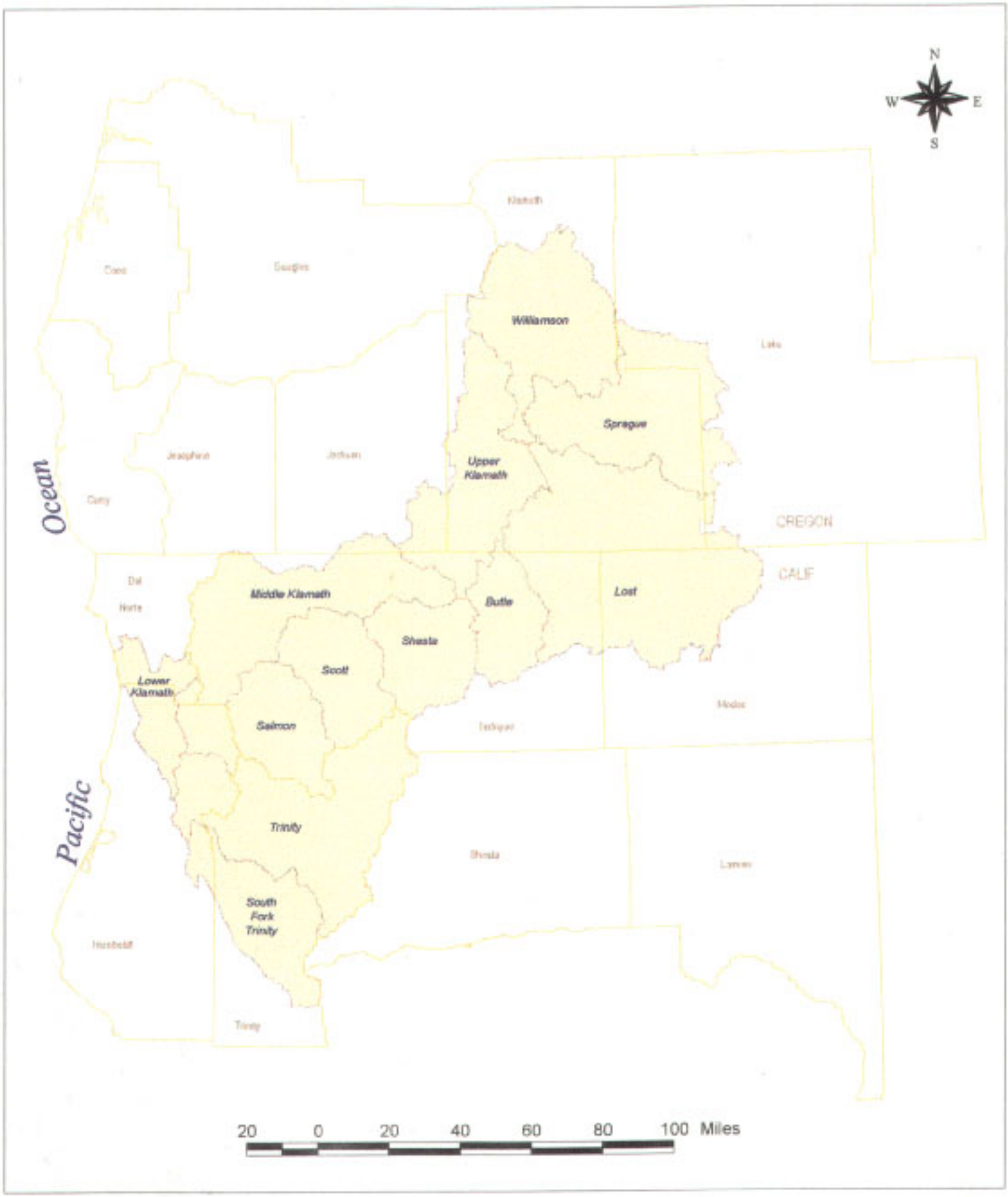

Figure 1: Location of Klamath River Basin

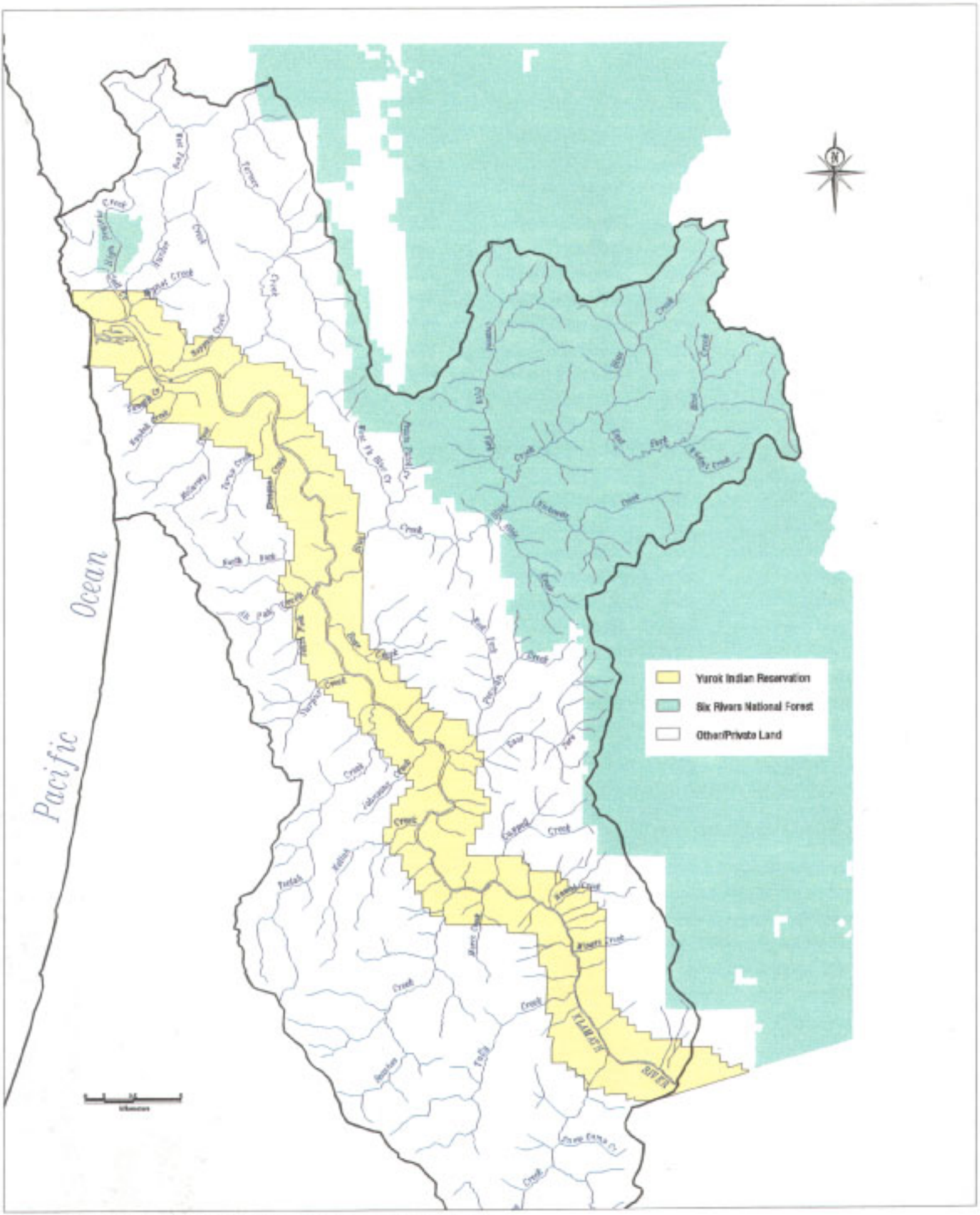

Figure 2. Location of lower Klamath River Tributaries

Table 2. Location and size of streams sampled in 1996.

Creek	Stream Order	Tributary to	River Mile	Location	Drainage (mi^2)	Perennial Flow?
Hunter	4th	Estuary	0.8	T13N,R1E,S4	24.0	no
Mynot	2nd	Hunter Creek	0.8	T13N,R1E,S4	5.0	no
Hoppaw	3rd	Estuary	3.0	T13N.R1E.S15	5.0	no
Saugep	2nd	Waukell Creek	3.2	T13N,R1E,S15	1.7	no
Terwer	4th	Klamath River	5.6	T13N,R1E,S13	33.2	no
McGarvey	3rd	Klamath River	6.4	T13N,R1E,S24	8.7	yes
Tamp	3rd	Klamath River	9.0	T13N,R2E,S20	5.0	no
Omagaar	2nd	Klamath River	10.5	T13N,R2E,S29	2.5	no
Blue	5th	Klamath River	16.0	T12N,R2E,S15	128.3	yes
Pularvasar	2nd	Blue Creek	16.0	T12N,R2E,S15	1.2	no
One Mile	1st	Blue Creek	16.0	T12N.R2E.S14	0.6	no
W. Fork Blue	3rd	Blue Creek	16.0	T12N.R2E.S12	9.7	yes
Slide	2nd	Blue Creek	16.0	T12N,R3E,S3	5.7	yes
Nickowitz	3rd	Blue Creek	16.0	T12N,R3E,S3	12.4	yes
C.C. Fork Blue	4th	Blue Creek	16.0	T13N,R4E,S34	13.4	yes
Bear	3rd	Klamath River	18.2	T12N,R2E,S27	19.5	no
Surpur	3rd	Klamath River	20.3	T12N.R2E.S35	5.7	no
Little Surpur	2nd	Klamath River	21.3	T11N,R2E,S1	2.7	no
Tectah	3rd	Klamath River	21.8	T11N,R2E,S1	20.1	no
Johnsons	2nd	Klamath River	24.0	T11N,R3E,S18	3.4	no
Roaches	4th	Klamath River	31.5	T10N,R3E,S8	29.8	yes
Morek	2nd	Klamath River	32.5	T10N,R3E,S9	4.1	no
Tully	3rd	Klamath River	38.9	T10N,R3E,S25	17.5	yes

Methods and Materials

Surveys were conducted from May through September 1996. Stream-flow and physical access for crews and equipment primarily influenced the selection of sampling sites and sampling method. Stream reaches were numbered progressively in an upstream direction, and where possible, were located to assess fish presence in lower, middle, and upper reaches of drainages. In more remote tributaries, such as Tully, Morek, and Little Surpur Creeks, lack of established access points restricted 1996 sampling.

Electrofishing methods: a Smith Root model 15-C electrofisher powered by a Honda EX 3500 gas generator was utilized for surveys. Two person crews, consisting of one shocker and one netter, proceeded upstream through a given reach, sampling all habitat types encountered. Electrofishing effort was delineated by the "s-time", or number of seconds that the anode was "on" during a pass (see details in Appendix B). In addition, the linear distance of each reach was recorded.

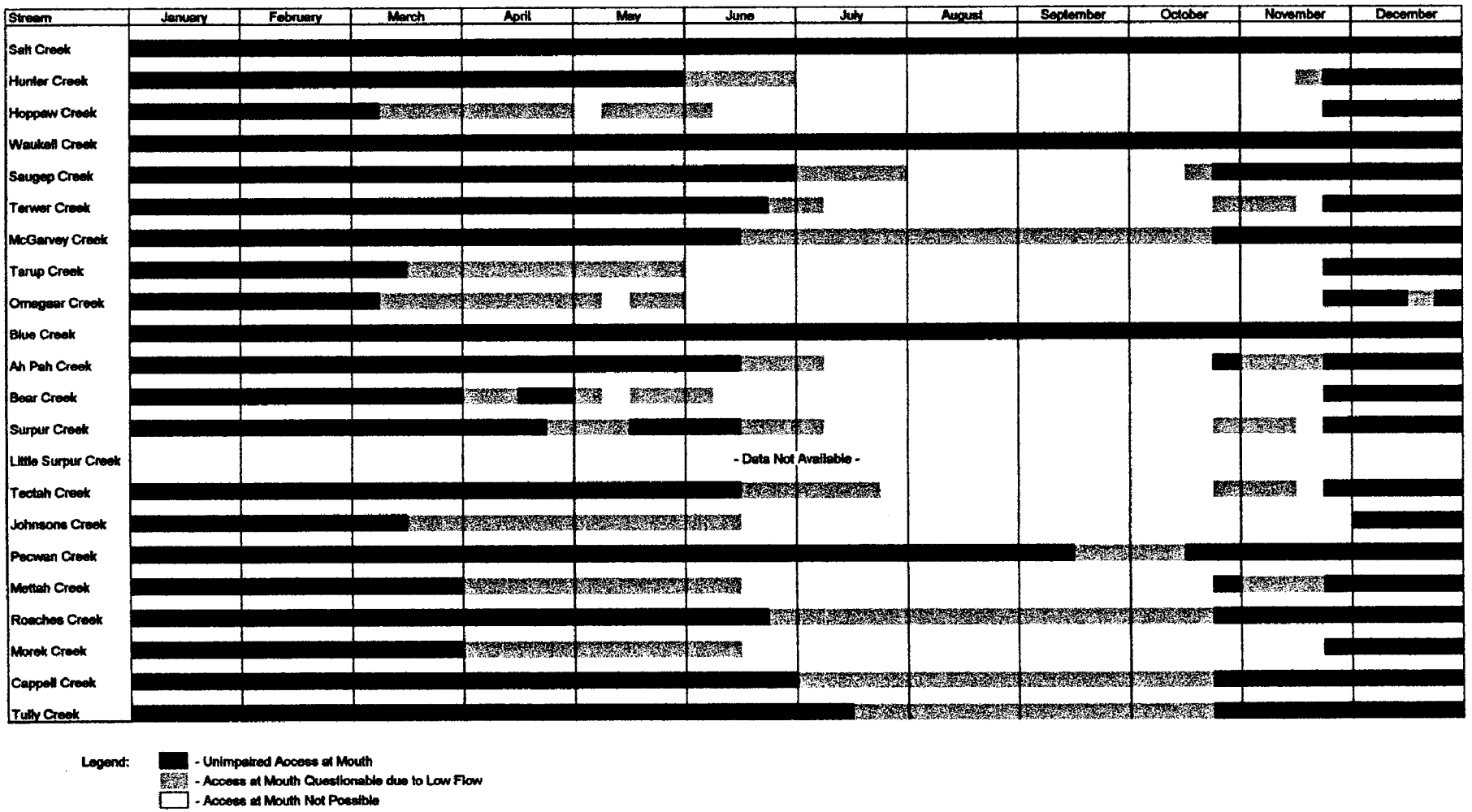

Figure 3. Fish access periodicity in lower Klamath River tributaries, California, 1996.

Captured fish were held in 5-gallon buckets in the shade. Fish densities in buckets were monitored closely, with fresh water replenished to reduce stress. Captured fish were tranquilized using MS-222 (0.6g./10 liters water), identified, and measured (fork length in mm). Scales were collected from age 1 and older cutthroat trout for age/length analysis. Fish were released throughout the sampled area, approximating "pre-sampling" densities and distributions as closely as possible.

Snorkel Survey Methods: snorkel surveys were utilized in larger streams where stream discharge and/or wide stream channels made electrofishing ineffective (i.e., mainstem Blue Creek, Slide Creek, Nickowitz Creek, and lower Roaches Creek). Snorkel surveys were conducted by two experienced divers who maintained lanes along each bank while looking towards the center of the channel. Blue Creek dives were conducted in the downstream direction with data collected on pre-established reaches. Nickowitz, Slide, and Roaches Creek dives were conducted in the upstream direction, on "open-ended" reaches (no pre-determined end point).

Juvenile salmonids were identified to species and age class where possible. Chinook and coho salmon fry were distinguished by physical characteristics such as parr marks and fin shape. Steelhead juveniles and small coastal cutthroat trout, on the other hand, were frequently indistinguishable when viewed underwater. The physical distinction between resident and anadromous salmonids of the same species can also be tenuous (i.e., juvenile steelhead vs. resident rainbow trout).

Outmigrant Trapping Methods: frame traps were operated on Hunter and Terwer Creeks between the months of March and June 1996, and March and April 1996, respectively. A rotary screw trap was operated on Blue Creek from March through September 1996.

Each frame trap consisted of a 28 ft. long frame net, steel frame, and two live boxes. The live boxes were attached at the cod end of the net, with an interconnecting nylon mesh sleeve between the two boxes. The frame and net were secured by anchor points on each bank. In addition, weir panels constructed from one by four planks and hardware cloth screening were utilized on each side of the frame trap to increase the proportion of stream sampled. Weir panels were placed and/or removed according to stream discharge, which fluctuated week to week in the early spring.

The rotary screw fish trap (manufactured by E.G. Solutions, Inc.) was equipped with a 5-ft diameter cone, and was supported by two aluminum coated foam pontoons. Water enters the upstream end of the trapping cone, and strikes the angled internal screw, rotating the screw assembly and perforated stainless steel cone. As the assembly rotates, fish are trapped within the chambers formed by the screw, and are moved rearward into the live box. Floating leaves and detritus are removed via a rotating drum screen at the rear of the live box. The trap was held in position by 3/8" steel cable attached to anchor points on each bank.

Traps were deployed seven nights a week whenever possible, based on observations by others that the vast majority of juvenile salmonids emigrate under cover of darkness (Hoar 1953; Miller 1970; Reimers 1973; Faudskar 1980). High flows during spring storm events precluded trap operation for several nights on Hunter Creek, and curtailed the trapping season altogether on Terwer Creek, when the trap itself was washed downstream and buried.

Captured fish were identified and enumerated. Salmonids were further identified by age class. Up to 30 fish from each salmonid species/age class were measured (forklength) to the nearest millimeter. In order to measure trapping efficiency, marked fish were released upstream for potential recapture. All other fish were released downstream of the trap site.

Water Temperature Monitoring: water temperature was measured with Optic StowAway 8K waterproof data loggers (Onset Corporation model #WTA08-05+37). Data loggers were placed in concrete blocks covered with hardware cloth and securely attached with steel cable to a nearby tree or other stable object. Data loggers were placed in fastwater habitat types (riffles or swift-flowing runs) where feasible to ensure adequate water mixing, and were set to record water temperature once every 30 minutes. Data were analyzed using dBase IV software to provide a daily average temperature throughout the monitoring period.

Water temperature was monitored in the following streams/locations with sampling dates in parentheses:

McGarvev Creek: immediately upstream of the lower bridge crossing on the Simpson Road #M-10; (1 May 1996- 2 Oct 1996).

Tarup Creek: immediately upstream of the lower bridge crossing on the Simpson Road #S-300; (9 Jan 1996- 2 Oct 1996).

Omagaar Creek: approximately 50 feet upstream of the culvert (now a bridge) crossing on the Simpson Road #S-10; (5 Jan 1996- 2 Oct 1996).

Blue Creek Basin:

- Lower mainstem Blue Creek: in the vicinity of the bridge crossing on the Simpson Road #B-10; (April 1995 to October 1996).
- Nickowitz Creek: approximately 50-ft. upstream of mainstem Blue Creek confluence; (23 Jul 1996- 22 Oct 1996).
- Upper mainstem Blue Creek: approximately 50-ft. upstream of the Crescent City Fork confluence; (23 Jul 1996- 22 Oct 1996).
- Crescent City Fork Blue Creek: approximately 30-ft.upstream of the mainstem Blue Creek confluence; (23 Jul 1996- 22 Oct 1996).

Bear Creek: immediately upstream of the bridge crossing on Simpson Road #BC-10; (30 Apr 1996- 2 Oct 1996).

Surpur Creek: approximately 200-ft.upstream of the bridge crossing on Simpson

Road #A-600; (5 Jan 1996- 2 Oct 1996).

Scale Analysis: initially, larger steelhead and cutthroat trout, and smaller fish that exhibited signs of anadromy were targeted for scale analysis. Due to an insufficient sample size for steelhead trout, only cutthroat trout scale data were analyzed. Scales were collected from below the dorsal fin on both left and right sides of each fish. Samples were placed in wax paper-lined coin envelopes and labeled with the date, location, species, fork length and crew. Each scale sample was mounted separately between two labeled microscope slides and viewed with a microfiche reader. All samples were aged and inspected for growth patterns using methods similar to those described by Devries and Frie (1996) and Jearld (1983).

Based on analysis of growth patterns, a determination was made whether scales from a given fish exhibited a standard "stream-type" growth pattern or else displayed other patterns such as uniform year-round growth (difficult or impossible to discern annuli) or noticeably large growth in a particular year. These latter traits could be indicative of a fish which has spent some portion of its life outside of the tributary where it was captured (i.e. anadromous or potamodromous life histories).

A "stream-type" growth pattern would be exhibited by a salmonid which has reared continuously in a small stream since emergence. Characteristics include wider spaced circuli during the spring/summer/fall period (i.e. increased metabolism and growth) with distinct annuli formation during winter period (i.e. reduced metabolism and growth). In addition, the relative spacing between successive annuli would be similar.

Results and Discussion

Fish Species Summaries

For the purposes of this report, anadromous "species presence" refers to the juvenile life history stages, unless otherwise qualified. Fish species observed in the lower Klamath basin during 1996 surveys were: chinook salmon, coho salmon, chum salmon *(Oncorhynchus keta),* steelhead trout, coastal cutthroat trout, brown trout *(Saimo salar),* pacific lamprey *(Lampetra tridentatd),* prickly sculpin *(Cottis asper),* coastrange sculpin *(Cottis aleuticus),* speckled dace *(Rhinicthys osculus),* Klamath small-scale sucker *(Catostomous rimiculus),* threespine stickleback *(Gasterosteus aculeatus),* and green sunfish *(Lepomis cyanellus).*

We found juvenile chinook salmon in 11 lower Klamath tributaries during 1996 investigations (Table 3). In general, electrofishing and snorkel surveys documented low numbers of chinook fry in limited longitudinal distributions. The late-spring start of surveys, however, likely biased these findings. Blue Creek was the major exception to this pattern: abundant chinook fry were widely distributed throughout the system (Fig. 4). Chinook fry were the most frequently captured salmonid during 1996 outmigrant trapping efforts on Hunter, Terwer, and Blue Creeks. Chinook were documented for the first time in two tributaries to Blue Creek: One Mile Creek and Nickowitz Creek. We did not find chinook, however, in four streams that had previously supported them: Omagaar, Bear, Surpur, and Roaches Creeks.

In 1996, we observed juvenile coho salmon in 14 lower Klamath tributaries (Table 4). Like chinook, coho were generally scarce and narrowly distributed where present. The single exception was Crescent City Fork of Blue Creek (Blue Creek reach #6) where snorkel surveys identified abundant coho fry. The Blue Creek system also had the widest distribution of juvenile coho relative to other surveyed streams (Fig. 5). Juvenile coho comprised very small percentages of the total salmonid catches during outmigrant trapping efforts (no more than 1% of salmonid catch at any of the three traps). In 1996, juvenile coho were found for the first time in Omagaar, Pularvasar, One Mile, and Johnsons Creeks.

Juvenile steelhead were present in all 22 lower Klamath tributaries sampled, ranging from Hunter Creek upstream to Tully Creek (Table 5), but their relative abundance varied between creeks. Snorkel surveys identified Blue Creek and its tributaries as having the highest steelhead abundance and widest distribution of any lower Klamath tributary (Fig. 6). Outmigrant trapping totals did not reflect abundant steelhead emigrants in Hunter, Terwer, or Blue Creeks (no more than 26% of salmonid catch at any of the three traps). Steelhead were documented for the first time in Hoppaw, One Mile, and Little Surpur Creeks.

Coastal cutthroat appeared generally abundant and well-distributed in 13 of 19 lower Klamath tributaries downstream of Johnsons Creek (Table 6). Cutthroat were the most

abundant salmonid in 8 of these 13 streams. Surveys in the Blue Creek basin found adult cutthroat widely distributed in mainstem reaches (including the Crescent City Fork) (Fig. 7); yet four of the six streams without cutthroat in 1996 were Blue Creek tributaries, and overall abundance of cutthroat in Blue Creek was low relative to other salmonids. Cutthroat emigrants were rarely captured during 1996 outmigrant trapping efforts (<1% of total salmonid catch was highest observed percentage). We documented cutthroat presence for the first time in Hoppaw and One Mile Creeks.

Table 3. Presence of juvenile chinook salmon in lower Klamath River tributaries, 1996.

Creek	Date(s) Observed	Method	Reach #	Historical Presence?
Hunter	Mar-Jun 1996	outmigrant trap	—	yes
Mynot	6 May 1996	electrofish	1	yes
Saugep	16 May 1996	electrofish	1	yes
Terwer	Mar-Apr 1996	outmigrant trap	—	yes
McGarvey	7 May 1996	electrofish	1	yes
Tarup	31 May 1996	electrofish	1	yes
Blue	Mar-Sept 1996	outmigrant trap		yes
Blue	Jun-Jul 1996	snorkel	1-6*	yes
One Mile	21 Jun 1996	electrofish	1,2	unknown
Nickowitz	25 Jun 1996	snorkel	1	unknown
Tectah	30 May 1996	electrofish	1	yes
Johnsons	29 May 1996	electrofish	1	yes

*Blue Creek reach #6 = Crescent City Fork Blue

Table 4. Presence of juvenile coho salmon in lower Klamath River tributaries, 1996.

Creek	Date(s) Observed	Method	Reach #	Historical Presence?
Hunter	Mar-May 1996	outmigrant trap	—	yes
Hoppaw	20,28 May 1996	electrofish	2,3	yes
Saugep	16 May 1996	electrofish	1,2	yes
Terwer	Mar-Apr 1996	outmigrant trap	—	yes
McGarvey	1, 7, 8 May 1996	electrofish	1,2,4-7	yes
Tarup	30 May 1996	electrofish	1	yes
Omagaar	11 Jul 1996	electrofish	2	unknown
Blue	Apr-Sept 1996	outmigrant trap	—	yes
Blue	Jun-Jul 1996	snorkel	1-6*	yes
Pularvasar	21 Jun 1996	electrofish	1	unknown
One Mile	21 Jun; 3 Jul 1996	electrofish	1-3	unknown
Bear	18 Jun 1996	electrofish	1	yes
Tectah	1 Jul 1996	electrofish	1	yes
Johnsons	29 May; 10 Jul 1996	electrofish	1,2	unknown
Roaches	24 Jun 1996	snorkel	1	yes

* Blue Creek reach *#6* = Crescent City Fork Blue

Table 5. Presence of juvenile steelhead trout in Lower Klamath River tributaries, 1996.

Creek	Date(s) Observed	Method	Reach #	Historical Presence?
Hunter	Mar-Jun 1996	outmigrant trap	—	yes
Hunter	5 Sept 1996	electrofish	1	yes
Mynot	6 May 1996	electrofish	1	yes
Hoppaw	20, 28 May 1996	electrofish	1-4,6	unknown
Saugep	16 May 1996	electrofish	1,2,4	yes
Terwer	Mar-Apr 1996	outmigrant trap	—	yes
McGarvey	1,7, 8 May 1996	electrofish	2-4, 6, 7	yes
Tarup	30, 31 May 1996	electrofish	1,2	yes
Omagaar	11 Jul 1996	electrofish	1,3	yes
Blue	Mar-Sept 1996	outmigrant trap	—	yes
Blue	Jun-Jul 1996	snorkel	1-6*	yes
Pularvasar	21 Jun 1996	electrofish	1	yes
One Mile	21 Jun; 3 Jul 1996	electrofish	1-3	unknown
W. Fork Blue	15 Jul 1996	electrofish	1	yes
Slide	17 Jun 1996	snorkel	1	yes
Nickowitz	25 Jun 1996	snorkel	1	yes
Bear	10,13 May; 18 Jun 1996	electrofish	1-4	yes
Surpur	9 May 1996	electrofish	1,2	yes
Little Surpur	23 May 1996	electrofish	1	unknown
Tectah	30 May; 1,2 Jul 1996	electrofish	1,2	yes
Johnsons	29 May, 10 Jul 1996	electrofish	1-3	yes
Roaches	24 Jun 1996	snorkel	1	yes
Roaches	27 Jun 1996	electrofish	2,3	yes
Morek	1 Jul1996	electrofish	1	yes
Tully	27 Jun 1996	electrofish	1	yes

* Blue Creek reach #6 = Crescent City Fork Blue

Table 6. Presence of juvenile cutthroat trout in Lower Klamath River tributaries, 1996.

Creek	Date(s) Observed	Method	Reach #	Historical Presence?
Hunter	Mar-Jun 1996	outmigrant trap	—	yes
Hunter	5 Sept 1996	electrofish	1,2	yes
Mynot	6 May 1996	electrofish	1-3	yes
Hoppaw	20, 28 May 1996	electrofish	1-7	unknown
Saugep	16 May 1996	electrofish	1-5	yes
McGarvey	1,7, 8 May 1996	electrofish	1-9	yes
Tarup	30, 31 May 1996	electrofish	1-4	yes
Omagaar	11 Jul 1996	electrofish	1-3	yes
Blue	Apr-Sept 1996	screw trap	—	yes
Blue	Jun-Jul 1996	snorkel	1-6*	yes
One Mile	3 Jul 1996	electrofish	3	unknown
Bear	10, 13 May; 18 Jun 1996	electrofish	1-4	yes
Surpur	2, 9 May; 2 Jul 1996	electrofish	1-4	yes
Tectah	22 May 1996	electrofish	3	yes
Johnsons	29 May; 10 Jul 1996	electrofish	1-4	yes

* Blue Creek reach #6 = Crescent City Fork Blue; cutthroat observed during snorkel surveys were "adults."

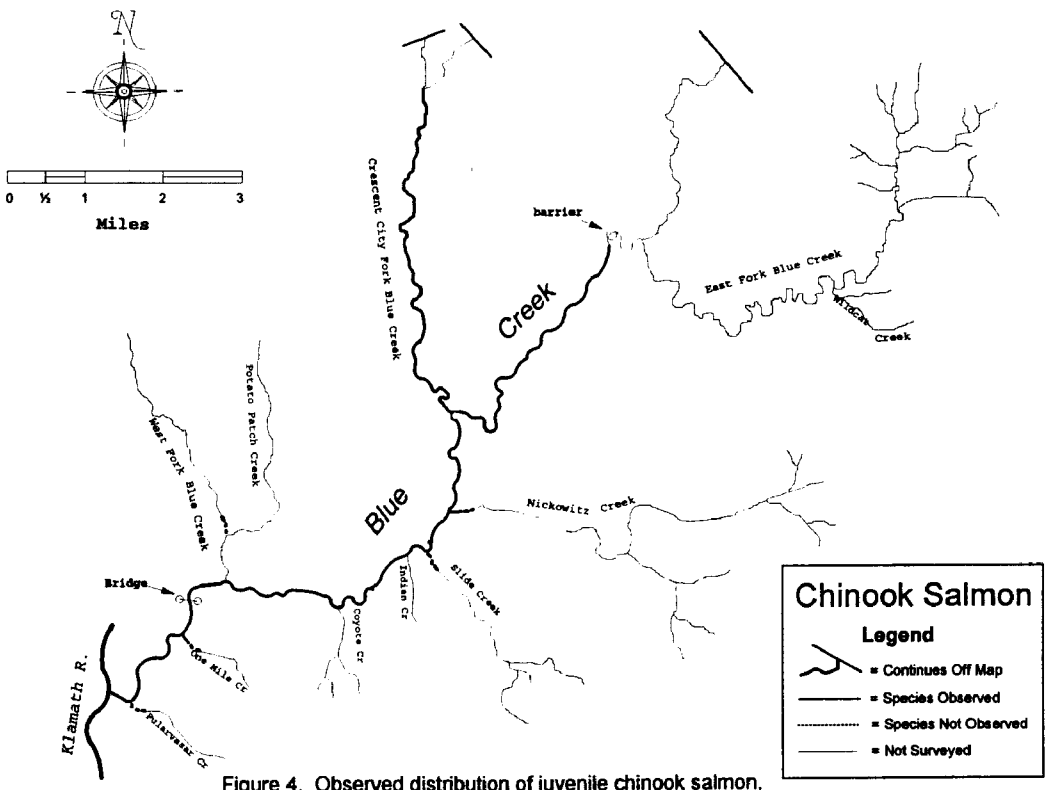

Figure 4. Observed distribution of juvenile chinook salmon, Blue Creek, Lower Klamath River, California, 1996.

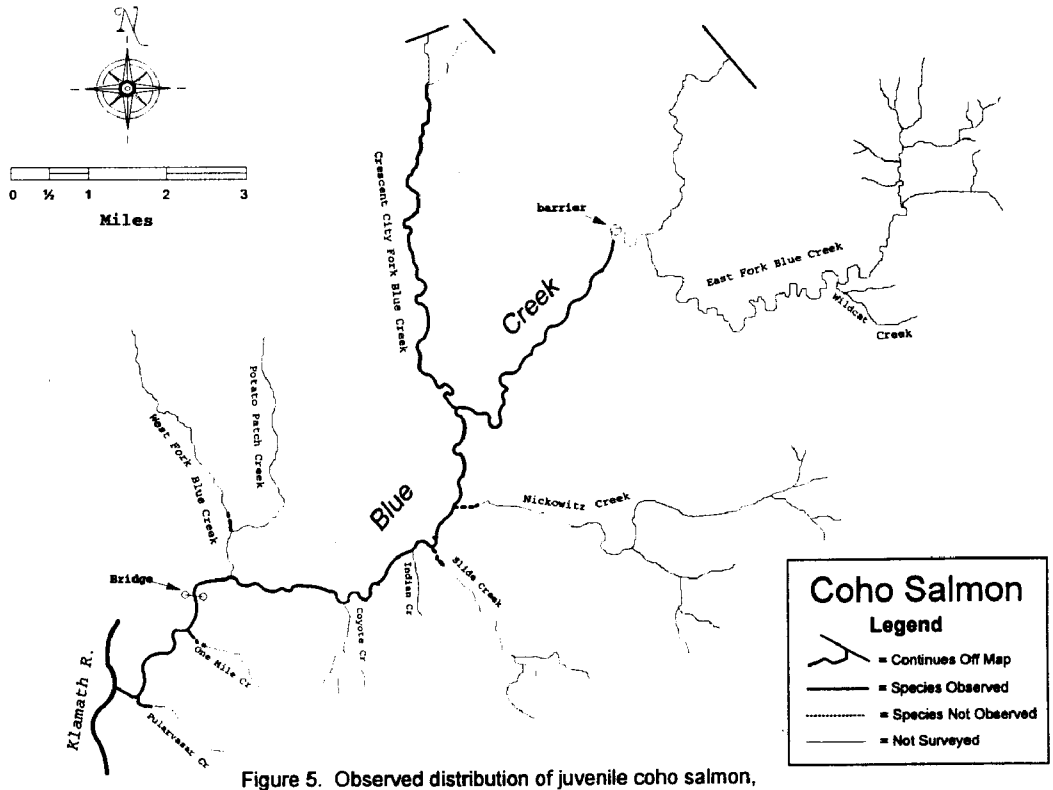

Figure 5. Observed distribution of juvenile coho salmon, Blue Creek, Lower Klamath River, California, 1996.

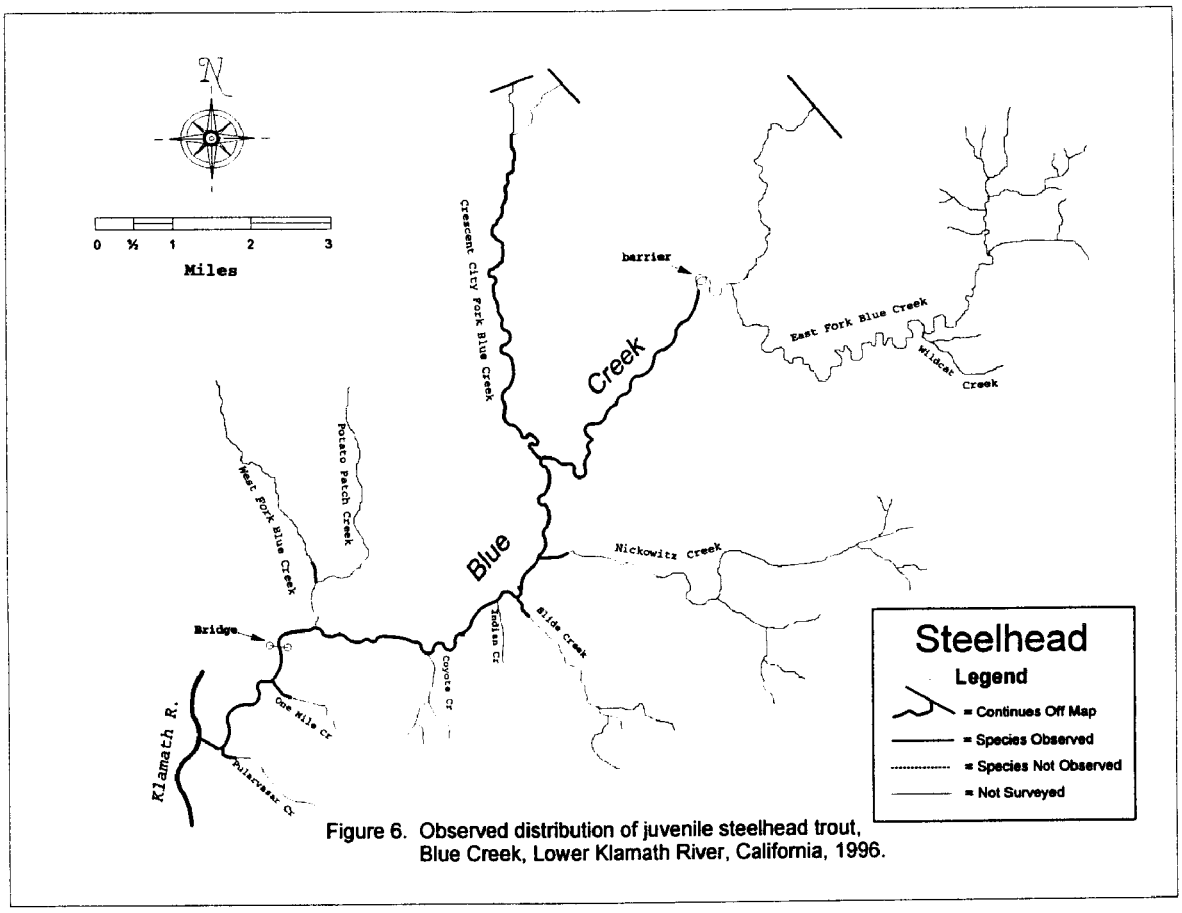

Figure 6. Observed distribution of juvenile steelhead trout, Blue Creek, Lower Klamath River, California, 1996.

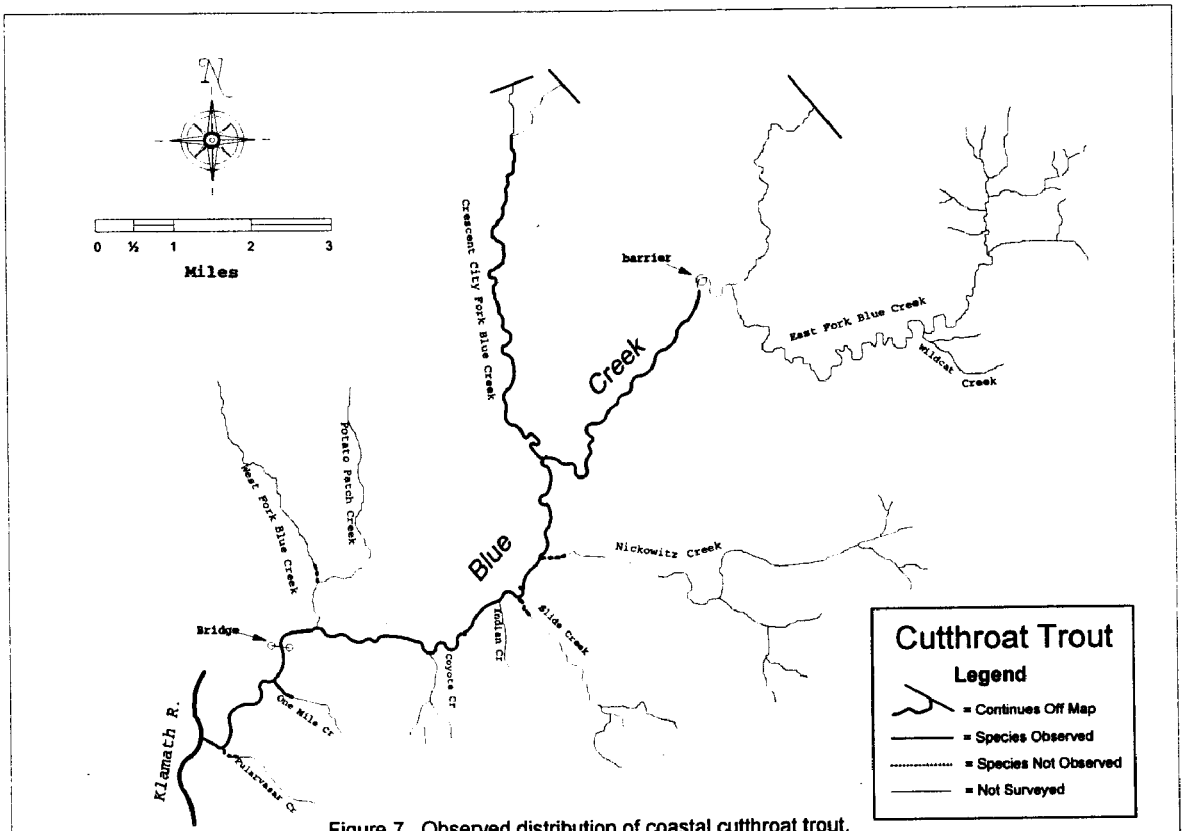

Figure 7. Observed distribution of coastal cutthroat trout, Blue Creek, Lower Klamath River, California, 1996.

Stream Summaries

Sampling results are organized by tributary drainage, including (1) fish species presence and longitudinal distribution patterns, and (2) relevant historical fish presence data. The amount of information collected differed by creek because of logistics, crew availability, and effort expended sampling. The quantity of historical fish data also varied greatly between tributaries. Accordingly, the level of analysis is different for each creek.

Detailed physical habitat data for each reach sampled and stream temperature graphs are presented in Appendix A. An overview table of 1996 investigations delineating survey time, effort, and all observed species by reach are found in Appendix B (includes amphibians). Scale analysis for all coastal cutthroat trout samples are summarized in Appendix C.

Hunter Creek

Synopsis: past and present land management activities within the watershed have degraded stream habitats. The stream channel reflects chronic accumulations of sediment, pool-tail spawning gravel tends to be highly embedded, and available fish cover is sparse. Juvenile chinook, coho, steelhead, and cutthroat were observed in 1996. Each of these species had previously been documented in Hunter Creek.

Fish Species Presence

Outmigrant Trapping: juvenile chinook, coho, steelhead, coastal cutthroat, coastrange and prickly sculpin, speckled dace, threespine stickleback, Klamath small-scale sucker, adult and ammocoete lamprey, and green sunfish were captured between 8 Mar and 28 Jun 1996. Juvenile chinook salmon were by far the most numerous salmonid captured during the trapping season, comprising 95% of the total catch (n=l,512) (Table 7).

The outmigrant frame trap was fished a total of 89 nights directly downstream of the Requa Road bridge. The trap was pulled for the season when salmonid emigrants were no longer being efficiently captured. Low fish numbers at the trap coincided with the start of flow intermittence in middle Hunter Creek.

Electrofishing

Reach #1: steelhead, cutthroat, prickly sculpin, and speckled dace were captured in the East Fork of Hunter Creek on 5 Sept 1996 (Table 8, Fig. 8, App. B-l). Cutthroat were very abundant while steelhead juveniles were observed infrequently in this middle basin reach. Five undifferentiated trout fry were also observed.

Reach#2: cutthroat trout were the only fish species observed in a Hunter Creek tributary known locally as "Kurwitz Creek" on 5 Sept 1996. Nineteen of 29 fish netted were less than 100 mm FL, indicating that young-of-the-year (YOY) dominated the sample. One relatively large fish (251 mm FL) was aged at 3+ yrs from its scales (App. C).

Table 7. Total number of juvenile salmonids captured by week in the frame net traps, Hunter and Terwer Creeks, Lower Klamath River, California, 1996.

HUNTER CREEK FRAME NET

Week Ending	# Days Sampled	Chinook	Steelhead		Coho		Cutthroat
			YOY	Parr/Smolt	YOY	Yearling	
3/9/96	2	4	0	0	0	0	0
3/16/96	5	268	0	0	1	0	0
3/23/96	7	92	0	6	0	0	0
3/30/96	6	24	0	7	0	0	2
4/6/96	4	6	0	5	0	0	0
4/13/96	5	14	0	3	0	0	0
4/20/96	5	6	0	1	0	0	0
4/27/96	2	2	0	1	4	0	0
5/4/96	5	398	0	8	1	0	2
5/11/96	7	255	0	16	0	0	0
5/18/96	4	11	0	0	0	0	0
5/25/96	3	50	0	0	0	0	0
6/1/96	7	97	0	1	0	0	0
6/8/96	7	151	0	4	0	0	1
6/15/96	7	55	0	3	0	0	0
6/22/96	7	5	0	9	0	0	0
6/29/96	6	1	0	1	0	0	0
Total:	89	1,439	0	65	6	0	5

TERWER CREEK FRAME NET

Week Ending	# Days Sampled	Chinook	Steelhead		Coho		Cutthroat
			YOY	Parr/Smolt	YOY	Yearling	
3/30/96	2	34	0	22	0	1	0
4/6/96	1	26	0	1	0	0	0
4/13/96	4	82	0	8	1	0	0
4/20/96	2	47	0	7	1	0	0
4/27/96		- Trap Pulled for Season Due To High Flow Damage -					
Total:	9	189	0	38	2	1	0

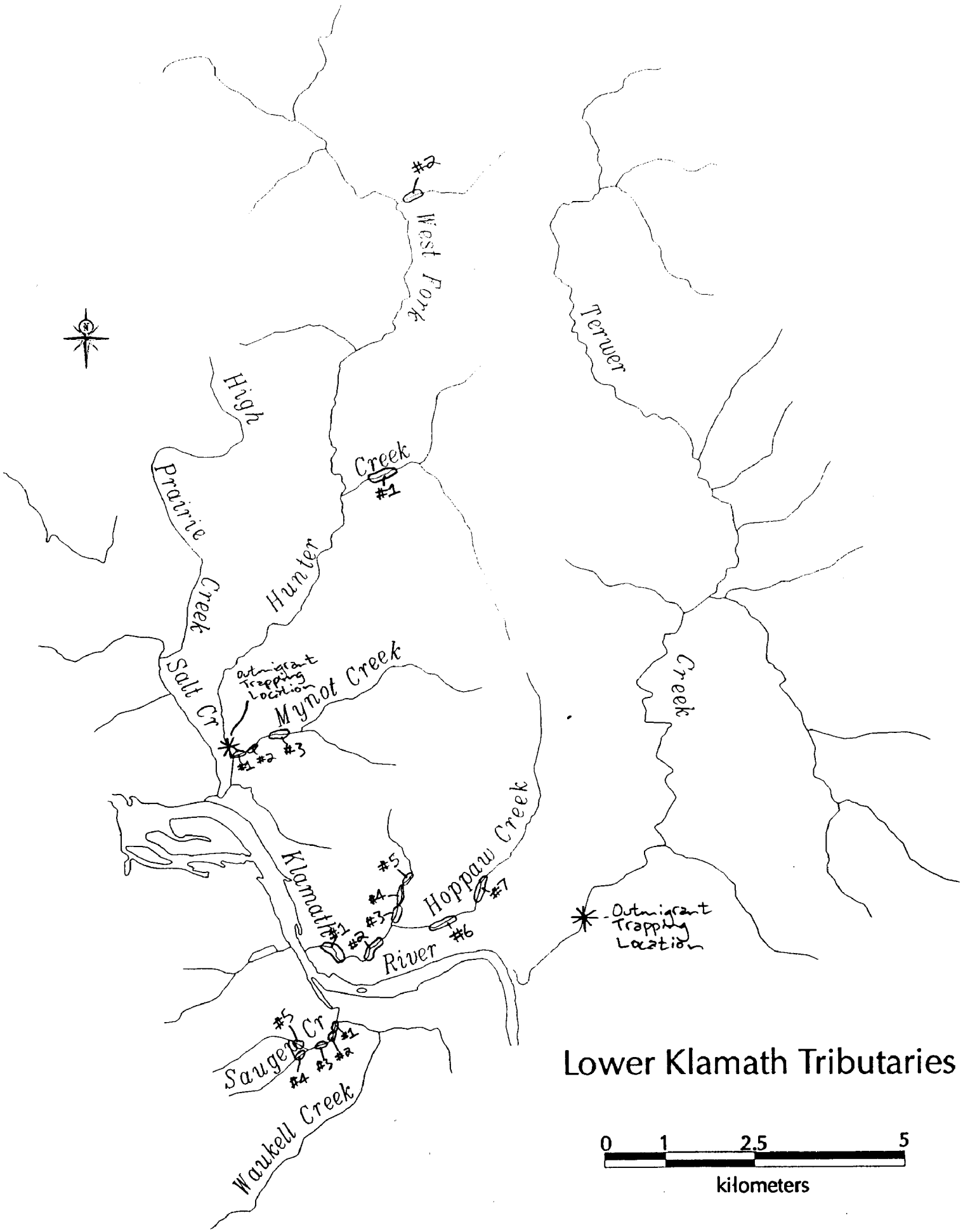

Figure 8. 1996 Electrofishing reach locations.

Table 8. Hunter Creek: juvenile salmonids captured by electrofishing, 5 Sept 1996.

	#fish	FL range (mm)	% salmonids captured
Reach #1:			
steelhead	10	110-151	14
cutthroat	59	66-146	80
trout fry	5	64-74	6
Reach #2:			
cutthroat	29	72-251	100

Historical Information

Hunter Creek has considerable historical fish species presence data relative to other lower Klamath tributaries (Table 9). Stream survey records date from 1945, but the majority of available fisheries information is from the mid-1970's to the present.

Available survey records do not document naturally spawned juvenile chinook presence until 1989, when USFWS conducted outmigrant trapping. Many past surveys, however, were conducted at times when juvenile chinook were not likely in the system (i.e., summer, fall, and winter months). Since adult chinook had been observed during spawning surveys since the late 1970's, it seems likely that juvenile chinook had been consistently missed by most survey efforts.

Juvenile steelhead and coho were the most frequently noted salmonids in Hunter Creek records from 1945 through 1993. Cutthroat trout were infrequently mentioned, and when present, their abundance was low relative to other salmonids. Current data indicate that cutthroat may have expanded their Hunter Creek distribution in the past decade. In 1996, cutthroat trout were numerically dominant in the East Fork and Kurwitz Creek while previous surveys in the same reaches had found only steelhead/rainbow trout.

Stocking records for the years 1986-1996 show a sustained effort to increase chinook runs in the drainage. Coho fingerlings were also planted in Hunter Creek as recently as 1989 (Table 10). Chinook salmon broodstock were collected from Hunter Creek and/or from the mainstem Klamath River adjacent to the mouth of Blue Creek.

Table 9. Hunter Creek: documented salmonid species presence, 1945-1996.

Species'	Date	Location	Survey type	Agency
CO	1945	Hwy. 101 bridge	seine net	CDFG[2]
CO,SH	11 Jul 1958	below Requa Road	bankside	CDFG[2]
CT	29 Sept 1975	3/4 mi. below East Fork Hunter	bankside	CDFG[2]
SH	6 Apr l976	trib. 3/4 mi. below "Kurwitz Creek"	bankside	CDFG[2]
SH adult, SH	21 Feb 1978	"Kurwitz Creek"	electrofish	CDF[2]
CK adults	Fall 1977-78	various	spawner	USFWS[3]
SH,CT	spring 1978	various	electrofish	USFWS[3]
CO,SH	4Junl987	1 mi. upstream Hwy 101 bridge	electrofish	CDFG[2]
CO adults	22 Dec 1987	3 miles b/w H-500 & H-100 Roads	spawner	CDFG[2]
CK adults	9Novl988	Hwy. 101 to Requa Road.	spawner	CDFG[2]
CO, CK adult	13 Dec 1988	from H-100 bridge upstream 4 mi.	spawner	CDFG[2]
CK, CO, SH, CT	spring 1989	lower Hunter Creek	outmigrant trap	USFWS[4]
CK, CO, SH, CT	spring 1990	lower Hunter Creek	outmigrant trap	USFWS[5]
SH	21 Jun 1990	East Fork Hunter Creek	electrofish	CDFG[2]
SH adult, CO	20 Mar 1992	downstream of Kurwitz Creek	bankside	CDFG[2]
CK, CO, SH	spring 1992	various-fish rescue	seine, traps	CDFG[2]
CO,SH	22 Oct1993	unknown	electrofish	CDFG[2]

[1]C0= coho; SH= steelhead/rainbow; CT= coastal cutthroat; CK= chinook.

[2]California Department of Fish and Game, Klamath River Stream Files, Eureka, CA.

[3]USFWS 1979a.

[4]Noble and Lintz 1990.

[5] Lintz and Noble 1992.

Table 10. Stocking efforts in Hunter Creek, 1986-1996

Date	**Program[2]**	**Species**	**# fish planted**
Oct 1986	NCIDC	chinook	6,350
Oct 1987	YASP	chinook	7,400
Oct 1988	YASP	chinook	8,900
5 Oct 1988	CDFG/BIA	chinook	6,000
Oct 1989	YASP	chinook	14,964
27 Sept 1989	CDFG/BIA	coho	1,860
Oct 1990	YASP	chinook	16,350
Oct 1991	YASP	chinook	10,442
Oct 1992	YASP	chinook	18,219
Oct 1993	YASP	chinook	30,082
Oct 1994	YASP	chinook	20,945
1996	YASP	chinook	15,814

[1]Walt Lara, Jr. (YASP), stocking records, Klamath, CA

[2]NCIDC= Northern California Indian Development Council; YASP= Yurok Accelerated Stocking Program; CDFG/BIA= California Department of Fish And Game with Bureau of Indian Affairs.

Mynot Creek

Synopsis: logging, cattle grazing, and channelization have negatively impacted instream habitats. The box culvert under Mynot Creek Road is a potential salmonid migrational barrier. Chinook salmon, steelhead/rainbow trout, and cutthroat trout were captured below the box culvert while only cutthroat trout were observed in upstream reaches. Historically, chinook adults spawned upstream of the road crossing.

Fish Species Presence

Electrofishing

Reach #1: chinook, steelhead, cutthroat, sculpin, speckled dace, threespine stickleback, Klamath small-scale sucker, and small adult lamprey were captured in lower Mynot Creek on 6 May 1996 (Table 11, Fig. 8, App. B-l). One captured steelhead apparently swam into Mynot Creek after receiving an upper caudal clip at the Hunter Creek outmigrant trap. Several factors suggest the chinook fry also may have originated from Hunter Creek: the lack of suitable spawning habitat in sampled reaches, tenuous access to potential spawning grounds upstream of the county road (see App. A), and the proximity of Hunter Creek with many chinook emigrants.

Table 11. Mynot Creek: juvenile salmonids captured by electrofishing, 6 May, 20 May, and 28 May 1996.

	#fish	FL range *(mm)*	% salmonids captured
Reach #1:			
chinook	2	52,64	14
steelhead	11	79-131	79
cutthroat	1	128	7
Reach #2:			
cutthroat	2	152,156	50
trout fry	2	55,60	50
Reach #3:			
cutthroat	4	62-73	44
trout fry	5	37-55	56

Reach #2: cutthroat, undifferentiated trout fry, sculpin, speckled dace, and threespine stickleback were sampled on 20 May 1996. The low catch of salmonids (4 total) was due in part to rain and associated water turbidity. At least 5 parr/smolt sized trout eluded netters during sampling.

Reach #3; cutthroat and undifferentiated trout fry were captured on 28 May 1996. This reach was upstream of the Mynot Creek Road crossing (a 77 ft long box culvert, or concrete apron, under the road). The size distribution of captured fish suggested all were YOY. Larger fry possessed definite cutthroat characters such as "slash marks," and long maxillary length. Smaller fry, although lacking the diagnostic red/orange marks under their jaw, resembled cutthroat in body shape ("snaky").

Historical Information

Very few records of fisheries surveys have been located for Mynot Creek. Dale Sanderson Jr., a YTFP employee and long time area resident, recalled catching large fall-run chinook salmon "above the Margaret Keating School" in 1962-63 (upstream of the road crossing). In addition, USFWS conducted electrofishing in various reaches during April/May, 1978 capturing only steelhead/rainbow trout.

Although the date when the box culvert was installed under Mynot Creek Road is uncertain (it did not exist in 1962), salmon (and likely steelhead and cutthroat) previously ascended to spawning grounds upstream of the road crossing. The box culvert should be assessed at fall, winter and spring flows to determine if spawners have access to upstream reaches. In addition, future surveys should be conducted in early spring to verify the potential presence of salmon/steelhead upstream of the box culvert. Suitable spawning habitat for chinook is very limited from the county road downstream to Hunter Creek. Currently, Mynot Creek's main value to anadromous fishes is rearing habitat.

Hoppaw Creek

Synopsis: instream habitats were similar to conditions in Mynot Creek: channelization from roads in the lower and middle basin; sparse cover because woody debris and habitat diversity are lacking; and a human-derived migrational hindrance that impedes anadromous salmonids. In 1996, juvenile coho, steelhead, and cutthroat were captured in lower reaches; steelhead and cutthroat were present in middle reaches. Historically, coho were present in the middle basin.

Fish Species Presence

Electrofishing

Lower Zone (reaches #1,2,3, & 4): coho, steelhead, cutthroat, trout fry, prickly sculpin, speckled dace, and threespine stickleback were captured on 20 May, and 28 May 1996 (Table 12, Fig. 8, App. B-l). Steelhead dominated the catch in lowermost Hoppaw Creek, although numbers declined as sampling proceeded upstream (15 out of 20 measured steelhead were captured in reach #1). Coho fry were found in both the lower mainstem and in an unnamed tributary known locally as North Fork of Hoppaw Creek (reaches #2 &3).

Table 12. Hoppaw Creek: juvenile salmonids captured by electrofishing, 20 May, and 28 May 1996.

	#fish	FL range (mm)	% salmonids captured
Lower Zone:			
coho	7	65-81	9
steelhead	20	78-179	27
cutthroat	10	80-306	13
trout fry	38	28-64	51
Middle Zone:			
steelhead	1	114	2
Cutthroat	26	60-150	46
trout fry	29	37-62	52

Cutthroat and undifferentiated trout fry became more numerous as sampling proceeded upstream (6 of 10 total cutthroat and 24 of 38 trout fry were captured in reaches #3 & 4). The largest sampled cutthroat (306 mm FL) was aged at 3+ years, and exhibited a large amount of growth between its second and third annuli. Captured in the lowermost reach on 20 May 1996, this fish had a noticeably "chrome" appearance, and was possibly in some phase of a spawning migration.

Middle Zone (reaches #5,6, & 7): steelhead, cutthroat, and trout fry were the only fish observed on 20 May and 28 May 1996. All three reaches were upstream of potential migrational hindrances. Reach #5, on North Fork of Hoppaw Creek, was upstream of a 6 ft. falls around and under a logjam. Reaches #6 & 7 were upstream of the culvert on mainstem Hoppaw Creek (see App. A). Judging from the observed salmonid communities, the culvert may have blocked upstream passage of some spawners (Fig. 9).

Historical Information

Records of fisheries surveys on Hoppaw Creek are scarce. USFWS did not survey the creek either in 1977-'78 or during its sampling period on Lower Klamath tributaries between 1989-'91. CDFG conducted seine hauls in various locations on mainstem Hoppaw Creek on 24 Apr and 25 Apr 1961. Coho salmon were observed well upstream of the confluence with the North Fork, in the vicinity of YTFP 1996 reach #6. No other pertinent fish data has been located.

The mainstem culvert immediately upstream of the North Fork confluence appears to be at least a partial barrier to migrating adult salmon. Its replacement with a permanent bridge (fall 1997) should do much to restore access to historical spawning habitat.

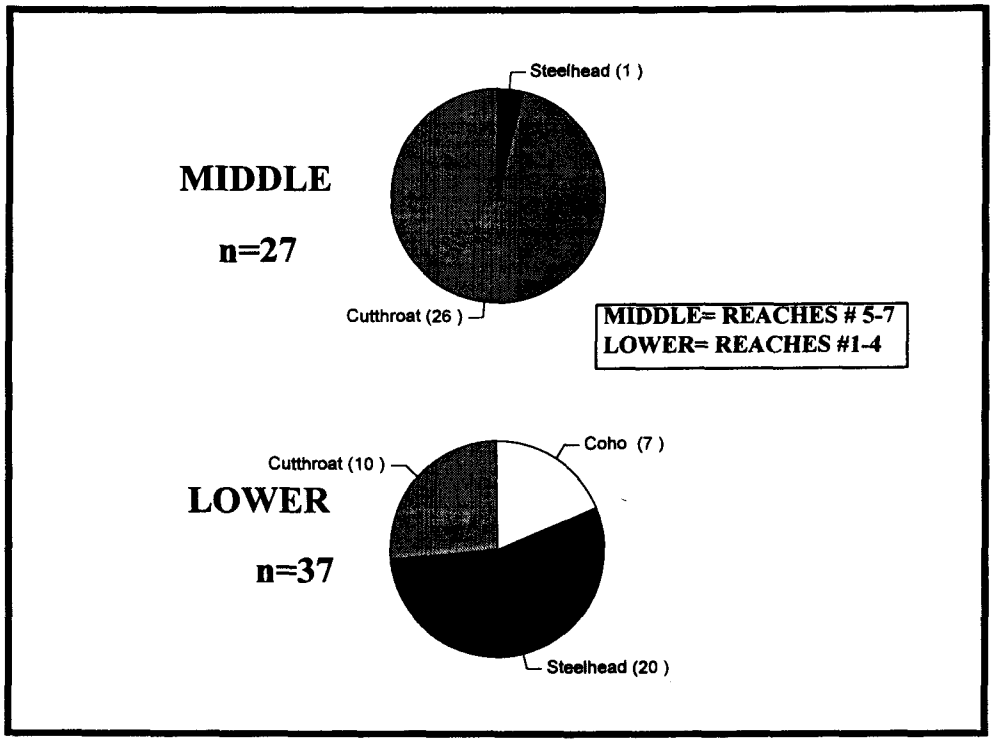

Figure 9. Observed distribution of age 1+ and older juvenile salmonids in Hoppaw Creek, 20 May and 28 May 1996.

Saugep Creek

Synopsis: instream habitat conditions reflect heavy accumulations of fine sediment from upslope sources, and in the lower creek from mainstem Klamath River deposition during high flows. Spawning habitat for salmon and steelhead appeared extremely limited. Salmonids historically documented in Saugep Creek include coho, steelhead and cutthroat. 1996 sampling confirmed the presence of these three species, as well as chinook.

Fish Species Presence

Electrofishing

Chinook, coho, steelhead, coastal cutthroat, trout fry, sculpin, speckled dace, threespine stickleback, Klamath small scale sucker, and ammocoete lamprey were captured on 16 May 1996. (Table 13, Fig. 8, App. B-l).

Table 13. Saugep Creek: juvenile salmonids captured by electrofishing, 16 May 1996.

	#fish	FL range (mm)	% salmonids captured
Reach #1:			
chinook	1	39	20
coho	1	41	20
steelhead	1	124	20
cutthroat	2	115,128	40
Reach #2:			
coho	2	42,70	20
steelhead	2	90,120	20
cutthroat	6	95-125	60
Reach #3:			
cutthroat	1	100	9
trout fry	10	30-50	91
Reach #4:			
steelhead	1	125	7
cutthroat	4	98-175	29
trout fry	9	27-50	64
Reach #5:			
cutthroat	1	106	13
trout fry	7	42-48	87

The chinook and coho fry were found in the lowermost two reaches. Habitat conditions of sampled reaches appeared unsuitable for chinook spawning and only marginally suitable for coho (see App. A). Because of the proximity of the Klamath River estuary, these fish may have originated elsewhere and were utilizing Saugep Creek as a nursery area.

Steelhead trout were infrequently captured, with no more than 2 fish observed in any given reach. Based on forklength and time of year, all steelhead appeared to be age 1+. The steelhead captured in reach #4 was notable in that the reach itself was upstream of several large debris jams that appeared to be severe migrational hindrances.

Cutthroat trout parr/smolt were sampled in each reach, but were not relatively abundant. Undifferentiated trout fry were by far the most numerous salmonids caught in reaches #3, 4 &5. Some of the larger fry strongly resembled cutthroat trout ("snaky" head shape, long maxillaries) although they lacked the diagnostic "slash marks."

Historical Information

Saugep Creek was not investigated by USFWS in either 1977-'78 or during their lower Klamath River tributary studies conducted between 1989-'91. CDFG observed juvenile coho throughout YTFP's 1996 reaches on 24 Apr 1961. CDFG electrofishing surveys conducted on 16 Apr 1968, and 2 May 1969 found juvenile coho, steelhead, and cutthroat in the vicinity of YTFP's 1996 reaches #1 &2. No other survey records have been located.

Although 1996 sampling confirmed the continued presence of historical salmonid species (coho, steelhead, and cutthroat trout), low relative densities of salmonids throughout each 1996 reach indicate that Saugep Creek is not currently supporting large runs of anadromous fish. The predominance of YOY trout versus older age class fish additionally suggests that few fish remain in the system long enough to become "resident trout".

Terwer Creek

Synopsis: no habitat data were collected, because no electrofishing occurred in 1996. Juvenile chinook, coho, and steelhead were captured during 1996 outmigrant trapping. Cutthroat, in addition to these three species, have been previously documented in the drainage.

Fish Species Presence

Outmigrant Trapping: juvenile chinook, coho, steelhead, prickly sculpin, coastrange sculpin, speckled dace, threespine stickleback, Klamath small-scale sucker, and ammocoete form lamprey were captured between 26 Mar and 18 Apr 1996 (Table 7, Fig. 8).

Juvenile chinook dominated the salmonid catch (82%, n=230) during trapping operations. Two age classes of juvenile coho were observed, but only three fish total were captured. The trapping season ended prematurely because of high flow damage to equipment.

Historical Information

Although past records are limited, both in terms of scope and occurrence, surveys since 1977 have consistently documented chinook, coho, steelhead, and cutthroat presence in Terwer Creek (Table 14).

Table 14. Terwer Creek: documented salmonid species presence, 1967-1994.

Species[1]	Date	Location	Survey type	Agency
SH adult, SH	27 Jul 1967	various, lower creek	bankside	CDFG[2]
CK adult	6 Dec 1977	1 mi. upstream from mouth	spawner	USFWS[3]
CK, CO, SH	spring, 1978	various	electrofish	USFWS[3]
SH,CT	1979	trib.: SE 1/4: S17 T14N R2E	electrofish	CDFG[2]
SH.CT	17 Jan 1980	trib.: NE 1/4 of NE 1/4: S20 T14N R2E	electrofish	CDFG[2]
CK, CO, SH,CT	spring, 1989	lower mainstem	outmigrant trap	USFWS[4]
SH adult, CT adult	9 Mar 1994	lower mainstem	spawner	CDFG[2]

[13]SH= steelhead/rainbow; CK= chinook; CO= coho; CT= coastal cutthroat.

[2] California Department of Fish and Game, Klamath River Stream Files, Eureka, CA.

[3]USFWS 1979a. [4] Noble and Lintz 1990.

McGarvey Creek

Synopsis: physical habitat conditions have been degraded from years of intensive logging and associated roads, as well as the construction of the Hwy. 101 Redwood Park bypass. Issues currently detrimental to salmonids include: large scale stream channel aggradation from upslope sediment sources, infiltration of spawning gravel by fine sediment, and the formation of massive log-jams impeding fish passage. Chinook, coho, steelhead and cutthroat were captured in 1996; all had been previously documented in the drainage.

Fish Species Presence

Electrofishing

Lower Zone (reaches #1, & 2): juvenile chinook, coho, steelhead, cutthroat, prickly and coastrange sculpin, speckled dace, Klamath small scale sucker, stickleback, and ammocoete form lamprey were captured on 1 May and 7 May 1996 (Table 15, Fig. 10, App. B-2). Small numbers of chinook and coho fry were present but steelhead and cutthroat parr/smolt dominated the salmonid catch (Fig. 11). Based on scales analysis, at least three age classes of cutthroat trout were present (1+, 2+, & 3+ yrs) (App. C).

Middle Zone (reaches #3-7): juvenile coho, steelhead, cutthroat, and all non-salmonid fishes present in the lower sampling zone were captured on 1 May and 8 May 1996. Two age classes of coho were observed: yearling coho were present in the West Fork (reaches #5 & 6) while YOY coho were seen in the mainstem reaches. Coho, however, were sparsely distributed when compared to steelhead and cutthroat.

Juvenile steelhead were present throughout the middle sampling zone, but a vast majority (16/18 fish) were captured in the mainstem reaches (#4 & 7). Cutthroat parr/smolt dominated the observed salmonid community in all middle reaches. Unlike chinook, coho, and steelhead, cutthroat were captured more frequently as sampling progressed upstream. Analysis of cutthroat scales indicated at least three age classes present (1+, 2+, & 3+ yrs) (App. C); but based on size, a majority of captured fish appeared to be age 1+ and 2+. Undifferentiated trout fry were found in the mainstem reaches, but YOY salmonids were conspicuously absent in the West Fork of McGarvey Creek.

Upper Zone (reaches #8 & 9): cutthroat and undifferentiated trout fry were the only fish captured on 7 May 1996. The largest fish captured (175 mm FL) was aged at 2+yrs from its scales. The vast majority, however, were likely 1+yr old fish that ranged in size from 84 to 120mm FL. Several massive log/debris jams that exist between reaches #7 & 8 are anadromous migrational hindrances (see App. A). Since no steelhead/rainbow parr/smolt were encountered in the upper reaches, the undifferentiated trout fry were likely cutthroat trout. Future sampling efforts in mainstem McGarvey should focus on delineating the "resident/anadromous" demarcation.

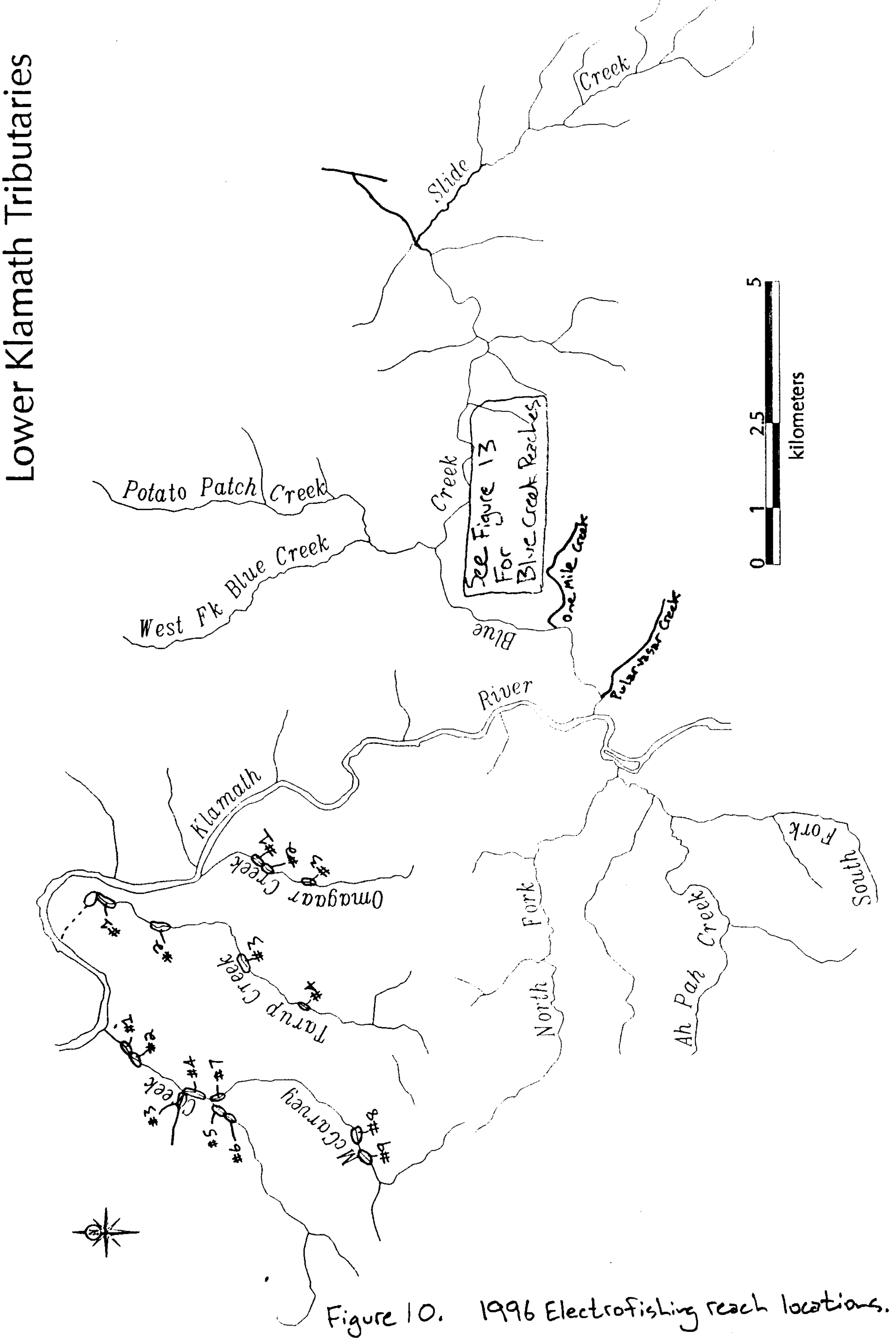

Figure 10. 1996 Electrofishing reach locations.

Table 15. Juvenile salmonids captured by electrofishing, McGarvey Creek, 1 May, 7 May, and 8 May 1996.

	#fish	FL range (mm)	% salmonids captured
Lower Zone			
chinook	3	40-48	11
coho	3	50-56	11
steelhead	8	84-153	30
cutthroat	12	86-251	44
trout fry	1	49	4
Middle Zone			
coho	7	38-115	6
steelhead	18	82-125	16
cutthroat	80	75-236	70
trout fry	9	29-70	8
Upper Zone			
cutthroat	33	84-175	80
trout fry	8	32-50	20

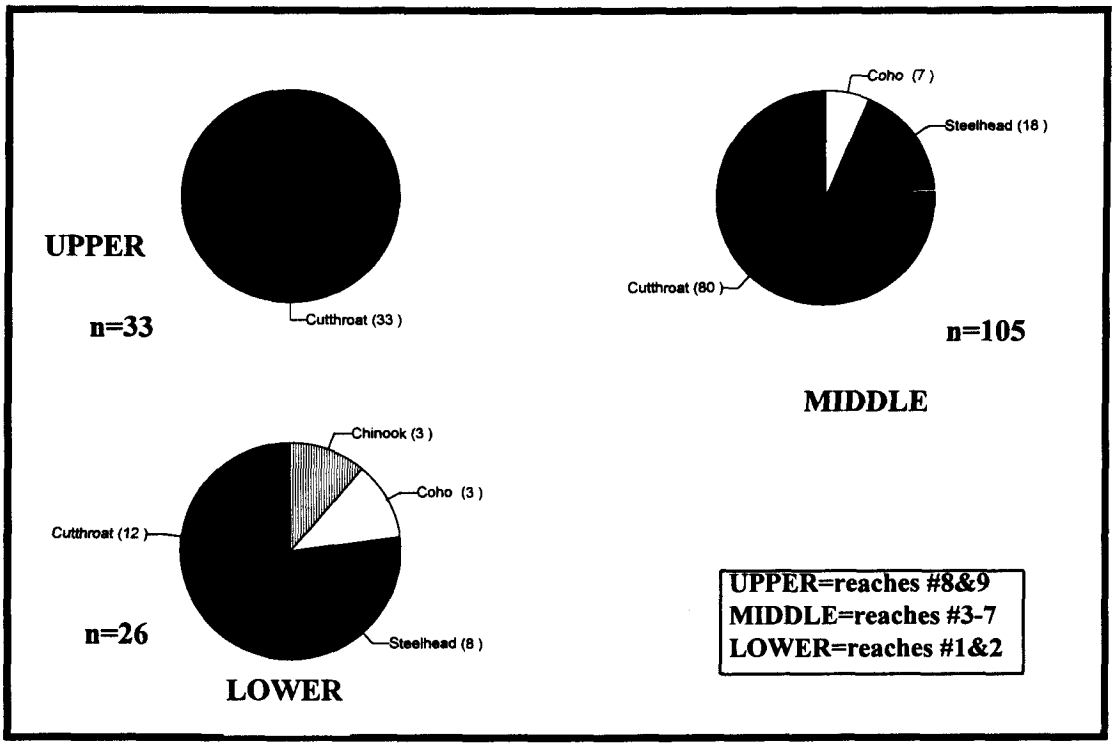

Fig. 11. Observed distribution of age 1+ and older salmonids in McGarvey Creek, 1 May, 7 May, and 8 May 1996.

Historical Information

Fish surveys by CDFG and USFWS have occurred sporadically since 1956 (Table 16). Small numbers of chinook salmon were noted in lower McGarvey Creek during surveys conducted in 1956, 1978, and in a 1984 outmigrant trapping effort. As previously mentioned, surveys for juvenile chinook are biased if not conducted during early to mid-spring months. Current data suggest a continued but sparse presence in the lower basin. While chinook abundance trends are impossible to discern, it seems unlikely that McGarvey Creek has hosted large returns of fall-run fish in recent years.

Juvenile coho have been documented more frequently and have tended to be more widely distributed than chinook. CDFG stocked 20,010 coho fingerlings from the Alsea River, Oregon between the years 1962-1963. Current stocks may be partial descendants of introduced/hatchery fish.

Steelhead/rainbow trout have been regularly documented in middle and lower reaches of McGarvey Creek since 1956. Judging solely from the few available surveys, steelhead are currently distributed (lower and middle basin) similarly to previous accounts.

Table 16. McGarvey Creek: documented salmonid species presence, 1956-1995.

Species'	Date	Location	Survey type	Agency
CK, CO, CT	12 Jul1956	various	unknown	CDFG[2]
CO	1962-1963	unknown-(20,010 fingerlings)	fish planting	CDFG[2]
CK,CO	summer 1972	various	bankside	CDFG[2]
CK, SH, CT	May,1978	lower *Vi* mile mainstem	electrofish	USFWS[3]
CO, SH, CT	Nov., 1978	S-250 bridge (YTFP reaches #5+6)	electrofish	CDFG[2]
CK, CO, SH, CT	spring 1984	unknown	outmigrant trap	CDFG[2]
CO,SH	6 May 1987	lower mainstem (YTFP reach #2)	electrofish	CDFG[2]
CT, trout fry	7 May 1987	approx. 3 mi. upstream from mouth	electrofish	CDFG[2]
CO,SH	16 Aug 1988	1400 ft. up M-10 Road., from M-1000	electrofish	CDFG[2]
SH	9 Aug 1989	1400 ft. up M-10 Road., from M-1000	electrofish	CDFG[2]
CO,SH	6 Aug 1992	1400 ft. up M-10 Road., from M-1000	electrofish	CDFG[2]
CO,SH	16 Jun 1993	M-10 bridge (YTFP reach #4)	electrofish	CDFG[2]
SH	5 Aug 1993	1400 ft. up M-10 Road., from M-1000	electrofish	CDFG[2]
SH	25 Aug 1994	1400 ft. up M-10 Road., from M-1000	electrofish	CDFG[2]
SH	7 Aug 1995	1400 ft. up M-10 Road., from M-1000	electrofish	CDFG[2]

'CK= chinook; C0= coho; CT= coastal cutthroat; SH= steelhead/rainbow.

[2] California Department of Fish and Game, Klamath River Stream Files, Eureka, CA.

[3] USFWS 1979A.

Although cutthroat trout have been widely distributed in McGarvey Creek since the 1950's, recent survey data may indicate that cutthroat relative abundance has increased from historic levels. Cutthroat were the most frequently captured salmonid overall during

from historic levels. Cutthroat were the most frequently captured salmonid overall during 1996 sampling (Table 15), yet previous surveys had never identified cutthroat as "dominant." CDFG's "index-reach" electrofishing surveys (YTFP 1996 reach #7, middle sampling zone) did not positively identify a single cutthroat trout from 1988-1995.

Tarup Creek

Synopsis: ephemeral fish access to and from the Klamath River limits anadromous production: the stream flows into a usually dry Klamath River side channel. Instream conditions varied by reach, but basin-wide logging and road construction have negatively impacted fish habitat. Juvenile chinook, coho, steelhead, and cutthroat were present in 1996 sampling; all four species have been reported in previous surveys.

Fish Species Presence

Electrofishing

Lower Zone (reaches #1 & 2): juvenile chinook, coho, steelhead, cutthroat, prickly and coastrange sculpin, speckled dace, threespine stickleback, Klamath small scale sucker, ammocoete form and adult lamprey were captured on 30 and 31 May 1996 (Table 17, Fig. 10, App. B-2). All salmon fry and 6 of 8 steelhead parr/smolt were captured in close proximity to the Klamath River side-channel pond at Tarup Creek's mouth (see App. A). Fish diversity in lower Tarup Creek may be attributable in part to fish emigrating out of the Klamath at higher flows (Fig. 12).

Cutthroat trout parr/smolt were captured throughout the lower reaches, and became more abundant as sampling moved upstream. Small numbers of YOY trout were present, but were not found to be numerous in either reach. Also of note, two adult lamprey spawners were observed in a muddy bottomed pool in reach #1.

Upper Zone (reaches #3 &4): juvenile cutthroat trout and trout fry were captured on 31 May 1996. Sampling revealed these reaches to have higher relative fish densities than

Table 17. Tarup Creek: juvenile salmonids captured by electrofishing, 30 May, and 31 May 1996.

	#fish	FL range *(mm)*	% salmonids captured
Lower Zone:			
chinook	1	82	3
coho	6	51-71	16
steelhead	8	80-148	21
cutthroat	16	102-142	42
trout fry	7	40-60	18
Upper Zone:			
cutthroat	33	59-154	66
trout fry	17	43-61	34

what was observed lower in the drainage- many more fish were captured over a shorter distance, and in less time (App B-2). Since cutthroat trout were the only fish observed, the numerous trout fry seen were probably also cutthroat.

Scale samples from six cutthroat trout all exhibited "stream-type" growth patterns, indicative of residency. A noticeable size overlap existed between 1+ and *1+* fish in this small sample (App. C). Judging from forklength data alone, no fish older than 2+ were captured in either zone.

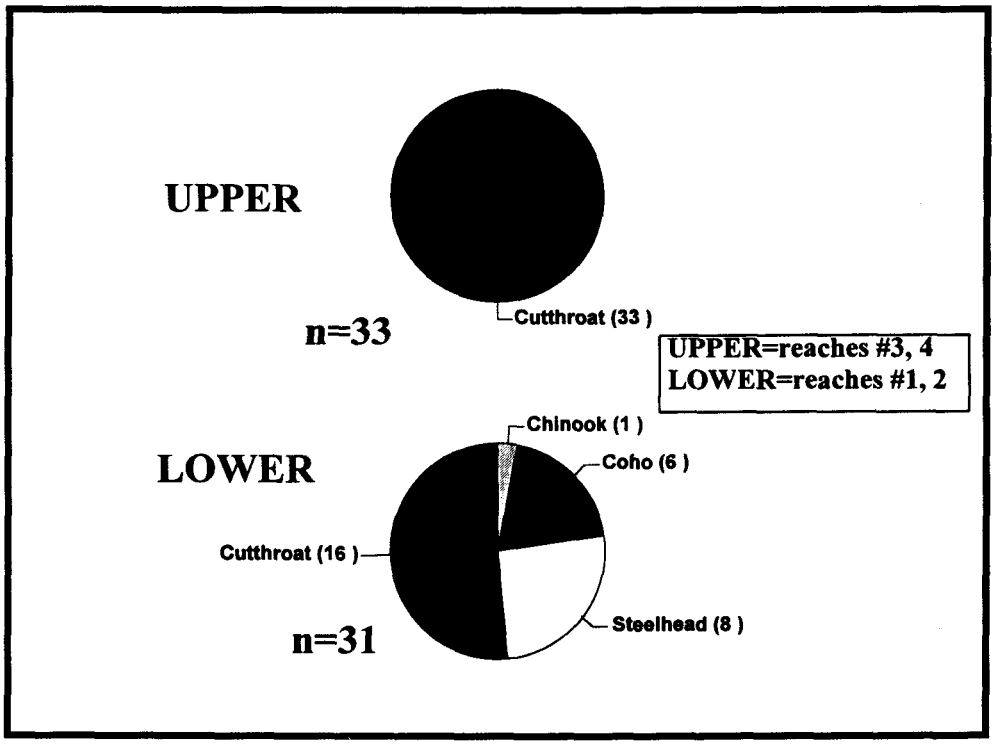

Figure 12. Observed distribution of age 1+ and older salmonids in Tarup Creek, 30 May, and 31 May 1996.

Historical Information

Available records indicate that chinook, coho, steelhead, and cutthroat have been present in Tarup Creek since 1970 (Table 18). Tarup Creek has not likely hosted sizable runs of fall chinook for many years- of the four anadromous salmonid species, chinook have been observed the least often.. Prior to 1996, chinook had not been seen in the drainage for over a decade. A CDFG spawning survey found two chinook adult carcasses in January 1984, and subsequent outmigrant trapping conducted in spring, 1984 identified chinook fry. Outmigrant trapping conducted in 1987,1989, and 1991 failed to catch any chinook.

Coho have been documented more frequently in the drainage than chinook but with wide time gaps between sightings. Juveniles were found in 1970, but were not observed again until the late 1980's. CDFG planted over 40, 000 coho fingerlings between 1969-1971;
the 1970 electrofishing likely located some of these planted fish (Table 19). Although coho were consistently found between 1987-1991, their presence was not confirmed again until 1996. Coho and chinook salmon may have been hit hard by the long drought period of the late 1980's-early 1990's. Tarup Creek is one of the last lower Klamath tributaries to regain spawner access after fall rains and in drought years this access may be so short-lived as to severely hinder returning adults (Fig. 3).

Table 18. Tarup Creek: documented salmonid species presence, 1970-1995.

Species'	Date	Location	Survey type	Agency
CO, SH,CT	6 Jul1970	approx. 1 mi. upstream of mouth	electrofish	CDFG[2]
CT	5 Aug 1975	#S-320 Road crossing	electrofish	CDFG[2]
CK, SH,CT	spring 1978	mouth upstream for 1.25 mi.	electrofish	USFWS[3]
CK adult carcass	9 Jan 1984	mouth upstream for 2.5 mi.	spawner	CDFG[2]
CK, SH,CT	Feb-May, 1984	approx. 1 mi. upstream of mouth	outmigrant trap	CDFG[2]
CO. SH.CT	Apr1987	approx. 1 mi. upstream of mouth	outmigrant trap	CDFG[2]
CK, CO, SH, BkT	28 Jun, 2 Jul 1987	pond in Klamath R. side channel	seine	CDFG[2]
CO, SH.CT	2 May 1988	approx. 1 mi. upstream of mouth	electrofish	CDFG[2]
CO, SH,CT	spring 1989	approx. 1 1/4 mi. upstream of mouth	outmigrant trap	USFWS[4]
CO, SH.CT	spring 1991	approx. 1 1/4 mi. upstream of mouth	outmigrant trap	USFWS[5]
CT, trout fry	29 Jun 1994	index reach in lower 1 mi.	electrofish	CDFG[2]
CT, trout fry	4 Aug 1995	index reach in lower 1 mi.	electrofish	CDFG[2]

' C0= coho; SH= steelhead/rainbow; CT= coastal cutthroat; CK= chinook; BkT= brook trout.
[2] California Department of Fish and Game, Klamath River Stream Files, Eureka, CA.
[3]USFWS 1979a.
[4]Noble and Lintz 1990.
[5]Lintz and Kisanuki 1992.

Table 19. Stocking efforts in Tarup Creek, 1969-1990'

Date	**Program**	**Species**	**# fish planted**
3 Mar 1969	CDFG	Coho	20,004
31 Mar 1970	CDFG	Coho	10,008
15 Apr 1971	CDFG	Coho	10,350
27 Sept 1990	CDFG/BIA[2]	Coho	750

[1]California Department of Fish and Game, Klamath River Stream Files, Eureka, CA.
[2] CDFG/BIA= Bureau of Indian Affairs with CDFG; coho broodstock taken from Hunter Creek and/or Klamath River at the mouth of Blue Creek.

Steelhead and cutthroat have been consistently observed in Tamp Creek since 1970. While steelhead presence has been mainly documented in lower Tamp, cutthroat have been widely distributed for at least the last 30 years. Cutthroat have regularly dominated the observed fish communities in upper drainage reaches. Survey and trapping efforts since 1991 have identified cutthroat to be prevalent in lower reaches as well.

Omagaar Creek

Synopsis: physical habitat throughout the drainage has been heavily degraded from logging and roads construction. Instream conditions are characterized by an overall lack of habitat diversity, depauperate cover (e.g., sparse accumulations of woody debris), and loose aggradation of the stream channel. Juvenile coho, steelhead, and cutthroat were documented in 1996; previous surveys had observed chinook, steelhead, and cutthroat.

Fish Species Presence

Electrofishing

Lower Zone (reaches #1 &2): juvenile coho, steelhead, cutthroat, speckled dace, and sculpin were captured on 11 July 1996 (Table 20, Fig 10, App. B-2). All coho fry were captured at the upstream extent of the lower sampling zone in the only significant pool habitat encountered. Steelhead were also very sparsely distributed, with only two 1+ age fish enumerated.

YOY cutthroat trout completely dominated the lower Omagaar salmonid sample. Scale sample analysis identified 1+ and 2+ aged fish in addition to the many 0+ present (App. C). 35 of the 44 identified cutthroat, however, were less than 100mm FL. Salmonid rearing habitat was extremely limited in amount and quality (App. A) and likely restricts the number of fish which survive past their first year.

Table 20. Omagaar Creek: juvenile salmonids captured by electrofishing, 11 Jul 1996.

	#fish	FL range (mm)	% salmonids captured
Lower Zone:			
coho	4	72-80	7
steelhead	2	105,110	4
cutthroat	44	55-153	83
trout fry	3	48-50	6
Middle Zone:			
steelhead	3	102-137	11
cutthroat	18	60-137	67
trout fry	6	48-58	22

Middle Zone (reach #3): juvenile steelhead, cutthroat, and undifferentiated trout fry were captured on 11 Jul 1996. Several steelhead parr were found, but cutthroat dominated the sample. YOY and 1+ sized cutthroat (based on FL's) were captured in

equivalent numbers; but with undifferentiated trout fry included, fish less than 100 mm FL were most abundant (16 of 27 fish).

Historical Information

Available fish species data are limited to the years 1978-1980. These data are more comparable to current/future survey efforts than most historical records because of similar reach locations and methods (one-pass electrofishing).

Omagaar Creek may have previously hosted fall-run chinook since fry were found two successive years (spring 1978 and 1979) (Table 21). 1996 electrofishing, however, was likely conducted too late in the year (July) to detect juvenile chinook presence. Currently, Omagaar is unlikely to support numerous adult spawners based on poor habitat conditions and very limited access to and from the Klamath River (see App. A).

The concept of "non-natal rearing" is an alternative hypothesis that could explain juvenile chinook presence in Omagaar Creek. This phenomenon refers to pre-smolt salmonids that leave their natal streams to rear in new drainages (Murray and Rosenau 1989). A USFWS biologist alluded to this possibility when discussing the 3 May 1979 surveys: "the two lower fish were large... .[and] had possibly entered the creek from the main Klamath" (USFWS 1979c)

Steelhead and cutthroat trout relative abundance in 1979 electrofishing surveys differed from 1996 results. In May 1979, steelhead comprised 75% of salmonids captured in the lower reach (n= 12), and 90% of those captured in the middle reach (n=20); cutthroat comprised 8%, and 10% respectively (USFWS 1979c). Our surveys in July, 1996 found cutthroat more abundant than steelhead in both lower and middle reaches (83% and 67%, respectively) (Table 20). Although these results may be attributable in part to our July sampling date (i.e., most steelhead smolts tend to emigrate in the spring (Bamhart 1986)), the large increase of cutthroat abundance appears to signify that community-level changes have occurred in the past twenty years.

Past surveys addressing fish passage through the old S-10 culvert are also of note. These data show that steelhead/rainbow were present upstream of the road crossing. Electrofishing conducted in winter and spring 1980 documented steelhead/rainbow trout and cutthroat on reaches upstream and downstream of the culvert. Prior to the replacement of the culvert by a permanent bridge in 1996, fish passage had been nonexistent for an undetermined time period. The upstream end of the culvert was 99% plugged by debris and sediment, and the downstream end was so bent and broken that water was "flowing" upwards through cracks in the metal rather than out the end. Although 1996 YTFP surveys did not include upper reaches of Omagaar, 1997-98 sampling will assess fish presence both above and below the new bridge.

Table 21. Omagaar Creek: documented salmonid species presence, 1978-1980.

Species'	Date	Location	Survey type	Agency
CK,SH	28Aprl978	various	electrofish	USFWS[2]
SH,CT	10Nov,27Novl978	upstream of S-10 culvert	electrofish	CDFG[3]
SH,CT	6Aprl979	1.5 mi. upstream from mouth	electrofish	USFWS[4]
SH	6Aprl979	1 mi. upstream from mouth	electrofish	USFWS[4]
SH,CT	6 Apr 1979	1/3 mi. upstream from mouth	electrofish	USFWS[4]
SH,CT	3 May 1979	1.5 mi. upstream from mouth	electrofish	USFWS[5]
CK, SH, CT	3 May 1979	1 mi. upstream from mouth	electrofish	USFWS[5]
CK, SH,CT	3 May 1979	1/3 mi. upstream from mouth	electrofish	USFWS[5]
SH,CT	31 Jan 1980	upstream of S-10 culvert	electrofish	CDFG[3]
SH,CT	31 Jan 1980	downstream of S-10 culvert	electrofish	CDFG[3]
SH,CT	7 Apr1980	upstream of S-10 culvert	electrofish	CDFG[3]
SH,CT	7 Apr1980	downstream of S-10 culvert	electrofish	CDFG[3]

[1]CK= chinook; SH= steelhead/rainbow; CT= coastal cutthroat.
[2]USFWS 1979a.
[3]California Department of Fish and Game, Klamath River Stream Files, Eureka, CA.
[4]USFWS internal memorandum, 1979b.
[5]USFWS internal memorandum, 1979c.

Blue Creek

Synopsis: the Blue Creek watershed possesses the highest quality salmonid habitat of any lower Klamath River tributary. Historically, as well as currently Blue Creek has hosted the largest spawning runs of salmon and steelhead in the lower Klamath.

Mainstem Blue Creek and Crescent City Fork

Fish Species Presence

Outmigrant trapping: juvenile chinook, coho, steelhead, cutthroat, speckled dace, prickly and coastrange sculpin, threespine stickleback, lamprey, and Klamath small scale sucker were captured betweenl9 Mar and 27 Sept 1996 (Table 22). In addition, an adult steelhead and several cutthroat adults were trapped. Chinook fry dominated the salmonid catch throughout the trapping season (73%, n=7,486 fish).

Snorkel surveys: YTFP conducted summer snorkel surveys on mainstem Blue Creek (reaches #1-5) in June and July 1996, and on the Crescent City Fork (reach #6) in July 1996 (Fig. 13, App. B-3). Juvenile chinook, coho, and steelhead were present each month in each reach sampled. Juvenile salmonids were distributed from Blue Creek's confluence with the Klamath River upstream to the anadromous barrier at rm 14.55, and upstream in the Crescent City Fork at least to rm 5.5.

Week Ending	# Days Sampled	Chinook	Steelhead		Coho		Cutthroat
			YOY	Parr/Smolt	YOY	Yearling	
3/23/96	5	228	0	22	0	0	0
3/30/96	6	210	0	27	0	0	0
4/6/96	7	147	0	30	4	1	0
4/13/96	6	134	0	41	5	1	0
4/20/96	7	207	0	45	2	0	1
4/27/96	3	147	0	12	0	0	0
5/4/96	6	213	8	41	2	0	0
5/11/96	6	281	15	57	1	0	0
5/18/96	6	235	34	64	0	0	0
5/25/96	6	178	95	6	1	0	0
6/1/96	7	385	61	18	1	0	0
6/8/96	7	220	90	14	0	1	0
6/15/96	7	387	137	20	0	0	0
6/22/96	7	294	131	21	16	0	0
6/29/96	7	252	92	12	3	0	0
7/6/96	7	180	12	6	5	0	0
7/13/96	7	298	96	17	6	0	1
7/20/96	7	335	136	36	6	0	2
7/27/96	7	263	49	14	5	0	0
8/3/96	7	294	27	8	1	0	1
8/10/96	7	373	73	29	6	0	0
8/17/96	7	58	102	11	1	0	1
8/24/96	7	24	102	9	0	0	0
8/31/96	5	10	17	6	0	0	0
9/6/96	4	90	29	9	3	0	1
9/13/96	7	20	48	11	2	0	0
9/20/96	0		- Trap Not Fished During This Week -				
9/27/96	3	0	2	1	0	0	0
Total:	168	5,463	1,356	587	70	3	7

Table 22. Total number of juvenile salmonids captured by week in the rotary screw trap, Blue Creek, Lower Klamath River, California, 1996.

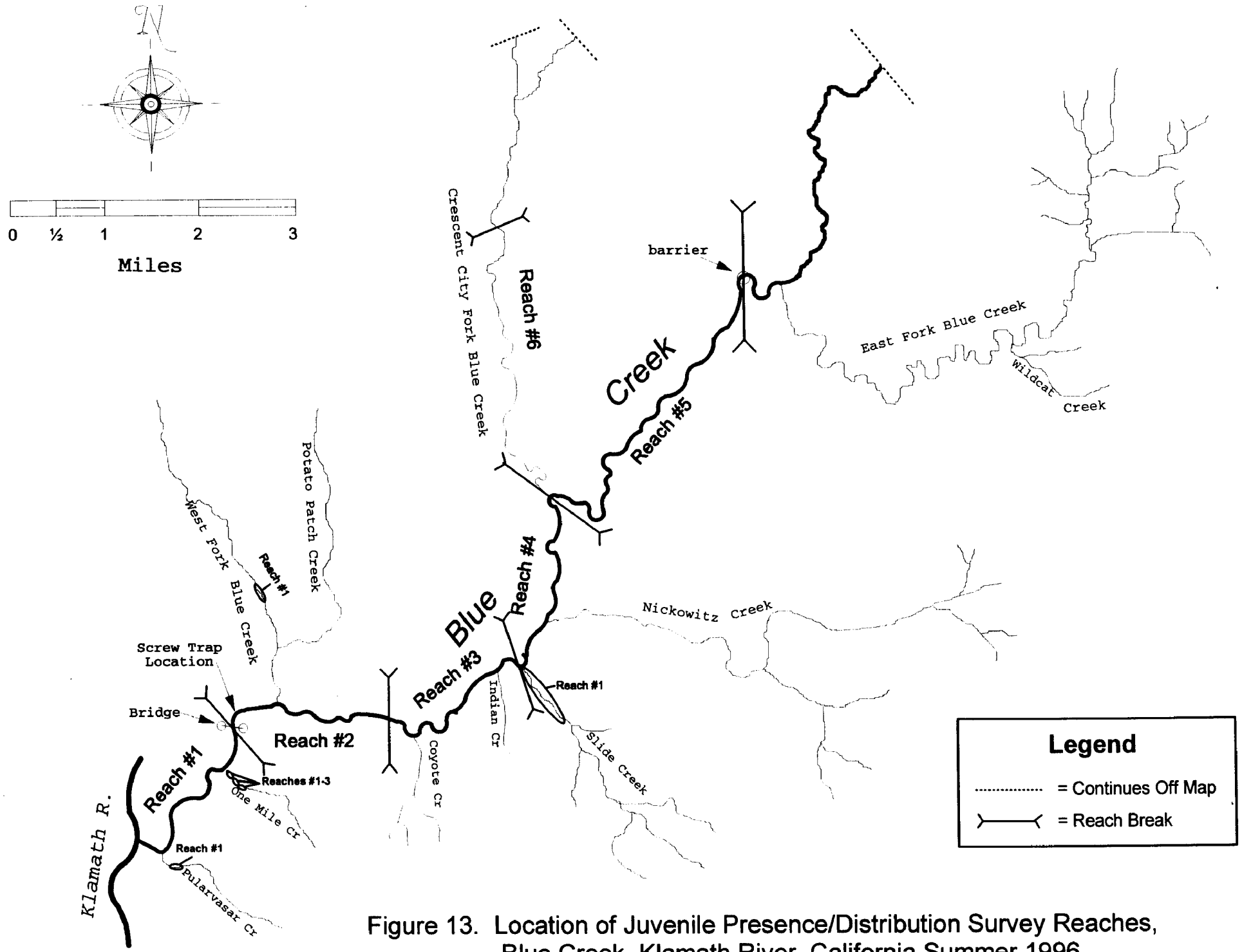

Figure 13. Location of Juvenile Presence/Distribution Survey Reaches, Blue Creek, Klamath River, California Summer 1996.

Crescent City Fork Blue Creek (reach #6) was especially notable for relatively high densities of coho fry. During the July 1996 surveys, juvenile coho were very abundant from approximately rm 3.5 downstream to rm 1.5 (snorkel surveys conducted during November 1996 documented similar densities of juvenile coho from the forks (rm 5.5) downstream to rm 3.5). Some pool units held 50-100 coho, and almost each habitat unit held at least a few individuals. From rm 1.75 downstream to the confluence with mainstem Blue Creek, coho fry were less commonly seen.

During the June 1996 dives, small numbers of adult summer steelhead (22 to 30"), and larger numbers of adult cutthroat trout (ranging in size from 12" to 20") were observed holding in each lower mainstem reach (upstream to rm 10.3).

YTFP expanded the dives to include the upper portions of the watershed in July. Adult cutthroat and resident rainbow trout (10" to 16") were observed in the upper mainstem reach. Adult cutthroat and an adult chinook salmon (26 to 28") were found in the Crescent City Fork. An adult chum salmon was observed in the lower mainstem at approximate rm 3.0. Otherwise, observations in reaches #1-4 were similar to those made in June: small numbers of adult steelhead and cutthroat were found in each reach.

Historical Information

Blue Creek is the most studied Lower Klamath River tributary. Both CDFG and USFWS have investigated fish species presence/distribution in the Blue Creek System since the 1960's. Because of the relative plethora of available records, the Blue Creek historical fish presence review is ongoing, will be included in the 1997 report.

Pularvasar Creek

Fish Species Presence

Electrofishing: Juvenile coho, trout fry, sculpin, and speckled dace were captured on 21 Jun 1996 (Fig 13, App. B-3). Four coho fry were captured in shallow step run habitat, very near the downstream extent of wetted channel. An undifferentiated trout fry was the only other salmonid captured. In addition, one parr/smolt sized trout jumped from the net during sampling.

Historical Information

A USFWS electrofish survey on 12 Jun 1990 found four steelhead fry in lower Pularvasar Creek. No other documented efforts have been located.

"One Mile Creek"

Fish Species Presence

Electrofishing

Lower Zone (reaches #1,2, & 3): juvenile chinook, coho, steelhead, cutthroat, trout fry, sculpin, and speckled dace were captured in "One Mile Creek" (unnamed tributary) on 21 Jun and 3 Jul 1996 (Table 23, Fig. 13, App. B-3). As of 21 Jun 1996, One Mile Creek was flowing into a Blue Creek side channel pond, but did not have an active confluence with Blue Creek (see App. A). Because salmon were found isolated from the main creek, these reaches were revisited to conduct "fish rescue."

Table 23. One Mile Creek: juvenile salmonids captured by electrofishing, 21 Jun, and 3 Jul1996.

21 Jun 1996	#fish	FL range *(mm)*	%salmonids captured
Reach #1:			
chinook	1	64	5
coho	1	73	5
trout fry	17	38-58	90
Reach #2:			
chinook	7	62-89	19
coho	1	93	3
trout fry	28	40-70	78
3 Jul 1996			
Reach #1: DRY			
Reach #2:			
chinook	2	65,75	2
steelhead	1	110	1
trout fry	114	46-68	97
Reach #3:			
coho	14	62-94	12
steelhead	14	102-166	12
cutthroat	1	150	1
trout fry	92	30-68	75

All chinook captured on 21 Jun and 3 Jul were below the PC-10 road crossing, close to the downstream extent of wetted channel. The small size of this stream (1st order), the lack of adequate spawning habitat, and restricted access much of the year would likely limit chinook spawning success. Although non-natal rearing has not been widely documented for progeny of fall chinook, the fry may have entered One Mile Creek from mainstem Blue Creek earlier in the spring. Previous investigators suggested chinook fry may enter non-natal streams to escape excessive mainstem turbidities (Murray and Rosenau 1989; Scrivener et al. 1994). Since water clarity is usually very good in Blue Creek (quickly clears after storms), other factors would likely influence hypothetical immigration into One Mile Creek.

Coho were found near the end of the wetted channel on 21 Jun, but by 3 Jul 1996, had moved upstream and all fish were captured in the first significant pool (reach #3). Like chinook, the presence of juvenile coho in One Mile is somewhat enigmatic. Although coho adults can utilize smaller drainages and substrate than chinook, the same factors of restricted access and poor overall habitat conditions would appear to make One Mile unsuitable for spawning (Bjomn and Reiser 1991). Unlike chinook, however, juvenile coho often have been frequently found to use non-natal habitats (Hartman and Brown 1987; Irvine and Johnston 1992; Sandercock 1991).

Undifferentiated trout fry dominated the salmonid catch during each sampling effort. Age 1+ steelhead were only sampled on 3 Jul 1996 (6% of total salmonid catch, n=238 fish). The majority of these fish were found in the first significant pool habitat upstream of the PC-10 road crossing (same location where coho were concentrated). A single cutthroat parr/smolt was captured above a low-water migration barrier in reach #3. The relative abundance of trout fry (87% of salmonid catch on 3 Jul, n=238) likely means steelhead and/or cutthroat actually spawned in the system (vs. immigration from mainstem).

Historical Information

No records have been located to date.

West Fork Blue Creek

Fish Species Presence

Electrofishing: steelhead parr/smolt and trout fry were the only fish captured on 15 Jul 1996 (Table 24, Fig. 13, App. B-3). Steelhead, present in at least three age classes (0+, 1+, and 2+), were abundant throughout the surveyed reach.

Table 24. West Fork Blue Creek: juvenile salmonids captured by electrofishing, 15 Jul 1996.

	#fish	FL range (mm)	% salmonids captured
Reach #1:			
steelhead	15	92-170	56
trout fry	12	33-72	44

Historical Information

Historical fish presence data are sparse. CDFG electrofishing surveys found juvenile coho and steelhead in the lower West Fork on 27 and 28 Jul 1988. USFWS snorkelers saw only juvenile trout in the lower West Fork on 15 May 1990. USFWS spawner surveys identified adult fall chinook in the lower West Fork on 1 Dec, and 23 Dec 1993.

YTFP spawner surveys observed adult fall chinook in the lower West Fork on 20 Nov, and 29 Nov 1995.

1996 YTFP electrofishing was inadequate to assess present fish utilization because sampling was limited to one "upper" reach and was conducted late in the season. Additional data are needed to properly discern past and present anadromous utilization.

Slide Creek

Fish Species Presence

Snorkel Survey: juvenile steelhead/rainbow were observed in lower Slide Creek on 17 Jun 1996 (Fig. 13, App.B-3). Juvenile trout in at least three age classes (0+, 1+, 2+) were abundant from the mouth upstream for *V** mile. Parr/smolt sized trout, abundant in every habitat unit surveyed, outnumbered YOY approximately 3:1 overall.

Historical Information

Previous surveys have addressed physical habitat conditions, but relevant fish data were lacking.

Nickowitz Creek

Fish Species Presence

Snorkel Survey: chinook and steelhead/rainbow trout were observed in lower Nickowitz on 25 Jun 1996 (Fig. 13, App. B-3). A single chinook fry was observed in a backwater pool 500 ft. upstream of the confluence with Blue Creek. At least three age classes of juvenile steelhead/rainbow were abundant throughout the reach. YOY trout were most numerous, with upwards of 100 individuals in certain pool and backwater units. Parr/smolt sized steelhead were also common, but at much lower densities than the fry (5-20 fish per habitat unit).

Historical Information

Past efforts have primarily documented physical habitat conditions, much like the available Slide Creek surveys. Juvenile steelhead/rainbow were sampled by hook and line or noted as "present" by CDFG on 13 Jun 1962; by the U.S. Forest Service (USFS) on 29 Jul 1968; and by CDFG on 17 Sep 1975.

Bear Creek

Synopsis: poor habitat conditions in lower reaches are inextricably tied to large-scale chronic stream channel aggradization. Salmonid rearing habitat was more abundant and

of better quality in middle basin reaches, but relative densities of fish per habitat unit were "low" throughout the creek. Juvenile coho, steelhead, and cutthroat were captured in 1996; previous efforts had documented juvenile chinook in addition to these species.

Fish Species Presence

Electrofishing

Lower Zone (reaches #1 & 2): juvenile coho, steelhead, cutthroat, sculpin, and speckled dace were captured on 10 May and 18 Jun 1996 (Table 25, Fig. 14, App. B-4). The May effort was hindered by high flows, which reduced "netting success" of stunned fish. As a result, reaches #1 & 2 were revisited in June when stream discharge had decreased substantially.

One coho fry was sampled close to the downstream extent of wetted channel on 18 Jun. This fish was present in reach #1 's only significant pool: a large scour pool formed from an old growth redwood stump in the active channel.

Juvenile steelhead dominated the catch, comprising close to 80% of captured salmonids (n=29) during both sampling efforts. At least two age classes (1+ and 2+) were present, but 1+ appeared most abundant: 13 of 23 steelhead were between 106 and 120 mm FL.

Cutthroat were infrequently captured in lower Bear Creek (13% of salmonid catch overall). Judging from the cutthroat size distribution, 1+ and 2+ aged fish were present. YOY trout abundance in lower Bear Creek appeared minimal, with just one undifferentiated fry captured during both efforts.

Table 25. Bear Creek: juvenile salmonids captured by electrofishing, 10 May, 13 May, and 18 Jun 1996.

	#fish	FL range (mm)	% salmonids captured
Lower Zone:			
coho	1	71	4
steelhead	23	106-213	79
cutthroat	4	112-224	13
trout fry	1	46	4
Middle Zone:			
steelhead	6	83-115	30
cutthroat	13	101-190	65
trout fry	1	50	5

Middle Zone (reaches #3,**4,** & 5): juvenile steelhead and cutthroat were captured on 13 May and 18 Jun. No fish of any kind were observed in reach #5. Instream flows were not found to limit "netting success" in this part of the watershed during May; thus reach #3 was not revisited.

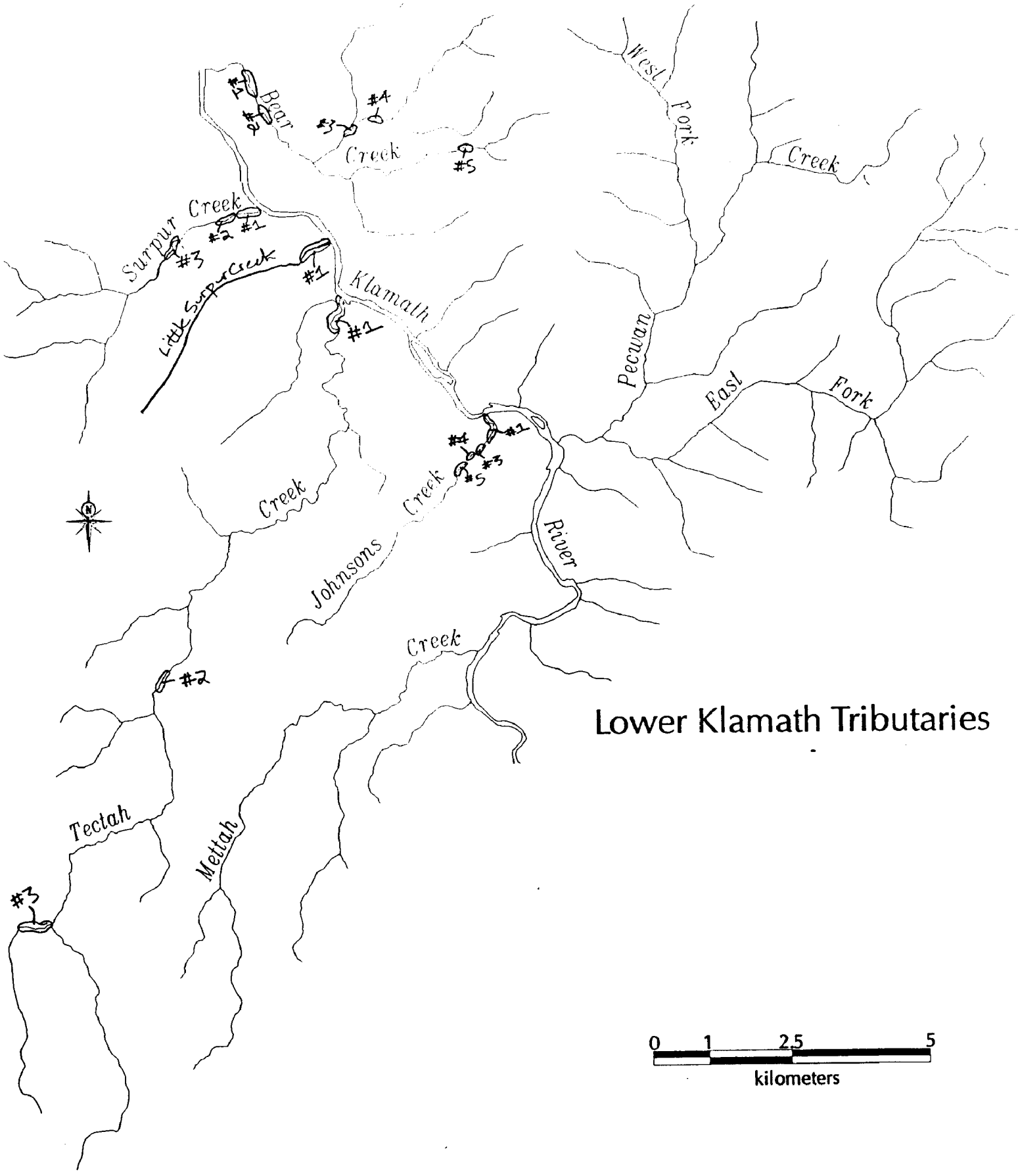

Figure 14. 1996 Electrofishing reach locations.

Steelhead were relatively scarce in middle Bear Creek, comprising 30% of captured salmonids (n=20) (Table 25). Based on size, no steelhead older than age 1+ were observed: all fish were less than 115 mm FL.

Juvenile cutthroat dominated the salmonid catch in both reaches #3 & 4. Seven cutthroat scale samples were analyzed from these reaches and two age classes were discerned: 1+ and 2+ (App. C). The largest cutthroat's (190 mm FL) scale sample exhibited evidence of potential migratory behavior: a "uniform annual growth" pattern with noticeably wide spacing between circuli. All other fish demonstrated "stream-type" growth patterns likely indicative of a resident life history pattern.

Historical Information

Previous efforts have been sporadic in occurrence, and generally have been concentrated in lower Bear Creek (Table 26). Juvenile steelhead/rainbow have been consistently documented in lower reaches; "half-pounder" form steelhead were enumerated in a 1978 USFWS electrofishing survey. Presence of juvenile chinook, coho, and cutthroat had been verified most recently by a 1990 USFWS outmigrant trapping effort.

Bear Creek's 1996 electrofishing "catch per unit effort" was low relative to other lower Klamath tributaries, even when sampled at moderate flows in June (Table 25, App. B-4). A USFWS biologist made a similar observation regarding electrofishing conducted 25 Jun 1984: "The failure to capture more fish appeared to be linked to... the general lack of juveniles inhabiting the stream. During the course of the survey, very few fish were observed..." (USFWS 1984). Unfortunately, no quantitative data exist to test these assertions. Future efforts could compare salmonid population estimates and amount of available habitat in Bear Creek with other tributaries to better understand fish abundance patterns.

Table 26. Bear Creek: documented salmonid species presence, 1973-1990.

Species[1]	Date	Location	Survey type	Agency
SH	Jun-Aug,1973	various in lower creek	electrofish	CDFG[2]
SH1/2, SH, CT	29 Mar, 5 May 1978	various	electrofish	USFWS[3]
CK	24 May 1984	lowermost 500 ft.	electrofish	CDFG[2]
SH	25 Jun 1984	lower 2 mi. of creek	electrofish	USFWS[4]
CK, CO, SH. trout fry	19 Apr-30 May 1989	lower creek	outmigrant trap	USFWS[5]
CK, CO, SH, CT	3 Apr-21 Jun 1990	lower creek	outmigrant trap	USFWS[6]

[1]SH= steelhead/rainbow; SH1/2= half-pounder steelhead; CT= coastal cutthroat; CK== chinook; C0= coho.

[2] California Department of Fish and Game, Klamath River Stream Files, Eureka, CA

[3]USFWS1979a.

[4] USFWS internal memo, 1 Aug 1984.

[5] Noble and Lintz 1990.

[6] Lintz and Noble 1992.

Surpur Creek

Synopsis: physical habitat conditions were characterized by an overall lack of diversity: scant available cover, infrequent pools, and massive stream channel aggradization. Juvenile steelhead and cutthroat were captured in 1996; a previous investigation had additionally identified chinook.

Fish Species Presence

Electrofishing

Lower Zone (reaches #1 & 2): juvenile steelhead, cutthroat, sculpin, and speckled dace were captured on 9 May 1996 (Table 27, Fig. 14, App. B-4). Steelhead and cutthroat were captured in relatively equal numbers (Fig. 15). Steelhead became progressively scarce as sampling moved upstream: 10 fish were netted in reach #1 vs. 3 fish in reach #2. Cutthroat, however, became progressively more abundant upstream: 4 fish in reach #1 vs. 11 fish in reach #2. Based on the size distribution of captured fish, the majority of steelhead and cutthroat were age 1+ (21 of 28 juvenile trout measured between 85 and 130 mm FL).

Table 27. Surpur Creek: juvenile salmonids captured by electrofishing, 2 May, 9 May 1996.

	#fish	FL range (mm)	% salmonids captured
Lower Zone:			
steelhead	13	97-180	45
cutthroat	15	85-150	52
trout fry	1	40	3
Upper Zone:			
cutthroat	28	76-157	80
cutt/stlhd	1	155	3
trout fry	6	34-49	17

Upper Zone (reach #3): cutthroat, a potential steelhead/cutthroat hybrid, and trout fry were captured on 2 May 1996. Possible migration barriers in the form of debris/log jams exist between reach #2 and reach #3 (YTFP 1996 habitat typing). Cutthroat clearly dominated the upper Surpur Creek fish community; besides the possible hybrid, all fish captured were cutthroat or "cutthroat-like" fry. This reach was re-visited on 2 Jul and results confirmed the initial findings: 21 cutthroat and 1 possible hybrid were captured. The 2 May data were used in the table and figure because of a larger sample size.

The possible hybrid possessed physical characteristics intermediate of steelhead/cutthroat. This fish had no "slash marks," "steelhead-like" coloring and spotting, yet had a large mouth and a long maxillary which extended past the eye.

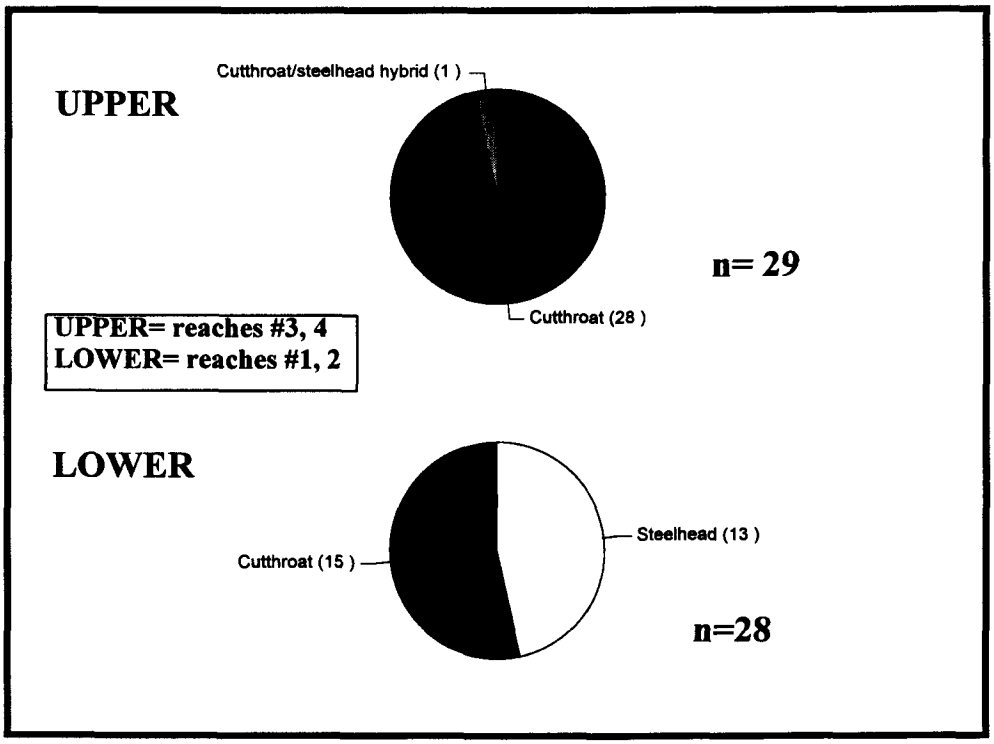

Figure 15. Observed distribution of age 1+ and older salmonids in Surpur Creek, 2 May and 9 May 1996.

The 2 Jul effort also identified a possible hybrid; based on size and physical characteristics, this was likely the same individual captured 2 May. Field identification of cutthroat/steelhead hybrids has been shown to be tenuous at best; thus genetic analysis is required to positively identify hybrids (Hawkins 1997)

Historical Information

The few available records reflect infrequent surveys (Table 28.). Although CDFG planted over 10,000 coho fmgerlings in 1969, juvenile coho have not been observed in Surpur Creek since. Small numbers of juvenile chinook were observed inl978, and most recently during 1991. Steelhead/rainbow juveniles have been consistently found in lower creek surveys, and cutthroat have been documented in upper reaches since at least 1970. YTFP's 1996 findings of numerous cutthroat in lower reaches appears to indicate that they have expanded their distribution in recent years.

Table 28. Surpur Creek: documented salmonid species presence, 1969-1991.

Species[1]	Date	Location	Survey type	Agency
CO	4 Mar 1969	1.5 mi. upstream	fish stocking (n=l 0,012)	CDFG[2]
CT	7 Jul 1970	upper creek	electrofish	CDFG[2]
CK,SH	21Apr, 24 May 1978	various	electrofish	USFWS[3]
SH	9 Jun 1987	lowermost 300 ft	electrofish	CDFG[2]
CK, SH, CT	28 Mar-24 Jun1991	lower creek	outmigrant	USFWS[4]

[1]CO= coho; CT= coastal cutthroat; CK = chinook; SH= steelhead/rainbow.

[2]California Department of Fish and Game, Klamath River Stream Files, Eureka, CA.

[3] USFWS 1979a.

[4] Lintz and Kisanuki 1992.

Little Surpur Creek

Synopsis: instream habitat conditions were poor overall: loose aggradation of the stream channel, sparse cover, and infrequent pools. Juvenile steelhead/rainbow trout were captured in a lower creek reach. No historical fish presence data have been located.

Fish Species Presence

Electrofishing: juvenile steelhead, prickly sculpin, and speckled dace were captured on 23 May 1996 (Fig. 14, App. B-4). The sampling effort was abbreviated due to malfunctioning equipment. Twelve steelhead parr between 91 and 129mm FL were enumerated. Several individuals possessed "cutthroat-like" faint slash marks on the lower jaw. All were recorded as steelhead, however, because of short maxillary length. The possibility of cutthroat residing higher in the watershed should be investigated in future surveys.

Historical Information

Past survey efforts described physical habitat conditions, but specific fish data were not collected.

Tectah Creek

Synopsis: habitat conditions varied between sampling zones; lower and upper Tectah were characterized by a lack of habitat diversity and sparse cover; middle Tectah appeared to have the best relative conditions because of an abundance of pool habitat and complex cover. Juvenile chinook, coho, steelhead, and cutthroat were present in 1996; all species had previously been documented in the creek.

Fish Species Presence

Electrofishing

Lower Zone (reach #1): juvenile chinook, coho, steelhead, cutthroat, sculpin, speckled dace, stickleback, and ammocoete form lamprey were captured on 30 May, and 1 Jul 1996 (Table 29, Fig. 14, App. B-4). The 30 May effort was hindered by high stream flows, which greatly reduced "netting success" of stunned fish. Many fish were observed, yet extensive sampling yielded only 8 salmonids. Reach #1 was re-visited on 1 Jul when conditions were more conducive for electrofishing.

Chinook fry were captured during the 30 May effort, but were not observed on 1 Jul; apparently, most chinook had emigrated from the system during the intervening month. This observed "absence" on 1 Jul illustrates how sampling time can be critical for determining juvenile chinook presence.

Juvenile coho were captured in lower Tectah Creek on 1 Jul, but were not abundant relative to steelhead. Steelhead parr/smolt comprised 74% of the observed salmonid community on 1 Jul 1996 (n=23). The forklength range suggests two age classes of fish present: 1+ and 2+. Undifferentiated trout fry were not frequently netted, comprising only 9% of measured fish.

Middle Zone (Reach #2): juvenile steelhead/rainbow and trout fry were captured on 2 Jul (Table 29). This sampling zone had the highest observed salmonid densities, and not coincidentally, the best overall habitat conditions in Tectah Creek. Steelhead juveniles and trout fry were numerous, and present in approximately similar densities. The size distribution of captured trout likely represents 1+ and 2+ aged fish. Judging by the high densities of YOY, steelhead (and cutthroat?) adults likely utilized spawning grounds nearby. In contrast, the low numbers of fry found in reach #1 on 1 Jul may indicate that few anadromous trout successfully spawned in lower Tectah during 1995-96.

Table 29. Tectah Creek: juvenile salmonids captured by electrofishing, 22 May, 1 Jul, and 2 Jul, 1996.

	#fish	FL range (mm)	% salmonids captured
Lower Zone:			
chinook*	2	50,55	n/a
coho	2	80,81	9
steelhead	17	100-162	74
trout fry	4	46-79	17
Middle Zone:			
steelhead	22	80-158	56
trout fry	17	35-58	44
Upper Zone:			
cutthroat	12	82-165	100

* (sampled 30 May 1996; n/a= not applicable)

Upper Zone (Reach #3): cutthroat were the only fish captured on 22 May 1996. These cutthroat are likely "resident fish" because of anadromous barriers which exist between reach #2 and #3 (YTFP 1996 habitat typing). Based on the forklengths of captured fish, at least two age classes were present: 1+ and 2+. One scale sample was analyzed from a 126 mm FL cutthroat that was determined to be an age 1+ fish. This fish exhibited "stream-type" or "resident" growth patterns. Zero trout fry were observed in this reach. Since cutthroat can spawn from late winter through late spring months (Meehan and Bjomn 1991; Trotter 1997) the 22 May sampling may have occurred while YOY trout were still in the gravel.

Historical Information

Like many of the more remote lower Klamath tributaries, Tectah Creek has a paucity of available fish survey records. Available data are mainly from lower creek investigations conducted over the past 20 years (Table 30). In addition, CDFG undertook fish stocking efforts in the late 1960's. Approximately 20,000 coho fingerlings were planted in middle Tectah each year 1966-1968 (YTFP 1996 reach #2).

All salmonid species found in 1996 have previously been observed in the drainage. Since 1978, juvenile chinook have been observed in most investigations conducted in late winter/early spring.

Despite CDFG's 1960's-era stocking efforts, juvenile coho presence wasn't documented until USFWS' 1989-'90 outmigrant trapping efforts. Coho, however, appear to have maintained presence since that time, having been found in 1992 and again by YTFP's 1996 surveys.

Table 30. Tectah Creek: documented salmonid species presence, 1978-1992.

Species[1]	Date	Location	Survey type	Agency
CK, SH, SH1/2	23 Feb, 21 Apr, & 24 May 1978	various	electrofish	USFWS[2]
SH	26 Jun l984	lowermost 300 ft	electrofish	USFWS[3]
SH,CT	8 Sept-10 Sept 1987	various	snorkel, hook/line	CDFG[4]
CK, CO, SH	5 Apr- 20 Jun 1989	lower creek	outmigrant trap	USFWS[5]
CK, CO, SH	3 Apr. 5 Jul 1990	lower creek	outmigrant trap	USFWS[6]
CK, CO, SH	13 May 1992	various	snorkel	CDFG[4]

[1]CK = chinook; SH= steelhead/rainbow; SH1/2= steelhead half pounder; CT= coastal cutthroat; CO= coho.
[2] USFWS 1979a.
[3] USFWS internal memo, 1 Aug 1984.
[4] California Department of Fish and Game, Klamath River Stream Files, Eureka, CA
[5] Noble and Lintz 1990.
[6] Lintz and Noble 1992.

Steelhead/rainbow presence has been noted in each survey conducted since 1978. No surveys have located steelhead upstream of the falls/chute barrier above the #T-200 Road. Bridge. Cutthroat seem to be concentrated solely in upper Tectah Creek; no survey or outmigrant trapping effort has identified cutthroat in lower reaches.

Johnsons Creek

Synopsis', physical habitats in lower reaches have been degraded from the use of the stream channel as a seasonal county road. Upper reaches offered better fish habitat but were upstream of anadromous migration hindrances. Juvenile chinook, coho, steelhead, cutthroat, and brown trout were observed in 1996; past surveys have found chinook, steelhead/rainbow, cutthroat, and brown trout.

Fish Species Presence

Electrofishing

Reach #1: juvenile chinook, coho, steelhead, cutthroat, sculpin, speckled dace, and Klamath small-scale suckers were captured on 29 May 1996 (Table 31, Fig. 14, App. B-5). The observed salmonid community was diverse with no species clearly dominant. Marginal access to the Klamath River still existed at the time, and may help explain the relative abundance of salmonids near the confluence— fish possibly seeking to emigrate before flows become subsurface (Fig. 3, App. A).

Chinook fry were found concentrated in the lowermost 600 ft. of creek, while coho were observed in pools throughout the reach. Steelhead were the most frequently captured salmonid, outnumbering cutthroat 7 to 1 in lower Johnsons Creek. The juvenile steelhead - were all 1+ based on size. Scales from the 161mm FL cutthroat were aged at 2+ yrs (App. C). The trout fry, all less than 41 mm FL, were too small to differentiate as species.

Reach #2: juvenile coho, steelhead, cutthroat, brown trout, sculpin, speckled dace, and Klamath small-scale suckers were captured on 10 Jul 1996. Johnsons Creek began flowing subsurface only a few hundred feet downstream of the intersection with the county road (start of reach #2).

Coho fry were the most frequently captured salmonid in reach #2- the only observed instance in 1996 electrofishing efforts. The salmon were concentrated in one of the first discernible pools upstream of the subsurface flow.

Steelhead juveniles comprised just 11% of the salmonid catch and were less abundant relative to numbers observed in reach #1 on 29 May. All were probably 1+ based on size and time of the year. Unlike steelhead, juvenile cutthroat became more frequently observed in reach #2 vs. reach #1. Age 0+ and 1+ fish were present based on size (largest cutthroat was 128 mm FL).

Table 31. Johnsons Creek: juvenile salmonids captured by electrofishing, 29 May, and 10Jull996.

	#fish	FL range *(mm)*	% salmonids captured
Reach #1:			
chinook	6	55-78	25
coho	5	55-61	21
steelhead	7	80-115	29
cutthroat	1	161	4
trout fry	5	30-41	21
Reach #2:			
coho	13	59-89	35
steelhead	4	108-134	11
cutthroat	9	64-128	24
brown	1	252	3
trout fry	10	55-70	27
Reach #3:			
steelhead	1	161	3
cutthroat	16	98-180	54
trout fry	13	37-61	43
Reach #4:			
cutthroat	32	75-216	84
trout fry	6	52-68	16

Several fry were discernible at sizes as small as 64 mm FL. Undifferentiated trout fry were also frequently observed, comprising almost a third of the salmonid catch. One brown trout was sampled and aged at 2+ years from its scales. This non native species was "permanently removed" from the creek, and was the only brown trout observed during 1996.

Reach #3: juvenile steelhead, cutthroat, and trout fry were observed on 10 Jul 1996. One steelhead was found and was likely age 2+ based on its size. Cutthroat and trout fry dominated the catch. Scale analysis revealed "stream-type" or resident growth patterns and two age classes: 1+ and 2+ (App. C). Many of the abundant trout fry exhibited a "cutthroat-like snaky appearance" making it possible that a large percentage were actually cutthroat.

Reach #4: cutthroat and trout fry were observed on 10 Jul 1996. Since this reach was located above potential barriers (p. A-26), captured fish likely represent resident populations. Three age classes were discerned through scale analysis: 1+, 2+, and 3+ (App. C). Fry, comprising only 16% of the catch, were not as abundant relative to lower reaches.

Historical Information

Historical fish data are sparse at best. Most of the available data describe physical habitat conditions with only two fish surveys located to date. Chinook fry, steelhead/rainbow, and cutthroat were identified by USFWS electrofishing during spring, 1978. CDFG

electrofishing on 24 May 1984 found a brown trout in the lowermost 500 ft. of creek. Since this rare lower river species has been found 12 years apart, a small population of browns may actually reside in Johnsons Creek.

Roaches Creek

Synopsis: moderate quality spawning, and high quality salmonid rearing habitats are found throughout the lowermost reach. A natural falls at creek mile 0.5 is a likely barrier to salmon attempting to spawn in the upper watershed. Habitats in upper reaches were visibly degraded from past logging operations. Juvenile coho and steelhead/rainbow were observed in 1996; juvenile chinook, coho, and steelhead/rainbow had previously been documented.

Fish Species Presence

Snorkel Survey

Lower Zone (reach #1): juvenile coho and steelhead/rainbow were identified in lower Roaches Creek on 24 Jun 96 (Fig. 16, App. B-5). Coho fry were observed downstream of the anadromous "migration hindrance" at rm 0.5. A majority of these fish (n=39/49) were holding together in one plunge pool. All coho were estimated to be between 50-80mm FL. No salmon were found above rm 0.3.

Steelhead/rainbow trout appeared abundant in at least three age classes (0+, 1+, and 2+ yrs.). Trout fry were numerous (20-50 fish) in most margin and backwater areas, with 5-20 larger juveniles present in most run and pool habitat units. Fry and parr/smolt were observed in approximately the same relative densities upstream of the migrational barrier as below.

Electrofishing

Upper Zone (Reaches #2 & 3): rainbow trout were the only fish captured on 27 Jun 1996 (Table 32, Fig. 16, App. B-5). These reaches were upstream of anadromous barriers; thus "resident rainbow" (vs. steelhead) populations were sampled. Based on a narrow size distribution, and time of year, most fish were 1+: 19 of 20 fish measured between 92-120 mm FL. In addition to the lack of older fish, YOY were also infrequently observed. Two of the three "fry" measured between 70 and 80 mm FL and could actually have been small age 1+.

Table 32. Roaches Creek- juvenile salmonids captured by electofishing. 27 Jun 1996.

	#fish	FL range *(mm)*	% salmonids captured
Upper Zone:			
resident rainbow	20	92-134	87
trout fry	3	56-80	13

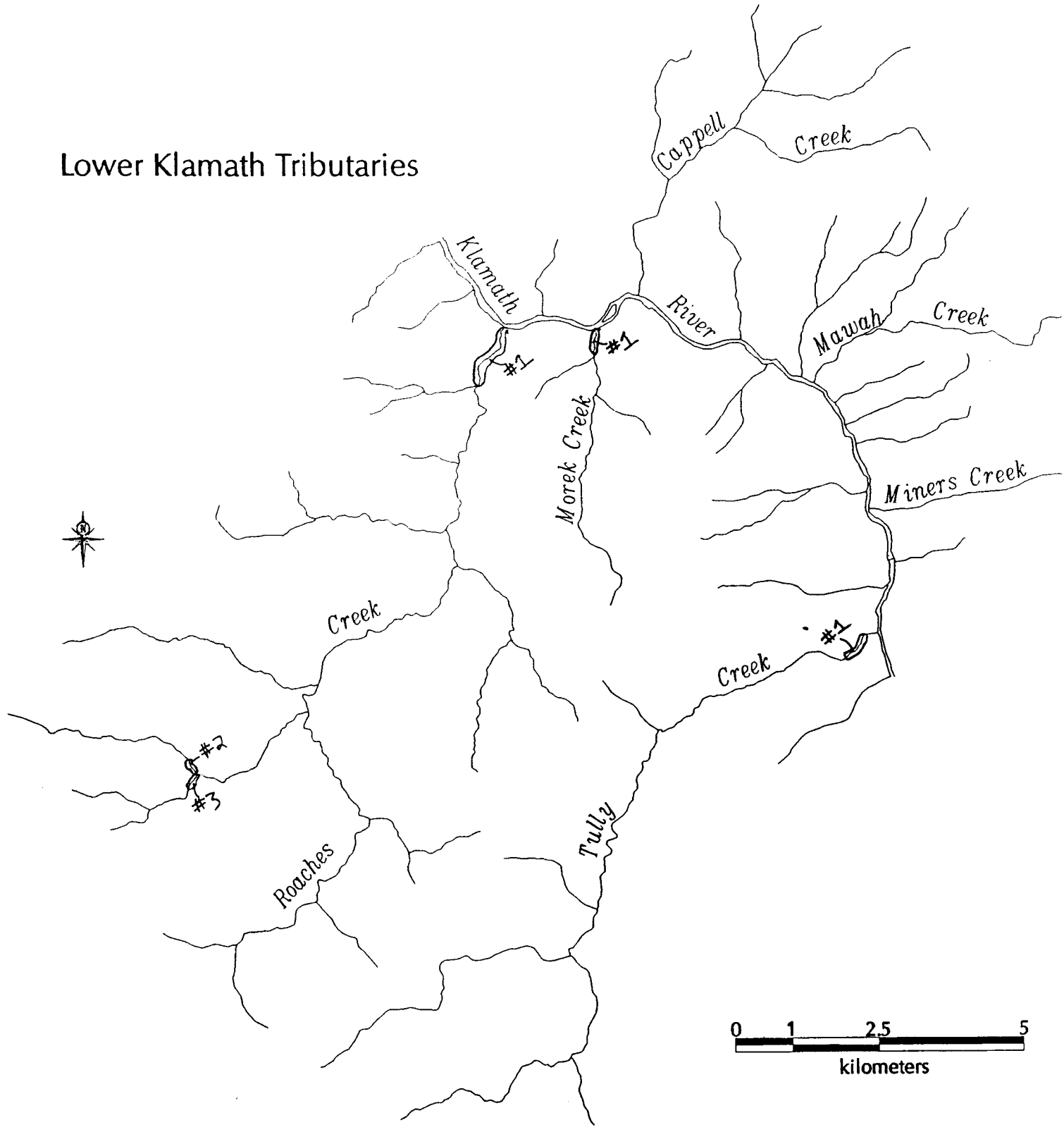

Figure 16. 1996 Electrofishing reach locations.

Historical Information

Like Bear, Tectah, Johnsons, and other "remote" tributaries, there are few documented fisheries surveys in Roaches Creek (Table 33). USFWS investigations of the late 70's and 80's comprise the bulk of available knowledge. Electrofishing conducted in June 1978, and May 1984 found steelhead/rainbow but no salmon. Juvenile chinook, coho, and steelhead/rainbow were captured during outmigrant trapping efforts in 1989 and 1991.

Table 33. Roaches Creek: documented salmonid species presence, 1978-1991.

Species[1]	Date	Location	Survey type	Agency
SH	5 Mav, and 2 Jun 1978	lower creek	electrofish	USFWS[2]
SH	24 May 1984	lowermost 400 ft creek	electrofish	CDFG[3]
CK, CO, SH	27Apr-20Junl989	lower creek	outmigrant trap	USFWS[4]
CK, CO, SH	1 Apr-15 Jul 1991	lower creek	outmigrant trap	USFWS[5]

[1]SH= steelhead/rainbow; CK= chinook; C0= coho

[2] USFWS 1979a.

3California Department of Fish and Game, Klamath River Stream Files, Eureka, CA.

[4] Noble and Lintz 1990.

[5] Lintz and Kisanuki 1992.

Morek Creek

Synopsis: fish access problems (steep confluence with the Klamath River) may restrict anadromous production. Instream conditions were good overall for salmonid rearing, but spawning habitat appeared limited. Juvenile steelhead/rainbow were identified in 1996, with previous documentation in 1978.

Fish Species Presence

Electrofishing

Reach #1: juvenile steelhead/rainbow, trout fry, and prickly sculpin were captured on 1 Jul 1996 (Table 34, Fig. 16, App. B-5). Emigrant access to the mainstem Klamath was marginal but still possible at the time. Fish access into Morek Creek, however, was questionable because of steep gradient at the mouth, a braided, undefined channel, and low stream flow (See App. A).

Table 34. Morek Creek: juvenile salmonids captured by electrofishing, 1 Jul 1996.

	#fish	FL range (mm)	% salmonids captured
Reach#1:			
steelhead/ rainbow	29	88-155	85
trout fry	5	38-51	15

Judging from the size distribution, most trout appeared to be 1+: 23 of 34 fish measured between 80 and 130 mm FL. Trout fry were infrequently captured, possibly indicative of the limited spawning habitat in the lower 1000 ft of creek.

Historical Information

Available historical data are limited to 1978 USFWS investigations. Electrofishing surveys in the lower creek on 5 May, and 2 Jun 1978 identified numerous steelhead/rainbow trout. Morek Creek continues to support abundant steelhead in 1996, but salmon utilization would appear minimal because of the steep gradient and limited access at the mouth.

Tullv Creek

Synopsis: instream conditions were favorable for salmonids: ample boulder and bubble curtain cover, areas of quality spawning substrate, and perennial instream flows. Juvenile steelhead/rainbow were captured in 1996; previous investigations have documented coho and steelhead presence.

Fish Species Presence

Electrofishing

Reach #1: juvenile steelhead/rainbow were captured in lower Tully Creek on 27 Jun 1996 (Table 35, Fig. 16, App. B-5). The size distribution of captured fish suggests at least three age classes: 0+, 1+, and 2+. Trout fry were relatively numerous throughout the surveyed reach, comprising almost 40% of the overall catch. Unlike the age distribution observed in Morek Creek, more YOY trout were captured in Tully than "1+ sized fish" (80-130mm FL). The higher instream flows in Tully Creek (vs. Morek Creek) likely reduced "netting success" of larger salmonids, and may have skewed the observed size distribution.

Table 35. Tully Creek: juvenile salmonids captured by electrofishing, 27 Jun 1996.

	#fish	FL range (mm)	% salmonids captured
Reach #1:			
steelhead/rainbow	29	80-205	62
trout fry	18	30-46	38

Historical Information

USFWS surveys conducted in the late 1970's and 1980's constitute the body of historical knowledge. An electrofishing survey on l4 Mar 1978 identified juvenile steelhead/rainbow. Outmigrant trapping efforts in 1989 and 1990 captured steelhead/rainbow (predominately fry), and one coho fry. Additional YTFP surveys in middle and upper zones of the watershed are planned in 1997.

Review of Findings-1996

Discussion of 1996 salmonid species distribution and abundance, and variables that seemed to affect the data are organized below by species. Relevant historical data are also reviewed, but large differences of survey type/effort, variable sample sizes, and year-to-year fluctuations offish populations make "past vs. present" comparisons tenuous.

Chinook salmon: small numbers of chinook fry were found almost exclusively in the downstream-most reaches of surveyed streams. Chinook fry were not numerically dominant in any electrofishing reach. Factors that strongly influenced these findings included sampling time and life history traits (i.e., sampling was conducted after most chinook fry had emigrated). Healey (1991) notes that downstream movement of fall-run chinook fry (30-45mm FL) peaks between February and May, being earlier in more "southern populations" (including lower Klamath River tributaries). Larger chinook fingerlings (50 to 120mm FL) tend to have an emigration peak between May and June of their first year. Thus, 1996 surveys either documented the end of chinook outmigration, or potentially missed the emigrants entirely.

In contrast to the electrofishing/snorkeling data, juvenile chinook salmon were by far the most abundant salmonid captured in 1996 outmigrant traps. Chinook fry accounted for 95%, 82%, and 73% respectively of the season-long salmonid catches at Hunter (n= 1,511 fish), Terwer (n= 230 fish), and Blue Creek (n=7,486 fish) trapping operations.

Sampling time and drainage size relative to other lower Klamath River tributaries may help to explain these findings. Unlike the electrofishing surveys, outmigrant trapping efforts were initiated (March 1996) before the bulk of the chinook emigration occurred. Overall drainage size was also important: Hunter, Terwer, and Blue are three of the four largest lower Klamath tributaries sampled in 1996 (Table 2). Although a few chinook may spawn in smaller streams (<3"^{d} order), Boehne and House (1983) found that large anadromous salmonids tended to use 4th order and larger streams in Oregon.

We found chinook fry for the first time in two Blue Creek tributaries: One Mile Creek, and Nickowitz Creek. Nickowitz Creek is a 3rd order stream and has much more potential chinook spawning habitat than One Mile Creek (1st order) (see App. A). Chinook may utilize One Mile Creek as "non-natal" rearing habitat (see Results). Chinook had been previously documented in all other streams where they were present.

No chinook were observed in Omagaar, Bear, Surpur, and Roaches Creeks in 1996, yet previous surveys had identified them as present. Chinook were found in Bear, Surpur and Roaches Creeks as recently as 1990-91 (Lintz and Kisanuki 1992, Lintz and Noble 1992). Chinook presence in Omagaar Creek was last confirmed in 1978 and may have been related to use of "non-natal" rearing habitat (USFWS 1979c) (see Results). None of these four streams is assessed as having abundant available spawning habitat and none is likely to have supported large salmon runs in recent years (App. A). Annual variation of the

number of chinook spawners in small stream systems where run sizes are small to begin with may bias observed distribution patterns. Successive-year surveys instead of a single "snap-shot-in-time" effort repeated every decade would help solidify existing knowledge of anadromous species utilization of small tributary habitats.

Coho salmon: we found small numbers of juvenile coho in lower and middle reaches of surveyed streams. Coho relative abundance was uniformly low: they were the most abundant salmonid in only one 1996 electrofishing reach (reach #2, Johnsons Creek, Table 31). Age 1+ coho smolts were rare. As described below, variables that seemed to affect 1996 coho distribution and abundance included sampling time, life history traits, habitat constraints, and interspecific competition.

The peak emigration of age 1+ coho probably occurred before the bulk of our surveys (February to May). Coho smolts were observed only in McGarvey Creek. Shapovalov and Taft (1954) found that smolt outmigration from Waddell Creek, California began in mid-March, increased through April, and peaked by mid-May. Chapman (1965) described the outmigration of coho yearlings in three Oregon streams as beginning in early February and continuing through May. Sampling time, however, was likely less crucial in determining the presence of coho fry. Age 0+ coho typically disperse both upstream and downstream from natal areas and remain in freshwater habitats throughout their first year (Meehan and Bjomn 1991, Shapovalov and Taft 1954).

Habitat conditions appeared to strongly influence the distribution and abundance of age 0+ coho. Juvenile coho are more susceptible to habitat degradation/loss than chinook fry because of their extended freshwater residency and requirements of habitat diversity. .Brown et al. (1994) describe the best juvenile coho habitat as having deep pools containing logs, rootwads, or boulders in heavily shaded sections of stream. Bustard and Narver (1975) found that overwintering presmolt coho tended to utilize backwaters with large woody debris. In addition, McMahon and Holtby (1991) found coho smolt abundance positively related to debris volume.

Some recent studies, however, have shown little correlation between summer abundance of coho 0+ and cover complexity (Bjomn et al. 1991; Spaulding et al. 1995). Nonetheless, instream habitat diversity and coho relative abundance were minimal in many lower Klamath River tributaries. We observed the highest relative numbers of coho fry and the best salmonid habitat conditions of any lower Klamath stream in the Crescent City Fork of Blue Creek.

Competition can also negatively affect coho distribution and abundance, especially in altered streams where coho are sympatric with other salmonids. In areas of simplified habitat, interspecific competition may increase. Harvey and Nakamoto (1996) reported that age 0 + coho growth was negatively correlated with juvenile steelhead densities in small streams with human-derived habitat changes.

Juvenile coho were infrequently captured during 1996 outmigrant trapping efforts. Coho comprised <1%, 1%, and <1% respectively of the season-long salmonid catches at Hunter (n= 1,511), Terwer (n= 230), and Blue Creeks (n=7,486). Age 1+ coho were rarely seen: only 1 fish was captured at the Terwer Creek trap, and 4 total taken at the Blue Creek trap.

Coho were documented for the first time in four tributaries: Omagaar, Pularvasar, One Mile, and Johnsons Creeks. All other streams with coho present in 1996 had records of previous utilization by this species. Coho were well distributed in McGarvey and Blue Creeks, with observed patterns similar to historical reports. Longitudinal distribution of juveniles appeared diminished compared to historical accounts in Hunter, Hoppaw and Tarup Creeks. Previously, small numbers of coho had been documented in the West Fork of Blue and Tully Creeks, but none were found in 1996. Additional surveys are planned in each drainage because 1996 investigations were limited to a single reach.

Steelhead/rainbow trout: juvenile steelhead and/or resident rainbow trout were widely distributed in all surveyed lower Klamath tributaries. We observed overall steelhead relative abundance to be greater than chinook and coho, but less than cutthroat'. In 1996, steelhead/rainbow were the most abundant salmonid in: lower Mynot Creek (reach #1), lower Bear Creek, Little Surpur Creek, lower and middle Tectah Creek, Roaches Creek, Morek Creek, and Tully Creek.

In tributaries with sympatric steelhead/cutthroat populations[2], steelhead numbers declined progressively upstream and resident steelhead/rainbow trout were not found upstream of anadromous barriers in these streams. Hartman and Gill (1968) investigated sympatric steelhead and cutthroat in British Columbia streams with similar results: juvenile steelhead tended to dominate lower reaches, while cutthroat were dominant in very small tributaries and headwaters reaches. In drainages with no documented cutthroat (Roaches, Morek, and Tully Creeks) steelhead appeared abundant throughout, and were present upstream of migration barriers (YTFP 1996-97 habitat typing) as resident trout.

Potential factors that affected 1996 steelhead distribution and abundance are discussed below, and included life history variation, sampling bias, habitat condition, and year-to-year population fluctuations.

Steelhead life history varies greatly regarding the length of time spent in freshwater, the times of emigration from and immigration to freshwater, and the length of time spent in saltwater (Bamhart 1986). For example, Oregon Department of Fish and Game has identified 15 life-history patterns among wild summer steelhead in the Rogue River

[1]except Blue Creek, Blue Creek tributaries.

[2] Lower Klamath River tributaries downstream of Mettah Creek (rm 29) except Blue Creek and Blue Creek tributaries.

(ODFW 1994). In most steelhead streams, at least one age class of juveniles is likely to be rearing at any time during the year. Sampling time, therefore, probably did not affect observed steelhead distributions.

The inability to differentiate steelhead/cutthroat fry during surveys (sampling bias) may have impacted distribution/abundance findings, particularly in small intermittent drainages (e.g. Mynot, Hoppaw, and Omagaar Creeks) where many steelhead may emigrate as subyearlings (Bjomn 1971; Faudskar 1980; Leider et al. 1986). In systems where most steelhead emigrate as age 0+ and older juvenile cutthroat are present year-round, the inability to differentiate fry of the two species will result in an underestimation of steelhead distribution/abundance.

Juvenile steelhead comprised relatively low proportions of the overall salmonid catch at each of the three outmigrant traps; Blue Creek had the highest observed proportion of steelhead (26%, n=7,486 fish). Larger emigrant trout may not have been as effectively captured as age 0+ salmonids (especially by frame traps operated during low flows). During late spring trap checks at Hunter Creek, juvenile trout (age 1+ and older) were sometimes observed swimming out of the frame net against the current.

In 1996, we found steelhead present in One Mile Creek and Little Surpur Creek but no past survey records were located for either creek. Previous survey records for all other sampled tributaries identified steelhead; and in some cases, these records included distribution data. Prior to 1996, stream obstructions[3] (i.e.: culverts, landslides/logjams) resulting from land management activities have likely limited steelhead distributions in a number of drainages, including Hoppaw, McGarvey, Omagaar, Surpur, and Little Surpur Creeks (YTFP 1996 habitat typing).

Coastal cutthroat trout: we found juvenile and/or adult coastal cutthroat in 13 of 19 tributaries downstream of and including Johnsons Creek. Four of the six streams without cutthroat were Blue Creek tributaries. Cutthroat dominated the overall salmonid catches during electrofishing in Hunter, Hoppaw, Saugep, McGarvey, Tamp, Omagaar, Surpur, and Johnsons Creek. Hooton (1997) reported a similar "wide distribution and consistent presence" of cutthroat in Oregon coastal streams.

Where present, cutthroat trout were typically more abundant at upstream sites. Cutthroat were the sole fish species captured in upper reaches of Mynot, Bear, and Tectah Creeks, in addition to the 8 previously mentioned tributaries. The variables that seemed to affect their observed distribution and abundance are discussed below and include life history strategies, habitat conditions, habitat availability, and interspecific interactions.

[3] The Omagaar Creek culvert on the Simpson #S-10 Road was replaced by a permanent bridge in summer, 1996; the Hoppaw Creek culvert was replaced by a permanent bridge during fall, 1997.

Coastal cutthroat trout possess the most flexible life history of any Pacific salmonid (Johnson et al. 1994; Northcote 1997). Three distinct variations are likely in lower Klamath tributary populations: an anadromous or sea-run form; a potamodromous or river-migratory form; and a resident non-migratory form (Trotter 1997). Northcote (1997) suggests that in response to environmental variability, cutthroat trout have developed a long-term population viability by arraying populations across a broad migratory/residency spectrum. In effect, the ability within any one cutthroat population to exploit a variety of habitats would ensure long term species survival even in an unpredictable environment.

In many tributaries with histories of intensive land management, anadromous salmonid populations have been negatively impacted by instream habitat loss or degradation. Sea-run cutthroat trout are perhaps more susceptible than other salmonids to these changes because: 1) they generally spend more time rearing in freshwater (up to 5 years); and 2) a reduction of available suitable habitat would place them in direct competition with other salmonids (Reeves 1997).

Hawkins (1997) cited numerous studies that showed in most interspecific interactions, cutthroat are forced to exist in less preferred habitat by more aggressive salmonids. Interspecific competition could help explain why cutthroat were observed more frequently as sampling progressed upstream in lower Klamath River tributaries: as competing species became more sparse in middle reaches, cutthroat began to dominate (e.g. Mynot, Hoppaw, McGarvey, Tarup, Bear, Surpur, Johnsons Creeks). In reaches accessible to anadromous species, migratory life history strategies such as anadromy or potadromy might be favored over residence (i.e., migration into areas with fewer competitors), especially if the stream habitat is simplified and doesn't allow for resource partitioning.

While impacts from land management activities appear to limit sea-run cutthroat, resident cutthroat abundance may receive an indirect boost. Cutthroat were often the only fish species observed in survey reaches (e.g.: McGarvey, Tarup, and Surpur Creeks) above anthropogenic barriers (logjams and/or debris slides) that block anadromous access and competitors. Thus, in streams with severely altered habitat, overall cutthroat abundance may increase relative to pre-disturbance numbers (Connolly 1997; Reeves 1997). That observed increase, however, could be entirely from resident fish, and could potentially mask declines of the sea-run portion of the population.

Cutthroat trout were rarely captured during 1996 outmigrant trapping efforts on Hunter, Terwer, and Blue Creeks. Like steelhead, juvenile cutthroat are usually present in several age classes, and larger trout likely evaded capture by the frame net in Hunter and Terwer Creeks. High relative densities of cutthroat in middle Hunter Creek electrofishing reaches suggested that cutthroat were much more abundant than trapping data indicated.

Cutthroat emigrants were not captured during the abbreviated trapping effort in Terwer Creek, and only a handful were seen in Blue Creek. No electrofishing surveys were

conducted in Terwer Creek in 1996; basinwide surveys are planned for 1997. In Blue Creek, however, extensive surveys (snorkel and electrofish) were carried out in addition to 1996 outmigrant trapping, and cutthroat trout relative abundance was judged to be low overall. This is contrary to Gerstung's (1997) assertions that Blue Creek supports large numbers of cutthroat relative to most lower Klamath tributaries.

In 1996, most streams where we observed cutthroat also had documentation of prior species presence. Hoppaw Creek and One Mile Creek supported cutthroat in 1996, but historical data were not located. The wide distribution of coastal cutthroat in lower Klamath tributaries is similar to historical reports, but their relative abundance has possibly increased compared to previous observations in middle/lower reaches of Hunter, Mynot, Hoppaw, McGarvey, Tarup, Omagaar, and Surpur Creeks.

Conclusion

Although 1996 lower Klamath sampling efforts were qualitative, two patterns offish presence were apparent. First, in tributaries where we electrofished in upper, middle, and lower reaches, the number of fish species decreased progressively upstream. Secondly, the relative abundance of chinook, coho, steelhead, and cutthroat was similar in many different tributaries. Generally, juvenile chinook and coho were infrequently captured, while steelhead, and especially cutthroat were more abundant.

Blue Creek was a major exception to the above patterns. The largest runs of chinook, steelhead, and coho in the lower Klamath basin occur in Blue Creek- each species was observed in all mainstem and Crescent City Fork reaches downstream of anadromous barriers. Cutthroat were also observed throughout all mainstem reaches, but were the least abundant species.

As might be expected, the lower Klamath stream with the best overall habitat conditions (see App. A) supported the most diverse and abundant salmonid populations. Reeves et al. (1993) suggest that high rates of timber harvest (>25% of basin) can cause basin-level habitat simplification and that such simplification can reduce the diversity of salmonid assemblages. Although timber harvest in the lower Blue Creek basin has been comprehensive and is ongoing, the upper two thirds of the watershed is located on remote, primarily roadless National Forest lands. A more detailed discussion of Blue Creek and its anadromous fish runs is presented by Gale et al. (1998).

Qualitative 1996 distribution/abundance data differ from previous accounts in more than one instance. Collectively, these "differences" may reflect recent changes to fish community structure in many lower Klamath tributaries. The lack of "comparable" quantitative or site-specific data for most streams, however, reduces discussion of "trends" to speculation. Meaningful temporal comparisons can only be made when reliable data are consistently collected over many years.

YTFP's 1996 investigations are perhaps the most comprehensive data collection effort in the lower Klamath basin to date, but many questions remain concerning salmonid use of reservation tributaries. There is uncertainty whether the observed patterns of salmonid presence/distribution truly represent current conditions or are artifacts of the "snapshot-in-time" sampling approach. Survey efforts conducted over the course of a 3-5 year period, and subsequently repeated every 10 years will provide a long-term data set that would more properly assess trends in fish distribution/presence.

Aside from filling obvious "data gaps," (i.e., either streams not sampled in 1996, or only partially sampled), YTFP's ongoing presence/distribution investigations should focus on documenting the "before/after" conditions in streams targeted for restoration projects, especially barrier modification projects. As YTFP and others begin implementing specific restoration projects, presence/distribution sampling should be used to evaluate the changes that projects may have on salmonid populations.

Long-term trend monitoring should also incorporate quantitative methods where possible. Such methods include but are not limited to outmigrant trapping, snorkel survey-based population estimates (i.e., Hankin and Reeves 1988), and multiple pass depletion electrofishing. With the proper sampling design, quantitative surveys can address "species absence" in situations where absence is suspected but not confirmed by qualitative methods. Additionally, quantitative sampling provides a true estimate of species abundance, including a measure of confidence for generated estimates. Over time, these estimates would provide a statistically-valid database for assessing long-term population trends.

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