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The Resources Agency
DEPARTMENT OF FISH AND GAME

ANNUAL REPORT
TRINITY RIVER TRIBUTARY JUVENILE STEELHEAD INDEX REACH PROJECT, 2000-2001
PROJECT 2c2

by

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Abstract

Two field seasons (2000 and 2001) of backpack depletion electrofishing have been completed on 22 index reaches on eight tributaries of the Trinity River in order to quantify juvenile steelhead densities during the low flow period of August through September. Juvenile steelhead were encountered in all (100%) reaches in both 2000 and 2001. Sub-yearling densities of juvenile steelhead averaged 0.313 and 0.261 fish per square meter for all tributaries, respectively for 2000 and 2001. Yearling and older (1+) juvenile steelhead densities averaged 0.062 and 0.053 fish per square meter for all tributaries, respectively for 2000 and 2001.

Introduction

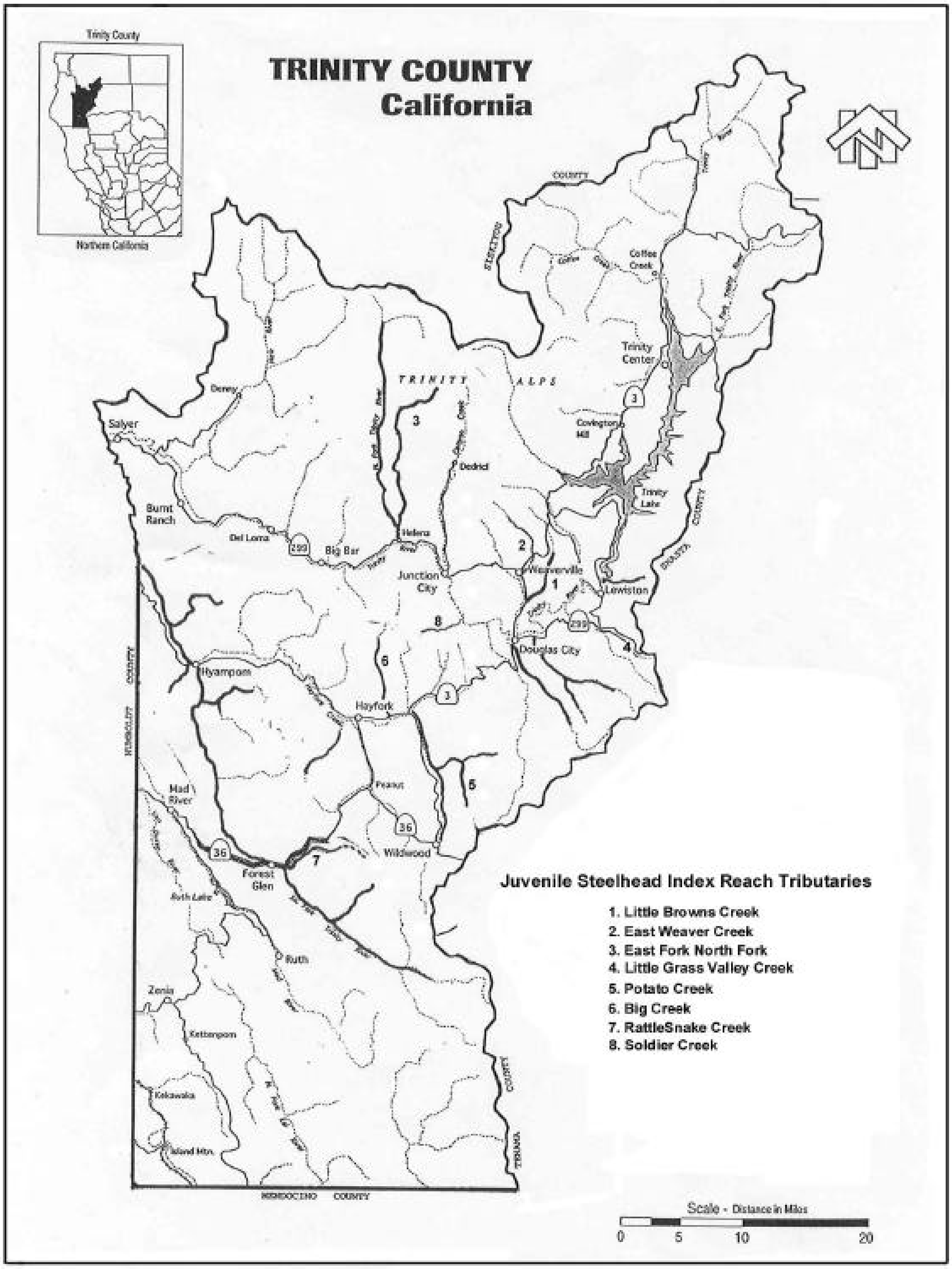
Estimating juvenile steelhead abundance within small streams is relatively easy to accomplish. The sampling protocol is well established, and it is normally conducted during the period of minimum stream flow (August – September). It can produce a statistically bounded estimate of the current number of steelhead inhabiting a small section of stream. It has the further advantage of examining an earlier life history stage than can be observed using passive out-migration traps. Other agencies, timber companies, consulting firms, and other sections of the Department have long-term index sections throughout the area for comparison.

Many of the rivers and streams included in this study have been surveyed and habitat typed by the United States Forest Service (USFS) in the past 12-15 years. These surveys were done to determine fish distribution related to timber harvest and road construction, and to aid in the preparation of watershed analysis reports in accordance with the Northwest Forest Plan (Chris James, USFS unit biologist, personal communication). A current sampling universe of all anadromous tributaries in the Trinity River basin is continually being updated and is provided in Appendix 4. Physical barriers to upstream adult steelhead migration are used to delineate the sampling universe whenever possible. In the absence of a physical barrier, an estimated gradient of 20% is used to identify the upper boundary.

Study Area

The Trinity River is the largest tributary to the Klamath River, and one of the most important steelhead and salmon sport-fisheries in California. The watershed is mountainous, semi-wilderness region of about 2,900 square miles in Trinity and Humboldt counties. The South Fork Trinity River is the largest tributary to the Trinity and has a drainage area of 898 square miles and originates in the Yolla Bolly wilderness area of southern Trinity County (Healy, 1970). The following map, Figure 1, displays the complete sampling universe of the Trinity basin with selected tributaries designated and highlighted.

Figure 1. Map of Trinity basin and juvenile steelhead index reaches



Sampling Methodology

Index reaches were selected from a sampling universe of all 1-4th order anadromous tributaries of the Trinity basin accessible to steelhead upstream of the New River, and including the entire South Fork of the Trinity River. The sampling universe was developed by careful evaluation of U.S. Forest Service (USFS) habitat typing files located at Weaverville and Hayfork Ranger Districts and through personal communication with Lee Morgan of the Lower Trinity Ranger District. Creeks not included or documented in USFS habitat typing files were either gleaned from Department files or estimated based upon gradient.

Index reaches were selected using weighted stratified random sampling. Anadromous tributaries were stratified into two basins: South Fork basin and Main-stem basin. Within each basin, creeks are assigned ranges of their applicable anadromous river mileage (km). From each basin, seven tributaries are randomly selected, with the probability of selection based upon creek mileage.

Creeks selected from the main-stem basin include East Fork North Fork of the Trinity River (EFNFTR), Rush Creek, Canyon Creek, Soldier Creek, East Weaver Creek, Brock Gulch and Redding Creek. Creeks selected from the South Fork basin include Rattlesnake Creek, Hayfork Creek, Mosquito Creek, Tule Creek, Big Creek, Potato Creek, and Butter Creek. Of these fourteen creeks, seven had index reaches set up on them in 2000. Seven of the fourteen selected were deemed inappropriate for index reach electrofishing based upon several deviations from essential critera. Rush Creek, Tule and Redding Creek were dropped due to problems with ascertaining continued permission to sample on private property. Canyon Creek and Brock Gulch were dropped due to size considerations; Canyon Creek has flows that prevent backpack electrofishing even at the lowest water in late September; Brock Gulch does not have substantial surface water flows, especially in critically dry water years. In 2001, three additional creeks were selected at random for sampling. Two of these creeks, North Philpot and Glade, were dry and deemed un-fishable due to the critically-dry water year. Little Grass Valley Creek was successfully selected with all three reaches meeting primary criteria.

Once a creek is randomly selected for sampling, two to three index reach locations are randomly selected within that creek based upon mileage. Longer creeks have three sites selected, while smaller creeks (less than three km.) have two sites selected. Sites are selected by computer, which randomly selects several site mileages from a creek's mileage range. Approximate locations are then plotted on the map before going into the field. Crews then proceeded to the approximate location and select a site that meets basic site criteria. Some site had to be "massaged" due to problems with excess pool depth, excessive vegetation, man-made structures within site boundaries, or private property concerns. When "massaging" a site during the selection process, crews always look down-stream of the selected site location.

Juvenile index reaches range from 200 to 250 feet in length, and ideally include sections of pool, riffle, and run habitat. Minimum site criteria require the presence of at least one pool, no deeper than three feet, per reach. Also, reaches are not located within areas with evidence of high levels of human activity such as camping or active mining claims, and do not contain man-made structures such as dams, weirs, or culverts.

Index reaches are visited by a variety of project crew members over the five year course of this study. It is imperative that reaches can be identified accurately by crew members even if they have not visited the specific index reach previously. Permanent hard copy files are maintained in the SRAMP Weaverville office, as well as electronic files, which identify reach location and length, and the location and type of markers used to locate the reach. Reach coordinates are programmed into portable GPS units. Hard copy files will include a map showing the location of the reach, the site coordinates, and a physical description of the reach site, especially as it relates to physical markers (such as township range and section markers) and other features. Reach descriptions, including start coordinates and directions are provided in Appendix 3.

Index reaches are to be sampled once a year during low flow conditions (August/September) by a crew of three to five people. Each reach is re-habitat typed every July to insure consistency between years. New physical parameter measurements are used each year to compute juvenile steelhead densities. After identifying the location of the index reach, the reach will be sampled using a Smith-Root backpack electrofisher (model 12-B, programmable waveform).

<u>Depletion electrofishing protocol</u>

a) Place block nets to separate habitat types within each index site.
b) Measure water conductivity and temperature.
c) For each habitat type within the index site, perform a single upstream electrofishing pass. Record time taken in first pass, so that equal effort can be made on each subsequent passes.
d) Collect fish in buckets, anesthetize with MS-222, and record species, length and weight. Take required biological samples.
e) Move fish to fresh water tank and observe recovery.
f) Hold fish in perforated in-stream bucket, in sheltered location outside of reach.
g) Conduct second and third passes in the same manner as the first and repeat data collection procedures. Repeat if necessary.
h) Remove block nets and record physical reach data and additional environmental parameters.

All necessary precautions are taken to avoid disturbing the sampling reach, especially prior to placement of block-nets. Water temperature and specific conductance are taken prior to electrofishing to determine the appropriateness of electrofisher settings. Electrofishing protocol will follow accepted DFG depletion methods.

Electrofisher settings protocol

The following electrofishing settings are to be used with their corresponding conductivities. Do not electrofish at conductivities below 50µS/cm^3.

50-100µS/cm^3- Start with 300V G4, If no fish response, increase to G5; then to 400 G4….400G5 etc. Do not exceed 500 V or 50 Hz.

100-300µS/cm^3- Start with 300V G4, if no fish response, increase to G5. Do not exceed 400 V or 40 Hz.

300+µS/cm^3- Start with 200V G4, if no fish response, increase to G5, then to 300V G4. Do not exceed 300V or 40Hz .

Selection of appropriate electroshocker settings is critical to the health of the sampled fish. All crew members are required to understand the principles of effective and safe electrofishing operation. Inexperienced crew members only operate the electrofisher under the direction of an experience crew member. All members of the electrofishing crew will and do have current CPR certification.

After electrofishing has been completed, captured fish from each habitat unit are separated by species. Steelhead are anesthetized, scale samples taken, and the following data collected: fork length (mm); weight (g); and total number. The fish will then be returned to a container of fresh water, and observed for injury or mortality. All fish mortalities are collected for future analysis. Additionally, genetic samples (upper caudal clip) are taken from every 10th sub-yearling steelhead and every 3rd yearling+ steelhead. After the fish have recovered sufficiently they are returned to the stream in a sheltered location downstream of current electrofishing efforts. Other species are counted and returned to the stream. All salamanders are immediately removed from any actively fished unit to reduce chances of predation.

Fish Population Estimation

Computer estimation of fish population sizes is accomplished with a maximum likelihood model that was developed by Dr. Ken Burnham from the U.S. Fish and Wildlife Service's Western Energy Land Use team. This model uses the successive depletion of catch sizes to estimate the actual population size by determining the likelihood of possible population sizes greater than or equal to total catch. The population size with the highest likelihood is considered the best estimate of actual population size. (Platts et al., 1983). From these estimates, juvenile steelhead densities (fish per meter^2) are developed for each index site, per habitat unit. Densities are further pooled to look at sub-yearling and 1+ juvenile steelhead densities in specific creeks and by type of habitat (fast-water or pool).

Results

Juvenile steelhead were encountered in 100% of tributary reaches selected for sampling. Several other species of fish were caught during sampling, and depletion estimates of abundance are made and available in Department files. Speckled dace, *Rhinichthys osculus*, were captured in EFNFTR, and Little Brown's, East Weaver, and Rattlesnake Creeks. Klamath small-scaled sucker, *Catastomus rimiculus*, were captured in EFNFTR, and Little Brown's and East Weaver Creeks. Pacific lamprey ammocetes, *Lampetra tridentata*, were found in EFNFTR, East Weaver and Rattlesnake Creeks. Brown trout, *salmo trutta*, were captured in EFNFTR, Soldier and East Weaver Creeks. Three-spined stickleback, *Gastreolus aculatus*, and coho salmon, *Oncorhynchus kisutch*, were only captured in Little Brown's Creek. Little Brown's Creek had the most diverse assemblage of fish with six species present.

Table 1. Trinity Tributary Index Reach Steelhead Catch Results by Reach, 2000.

Tributary	Reach	Area (m^2)	SH 0 captured	SH 0 Density (per m^2)	SH 1+ captured	SH 1+ Density (per m^2)	Juv SH Density (per m^2)
Rattlesnake	1	375.03	144	0.384	17	0.045	0.429
Rattlesnake	2	203.48	239	1.175	8	0.187	1.361
Rattlesnake	3	249.55	182	0.729	21	0.084	0.813
Big	1	426.84	158	0.370	20	0.047	0.417
Big	2	322.12	105	0.326	14	0.043	0.369
Big	3	330.25	50	0.151	30	0.091	0.242
Soldier	1	218.74	59	0.270	20	0.091	0.361
Soldier	2	177.72	47	0.264	22	0.124	0.388
Soldier	3	314.74	52	0.165	28	0.089	0.254
Potato	1	219.55	81	0.369	3	0.014	0.383
Potato	2	228.95	70	0.306	8	0.035	0.341
EFNF	1	526.01	66	0.125	20	0.038	0.163
EFNF	2	574.38	58	0.101	10	0.017	0.118
EFNF	3	449.90	49	0.109	25	0.056	0.164
Little Browns	1	290.50	18	0.062	11	0.038	0.100
Little Browns	2	200.03	24	0.120	25	0.125	0.245
Little Browns	3	268.35	130	0.484	16	0.060	0.544
East Weaver	1	439.69	228	0.519	27	0.061	0.580
East Weaver	2	178.00	118	0.663	14	0.079	0.742
Totals	19	5993.8	1878	0.313	339	0.062	0.375

Table 2. Trinity Tributary Index Reach Steelhead Catch Results by Reach, 2001.

Tributary	Reach	Area (m^2)	SH 0 captured	SH 0 Density (per m^2)	SH 1+ captured	SH 1+ Density (per m^2)	Juv SH Density (per m^2)
Little Grass Valley	1	165.40	9	0.054	11	0.067	0.121
Little Grass Valley	2	146.60	40	0.273	11	0.075	0.348
Little Grass Valley	3	178.17	17	0.095	11	0.062	0.157
Big	1	462.63	118	0.255	30	0.065	0.320
Big	2	340.89	41	0.120	17	0.050	0.170
Big	3	205.63	33	0.160	11	0.053	0.214
Soldier	1	166.62	94	0.564	8	0.048	0.612
Soldier	2	193.33	75	0.388	12	0.062	0.450
Soldier	3	209.09	87	0.416	18	0.086	0.502
Potato	1	231.00	119	0.515	7	0.030	0.545
Potato	2	259.79	84	0.323	25	0.096	0.420
EFNF Trinity	1	549.54	83	0.151	29	0.053	0.204
EFNF Trinity	2	443.80	76	0.171	6	0.014	0.185
EFNF Trinity	3	553.52	202	0.365	22	0.040	0.405
Totals	14	4106.0	1078	0.261	218	0.053	0.314

Length frequency analysis is conducted for each creek and available in Department files. Length frequency diagrams for juvenile steelhead for all creeks by year are shown below. Sub-yearling (0 age) steelhead are defined as all steelhead under 90 mm (Chicolte, 2001). Length-frequency histograms for all creeks show an obvious nadir around the 90 mm area, with the exception of EFNFTR.

Figure 2. Length-frequency diagram of all juvenile steelhead captured by electrofishing in Trinity River Tributaries, August-September, 2000.

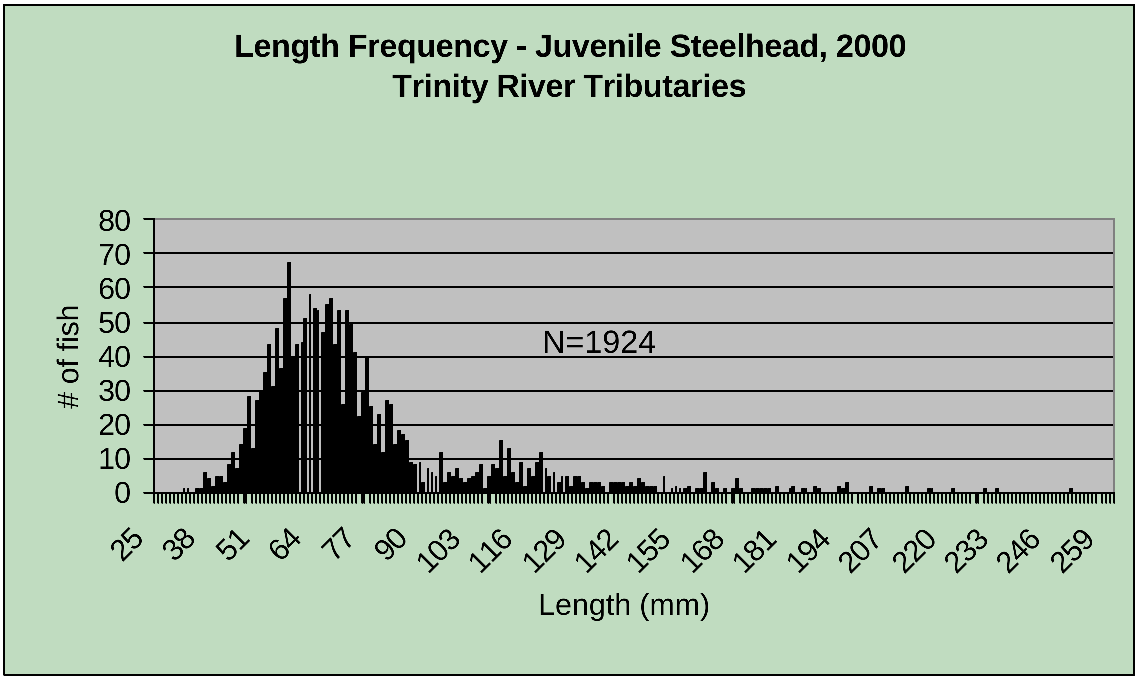


Figure 3. Length-frequency diagram of all juvenile steelhead captured by electrofishing in Trinity River Tributaries, August-September, 2001.

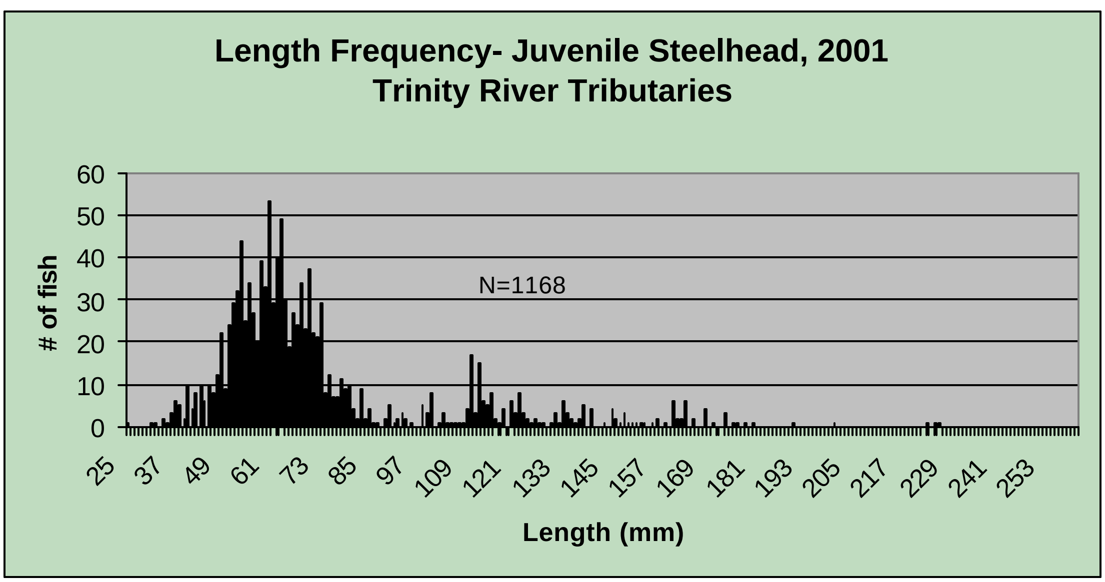


Table 3. Juvenile Steelhead Densities Summaries per Tributary –August-September, 2000.

Tributary	Number of Units (n=)	Area of Habitat sampled (m^2)	Steelhead 0 Density (per m^2)	Steelhead 1+ Density (per m^2)	Total Juv. Steelhead Density (per m^2)
Little Browns	14	758.88	0.202	0.070	0.272
EFNF Trinity	12	1550.29	0.112	0.035	0.147
Potato	12	448.50	0.337	0.025	0.362
Soldier	18	711.20	0.207	0.103	0.310
Big	14	1079.21	0.290	0.062	0.352
Rattlesnake	17	828.06	0.682	0.091	0.773
East Weaver	10	617.68	0.560	0.066	0.626
Totals	97	5993.8	0.313	0.062	0.375

Table 4. Juvenile Steelhead Densities per Tributary, August-September 2001.

Tributary	Number of Units (n=)	Area of Habitat sampled (m^2)	Steelhead 0 Density (per m^2)	Steelhead 1+ Density (per m^2)	Total Juv. Steelhead Density (per m^2)
EFNF Trinity	12	1546.86	0.233	0.037	0.270
Potato	12	490.79	0.415	0.065	0.480
Soldier	18	569.04	0.450	0.067	0.517
Big	13	1009.45	0.190	0.058	0.248
Little Grass Valley	14	490.17	0.135	0.067	0.202
Totals	69	4106.31	0.261	0.053	0.314

Hydro-thermographs were placed in each reach prior to the beginning of the 2001 electrofishing season. The purpose of these installations was to monitor daily mean and maximum water temperatures. The NMFS recommended temperature of 18 °C for backpack electrofishing was exceeded in 16 of the 22 index reaches during the 2001 low flow season. Mean daily temperatures all fall within allowable tolerance levels for juvenile steelhead. Severe maximum temperatures detrimental to juvenile steelhead were observed in Little Brown's, East Weaver and Rattlesnake Creeks, all of which were not electrofished this year. All thermal/flow impaired units were visited several times during the season and no steelhead mortality was ever observed. However, during these periods of low flow, larger juvenile steelhead were often observed utilizing deep stagnant pools, again with no observed mortality.

Table 5. Thermograph Data – Trinity River tributaries, August 1, 2001- September 30, 2001

Creek	Reach	Mean Temperatures (°C)			Extreme Temperatures (°C)	
		Daily	Minimum	Maximum	Minimum	Maximum
Big Creek	1	13.61	12.09	15.37	9.17	18.42
Big Creek	2	13.29	12.11	14.56	8.99	17.41
Big Creek	3	13.54	12.18	14.71	8.72	17.94
EFNF	1	17.51	15.47	19.70	11.63	23.83
EFNF	2	17.47	16.18	18.69	11.99	22.53
EFNF	3	16.69	15.34	18.09	11.76	21.63
East Weaver	1	18.77	15.33	25.59	12.59	29.38
East Weaver	2	15.40	13.70	17.48	10.22	21.12
Little Browns	1	16.16	13.40	18.95	9.59	23.79
Little Browns	2	18.70	13.89	28.88	10.07	35.74*
Little Browns	3	16.32	13.40	22.44	9.46	28.57
Little Grass Valley	1	13.35	11.86	14.71	9.07	17.83
Little Grass Valley	2	12.96	11.69	14.10	9.14	16.78
Little Grass Valley	3	12.67	11.22	13.98	8.83	16.60
Potato	1	15.00	13.18	16.96	10.13	20.22
Potato	2	14.31	13.35	15.17	10.26	17.92
Rattlesnake	1	16.12	14.04	18.83	10.54	23.12
Rattlesnake	2	15.62	14.32	17.22	10.73	21.17
Rattlesnake	3	15.37	14.13	16.81	10.07	19.99
Soldier	1	14.90	13.58	16.13	10.68	19.01
Soldier	2	14.33	13.27	15.28	10.87	17.45
Soldier	3	13.75	12.75	14.63	10.70	16.79

*Extremely high water temperature probably due to thermograph de-watering

Discussion

Densities of sub-yearling and yearling and older juvenile steelhead observed during this study fall within the ranges other agencies have found within the Klamath Mountains Province (KMP) ESU. In 1999 and 2000, Oregon Department of Fish and Wildlife conducted a similar survey of juvenile steelhead in the KMP. Across the entire KMP, the mean density of presumed juvenile steelhead ranged from 0.32 to 0.96 fish/m^2 for sub-yearlings and 0.034 to 0.097 fish/m^2 for yearling and older fish (ODFW, 2001). Densities in Trinity River tributaries (also in the KMP) for juvenile steelhead ranged from 0.062 to 1.175 fish/m^2 for sub-yearlings and 0.014 to 0.187 fish/m^2 for yearling and older fish.

Observed fish density between tributaries differed greatly within the Trinity basin. In 2000, East Weaver Creek and Rattlesnake Creek show the highest densities of juvenile steelhead; unfortunately, neither of these creeks were sampled in 2001 due to low flows. In 2001, Little Brown's Creek had the lowest juvenile steelhead densities; coincidentally, Little Brown's Creek appears to have a temperature problem and a preponderance of suckers and dace. Little Grass Valley Creek had the lowest juvenile steelhead densities in 2001; this is most likely due to the creek's lack of in-stream cover, and monotypic substrate (sand). Long-term analysis of juvenile steelhead densities will include trend analysis of densities over time and use of ANOVA to examine significance of difference between creeks.

Juvenile steelhead densities were pooled to examine the utilization of pool vs. riffle habitat. For the purpose of this comparison, riffle habitat designation was further expanded to include any fast-water habitat. As expected, densities of sub-yearling and yearling and older juvenile steelhead are slightly higher in pool than riffle habitat. Additionally, mean pool densities of yearling and older juvenile steelhead are nearly double that of densities in riffles during both years. One possible explanation to the disparity between densities in pool vs. riffles is that riffles are inherently more difficult to sample. The most probable explanation is that more older juvenile fish inhabit the "preferred" habitat, i.e. the pools, while sub-yearling fish are dispersed throughout all habitat types fairly evenly.

Table 6. 2000 Trinity Index Reach Riffle Habitat Steelhead Densities.

Tributary	Number of Units (n=)	Area of riffles Sampled (m^2)	% habitat Riffle	Steelhead 0 Density (per m^2)	Steelhead 1+ Density (per m^2)	Total Juv. Steelhead Density (per m^2)
Little Brown's	7	359.76	47.4	0.322	0.056	0.378
EFNF Trinity	7	982.07	63.3	0.089	0.031	0.120
Potato	6	291.46	65.0	0.347	0.007	0.354
Soldier	8	469.59	66.0	0.190	0.072	0.262
Big	5	436.31	40.4	0.250	0.048	0.298
Rattlesnake	7	252.57	30.5	0.519	0.048	0.567
East Weaver	7	543.24	87.9	0.486	0.050	0.536
Totals	47	3335.0	55.6	0.269	0.044	0.313

Table 7. 2000 Trinity Index Reach Pool Habitat Steelhead Densities

Tributary	Number of Units (n=)	Area of Pools Sampled (m^2)	% habitat Pool	Steelhead 0 Density (per m^2)	Steelhead 1+ Density (per m^2)	Total Juv. Steelhead Density (per m^2)
Little Brown's	7	399.12	52.6	0.140	0.080	0.220

EFNF Trinity	5	568.21	36.7	0.151	0.044	0.195
Potato	6	157.04	35.0	0.318	0.057	0.375
Soldier	10	241.61	34.0	0.286	0.149	0.435
Big	9	642.89	59.6	0.317	0.067	0.384
Rattlesnake	10	575.49	69.5	0.754	0.111	0.865
East Weaver	3	74.44	12.1	1.102	0.188	1.290
Totals	50	2658.8	44.4	0.368	0.084	0.452

Table 8. 2001 Trinity Index Reach Riffle Habitat Steelhead Densities

Tributary	Number of Units (n=)	Area of riffles Sampled (m^2)	% habitat Riffle	Steelhead 0 Density (per m^2)	Steelhead 1+ Density (per m^2)	Total Juv. Steelhead Density (per m^2)
EFNF Trinity	7	994.18	64.2	0.205	0.033	0.238
Potato	5	271.56	55.3	0.339	0.022	0.361
Soldier	8	359.39	63.2	0.390	0.053	0.442
Big	5	414.81	41.1	0.198	0.046	0.243
Little Grass Valley	7	247.78	50.5	0.170	0.052	0.222
Totals	32	2287.71	55.7	0.245	0.039	0.284

Table 9. 2001 Trinity Index Reach Pool Habitat Steelhead Densities

Tributary	Number of Units (n=)	Area of Pools Sampled (m^2)	% habitat Pool	Steelhead 0 Density (per m^2)	Steelhead 1+ Density (per m^2)	Total Juv. Steelhead Density (per m^2)
EFNF Trinity	5	552.68	35.6	0.284	0.043	0.327
Potato	6	219.23	44.7	0.506	0.119	0.625
Soldier	10	209.66	36.8	0.553	0.091	0.644
Big	8	594.33	58.9	0.185	0.066	0.251
Little Grass Valley	7	242.39	49.5	0.099	0.083	0.182
Totals	36	1818.29	44.3	0.281	0.070	0.351

This study samples from a universe of all anadromous tributaries of the Trinity River, 4th order and smaller, upstream of the New River, including the entire South Fork Trinity River basin. ODFW, along with several other agencies studying steelhead over-summering habitat, only include 1st-3rd order streams in their sampling universe. I felt it was important to include larger streams as there is a pronounced migration of juvenile fish to deeper holding habitat during low flow periods. During the summer, in several larger tributaries within the basin I have observed what appeared to be significantly high densities of juvenile steelhead occupying every riffle and pool tail-out. The East Fork of the North Fork ranges from 3rd -5th stream order and was included when electrofishing proved plausible. Canyon Creek, another 3rd-5th order stream was selected but deemed unfeasible due to higher flows.

It is important to recognize possible sources of biases that result from the elimination of certain possible portions of the sampling universe. All inaccessible streams or portions of streams have been removed from the sampling universe, these include all streams that are not within one mile of driving access. Most of the area eliminated by access is wilderness area, specifically a large majority of the North Fork basin, which is generally recognized as the most pristine of the entire basin. Also eliminated from the sampling universe is a the private property where access has been denied to the Department.

Several assumptions must be met when using a depletion removal electrofishing model. No fish must be able to immigrate/emigrate to/from the unit, thus the use of block nets. Sampling effort should be equal between passes, hence the passes are timed and approximately equal effort is used between each pass. Finally, there must be equal sampling probability within each species and age class that is expanded separately. It is important to recognize that some inequity in effort does exist within this study, but is minimized whenever possible. Different people operating the electrofisher have different skill levels, as well as different abilities to communicate. This is why we only change electrofishers between units and not within them. Another possible source of variation in effort is lack of power equalization. Whenever a crew fails to gain positive electrical response from a fish, the generally tendency is to "turn up the juice;" it is important to always keep the same electrofisher setting for the entire habitat unit, for all three passes. Yet another source of variation in equality of effort is density of cover (i.e. large woody debris, boulders, overhanging vegetation), which tends to complicate electrofishing. Whenever possible, excessive cover was held back by a third-party crew member while electrofishing. Excessive vegetation was never removed, as cover is an important component of fish habitat.

Possible safety concerns exist, both to person and wildlife, when electricity is used in connection with water. All personnel have been CPR and First Aid certified, and made aware of the dangers of electricity, prior to the field season. Excessive mortality to fish can result from either the excessive use of power or time when electrofishing. Aside from mortality, "over-shocking" is apparent by the appearance of bruising, back deformities, and increased recovery times. Mortality was minimal throughout both seasons of this study (2.4% in 2000, and 3.02% in 2001) and only a problem with one crew member (source of most mortality). During the 2000 season, we frequently electrofished at frequencies of 50-60 mHz. In 2001, we changed our protocol to use only frequencies from 30-40 mHz, in an attempt to reduce mortality. However, mortality between years of sampling increased by 0.52%. One possible explanation to increased mortality could be the critically dry water year; fish get shocked harder when there is a lesser volume of water to power relationship. Another possible explanation could be the change in shape and size of the electrical field (with less power) and how it relates to severity of fish response and the amount of time it takes to net a fish. High frequencies elicit a greater response from the fish, therefore making the fish easier to net, eliminating additional mortality due to over-shocking and smashing.

Temperature plays an important role in fish abundance, migration and our ability to electrofish. NMFS backpack electrofishing guidelines state that no one should electrofish in water that is expected to exceed 18 °C during that sampling day (NMFS, 1998). This upper limit for backpack electrofishing was exceeded in 16 of the 22 index reaches during the 2001 low flow season. During the 2000 season, we used an upper limit to electrofish of 20°C, and only one day of electrofishing had to be postponed, on Little Brown's Creek. In 2001, we changed our upper limit to 18 °C, and again were lucky to have to cancel only one day of electrofishing, again on Little Brown's Creek. Later in the season additional thermal/low flow problems became apparent on Little Brown's, East Weaver, and Rattlesnake Creeks, all of which were not electrofished in 2001 to minimize the risk to juvenile steelhead stocks.

Regression analysis of fish density versus temperature was examined by comparing reach densities to their corresponding thermograph summaries. The only correlation discovered existed between older juvenile steelhead (yearling+) and maximum and mean daily temperature. There was a weak to moderate correlation ($R^2=0.35$) between daily mean temperature and yearling and older steelhead density. There was also a moderate correlation ($R^2=0.39$) between seasonal maximum temperature and yearling+ steelhead density.

De-watering of index reaches in critically dry years appears to be a major problem in the Trinity basin, especially in more highly populated areas such as Weaverville. It is nearly impossible to tell if a creek should have surface flow or if it is being over-diverted by local citizens. Diversion law is enforced by the Department, further complicating any private landowner relationships if we were to "turn in" the offending over-diverters.

Recommendations

I have several recommendations that I feel will improve and focus our efforts to monitor over-summering juvenile steelhead.

More index reaches need to be selected and sampled to increase the power of possible conclusions. At present only 22 index reaches are sampled on a annual basis. A properly trained and staffed field crew should be able to sample approximately 40 reaches per season, weather and water-year permitting. I propose selecting, at the minimum, an additional nine reaches for next year.

A more statistically sound sample selection process should be developed. A simple random sample was selected over a systematic random sample because of lack of a developed sampling universe, lack of private property permission, and lack of knowledge regarding project feasibility. Once a more accurate and plausible sampling universe is developed, systematic random samples can be drawn at the proper scale a statistician deems necessary.

The sampling universe of all anadromous habitat available to steelhead in the Trinity basin needs to be expanded and ground-truthed. Many tributaries in the Trinity basin are in federal ownership (USFS or BLM), but a substantial portion still lies within private ownership. Most tributaries on federal lands have semi-current surveys, but most private land has never been surveyed. Currently, we estimate anadromous river mileage by gradient. Agreements need to be made with private landowners to survey possible steelhead tributaries. Additionally, past surveys need to be re-examined for validity of migrational barriers. Many structures previously classified as barriers are no longer considered barriers to fish passage. Debris jams have most likely moved, and small cascades we now know fish can navigate.

Finally, I would like to propose that we consider expanding our sampling effort on index reach tributaries to include downstream migrant trapping and possibly spawning surveys. Downstream migrant trapping could be used to both quantify out-migrants and examine in conjunction with a mark-recapture protocol, to what extent juvenile steelhead are leaving smaller tributary systems to over-summer in cool deep 4^{th} and 5^{th} order tributaries. Spawning surveys could possibly be used to correlate redd numbers with the next year's sub-yearling densities and eventually out-migrant production.

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Appendix 1: Individual Habitat Unit Catch Statistics 2000
Big Creek, 2000 – sub-yearling steelhead (0)

Reach	Unit #	habitat type	Pass 1	Pass 2	Pass 3	Total	Estimate	SE	Conf. Int.	Capture P	Density per m^2
1	1	MCP	17	14	9	40	60	19.309	40, 99	0.303	0.502512
1	2	LGR	23	15	6	44	50	5.361	44, 61	0.4944	0.268966
1	3	MCP	10	6	5	21	27	7.711	21, 43	0.3818	0.347508
1	4	HGR	16	4	1	21	21	0.567	21, 22	0.7778	0.478948
2	1	TRP	20	10	4	34	36	2.665	34, 41	0.5862	0.410238
2	2	MCP	12	8	7	27	40	15.354	27, 71	0.3068	0.807922
2	3	HGR	11	4	4	19	21	3.109	19,	0.5135	0.218983

									27		
2	4	MCP	3	2	2	7	8	2.993	7, 15	0.4375	0.08993
3	1	MCP	5	0	0	5	5	0	5, 5	0	0.148609
3	2	LGR	1	1	0	2	2	0.384	2, 7	0.6667	0.096168
3	3	MCP	4	1	0	5	5	0.168	5, 5	0.8333	0.107182
3	4	STP	9	1	1	11	11	0.384	11, 12	0.7857	0.140238
3	5	LGR	7	5	2	14	15	2.274	14, 20	0.5385	0.166899
3	6	LSP	8	1	3	12	12	1.172	12, 15	0.6316	0.197238
Total						262	313	15.529	277, 339	0.4679	0.290028

Big Creek, 2000 – yearling + steelhead (1+)

Reach	Unit #	hab type	Pass 1	Pass 2	Pass 3	Total	Estimate	SE	Conf. Int.	Capture P	Density per m^2
1	1	MCP	4	1	2	7	7	1.195	7, 10	0.5833	0.058626
1	2	LGR	6	0	0	6	6	0	6, 6	0	0.032276
1	3	MCP	3	1	2	6	6	1.381	6, 10	0.5455	0.077224
1	4	HGR	0	0	1	1	1	0	1, 1	0	0.022807
2	1	TRP	1	0	0	1	1	0	1, 1	0	0.011395
2	2	MCP	5	2	2	9	9	1.228	9, 12	0.6	0.181782
2	3	HGR	1	0	0	1	1	0	1, 1	0	0.010428
2	4	MCP	3	0	0	3	3	0	3, 3	0	0.033724
3	1	MCP	1	1	0	2	2	0.384	2, 7	0.6667	0.059444
3	2	LGR	5	1	1	7	7	0.578	7, 8	0.7	0.336589
3	3	MCP	6	2	0	8	8	0.29	8, 9	0.8	0.171491
3	4	STP	3	0	0	3	3	0	3, 3	0	0.038247
3	5	LGR	6	0	0	6	6	0	6, 6	0	0.066759
3	6	LSP	1	2	1	4	4	1.468	4, 9	0.5	0.065746
		totals	45	10	9	64	67	2.734	64, 72	0.6337	0.062083

Rattlesnake Creek, 2000 – sub-yearling steelhead (0)

Reach	Unit #	hab type	Pass 1	Pass 2	Pass 3	Total	Estimate	SE	Conf. Int.	Capture P	Density per m^2
1	1	MCP	18	14	2	34	36	2.665	34, 41	0.5862	0.363035
1	2	LGR	16	4	2	22	22	0.814	22, 24	0.7333	0.296493
1	3	MCP	30	11	3	44	45	1.593	44, 48	0.6875	0.454151
1	4	LGR	9	5	2	16	17	1.997	16, 21	0.5714	0.33239
1	5	MCP	18	3	3	24	24	0.887	24, 26	0.7273	0.466589
2	1	LGR	6	3	0	9	9	0.461	9, 10	0.75	0.346768
2	2	MCP	20	24	7	51	69	14.456	51, 98	0.3566	0.781796
2	3	MCP	23	11	6	40	44	4.012	40, 52	0.5333	1.315765
2	4	MCP	36	25	8	69	78	6.345	69, 91	0.5036	1.985612
2	5	LGR	29	6	4	39	39	1.064	39, 41	0.7358	2.357603
3	1	LGR	6	6	1	13	14	2.156	13, 19	0.5417	1.388334
3	2	MCP	13	2	4	19	20	1.899	19, 24	0.5938	0.790731
3	3	MCP	29	10	8	47	51	3.854	47, 59	0.5529	0.746487
3	4	LGR	9	3	3	15	16	2.126	15, 21	0.5556	0.44254
3	5	MCP	11	7	6	24	33	10.934	24, 55	0.3429	0.911749
3	6	LGR	9	4	1	14	14	0.818	14, 16	0.7	0.363705
3	7	MCP	22	7	4	33	34	1.793	33, 38	0.6471	0.971121
	Totals		304	145	64	513	565	13.914	541, 595	0.5394	0.682317

Rattlesnake Creek, 2000 – yearling + steelhead (1+)

Reach	Unit #	hab type	Pass 1	Pass 2	Pass 3	Total	Estimate	SE	Conf. Int.	Capture P	Density per m^2
1	1	MCP	2	0	1	3	3	0.709	3, 6	0.6	0.030253
1	2	LGR	6	0	0	6	6	0	6, 6	0	0.080862
1	3	MCP	2	3	0	5	5	0.787	5, 7	0.625	0.050461
1	4	LGR	1	1	0	2	2	0.384	2, 7	0.6667	0.039105
1	5	MCP	1	0	0	1	1	0	1, 1	0	0.019441
2	1	LGR	0	0	0	0	0	0	0,	0	0

									0		
2	2	MCP	9	1	2	12	12	0.728	12, 14	0.7059	0.135965
2	3	MCP	4	0	1	5	5	0.444	5, 6	0.7143	0.149519
2	4	MCP	15	3	1	19	19	0.481	19, 20	0.7917	0.483675
2	5	LGR	2	0	0	2	2	0	2, 2	0	0.120903
3	1	LGR	1	0	0	1	1	0	1, 1	0	0.099167
3	2	MCP	4	0	1	5	5	0.444	5, 6	0.7143	0.197683
3	3	MCP	7	2	1	10	10	0.627	10, 11	0.7143	0.14637
3	4	LGR	0	0	0	0	0	0	0, 0	0	0
3	5	MCP	4	0	0	4	4	0	4, 4	0	0.110515
3	6	LGR	0	1	0	1	1	0	1, 1	0	0.025979
3	7	MCP	0	0	0	0	0	0	0, 0	0	0
		Totals	58	11	7	76	76	1.55	76, 80	0.7308	0.091781

Soldier Creek, 2000 – sub-yearling steelhead (0)

Reach	Unit #	hab type	Pass 1	Pass 2	Pass 3	Total	Estimate	SE	Conf. Int.	Capture P	Density per m^2
1	1	MCP	5	2	1	8	8	0.769	8, 10	0.6667	0.406
1	2	LSP	1	3	2	6	18	57.638	6, 140	0.1224	0.612
1	3	LGR	12	6	1	19	19	0.929	19, 21	0.7037	0.160
1	4	HGR	7	1	1	9	9	0.461	9, 10	0.75	0.388
1	5	MCP	3	1	1	5	5	0.787	5, 7	0.625	0.179
2	1	MCP	1	5	1	7	11	10.572	7, 35	0.2692	0.572
2	2	LGR	3	2	0	5	5	0.444	5, 6	0.7143	0.171
2	3	MCP	4	2	0	6	6	0.376	6, 7	0.75	0.389
2	4	LGR	6	1	0	7	7	0.124	7, 7	0.875	0.169
2	5	MCP	3	0	3	6	8	5.733	6, 22	0.3333	0.221
2	6	LGR	2	2	1	5	5	1.189	5, 8	0.5556	0.148

2	7	MCP	3	1	1	5	5	0.787	5, 7	0.625	2.168
3	1	LGR	11	2	1	14	14	0.463	14, 15	0.7778	0.304
3	2	MCP	3	1	0	4	4	0.205	4, 5	0.8	0.131
3	3	HGR	7	1	5	13	18	8.599	13, 36	0.3333	0.275
3	4	PP	1	1	0	2	2	0.384	2, 7	0.6667	0.052
3	5	MCP	2	0	0	2	2	0	2, 2	0	0.090
3	6	HGR	9	3	0	12	12	0.355	12, 13	0.8	0.107
		Totals	83	34	18	135	147	6.274	135, 159	0.5602	0.207

Rattlesnake Creek, 2000 – yearling + steelhead (1+)

Reach	Unit #	hab type	Pass 1	Pass 2	Pass 3	Total	Estimate	SE	Conf. Int.	Capture P	Density per m^2
1	1	MCP	3	0	1	4	4	0.544	4, 6	0.6667	0.203
1	2	LSP	3	0	2	5	5	1.189	5, 8	0.5556	0.170
1	3	LGR	3	1	0	4	4	0.205	4, 5	0.8	0.034
1	4	HGR	4	1	0	5	5	0.168	5, 5	0.8333	0.216
1	5	MCP	1	1	0	2	2	0.384	2, 7	0.6667	0.072
2	1	MCP	1	2	0	3	3	0.709	3, 6	0.6	0.156
2	2	LGR	2	0	0	2	2	0	2, 2	0	0.068
2	3	MCP	4	0	0	4	4	0	4, 4	0	0.260
2	4	LGR	2	2	0	4	4	0.544	4, 6	0.6667	0.096
2	5	MCP	1	0	2	3	5	9.677	3, 32	0.2308	0.138
2	6	LGR	0	0	0	0	0	0	0, 0	0	0.000
2	7	MCP	3	0	1	4	4	0.544	4, 6	0.6667	1.735
3	1	LGR	3	0	0	3	3	0	3, 3	0	0.065
3	2	MCP	0	1	0	1	1	0	1, 1	0	0.033
3	3	HGR	5	3	2	10	11	2.434	10, 16	0.5	0.168
3	4	PP	2	3	1	6	6	1.381	6, 10	0.5455	0.156
3	5	MCP	1	1	0	2	2	0.384	2,	0.6667	0.090

									7		
3	6	HGR	3	1	1	5	5	0.787	5, 7	0.625	0.045
		Totals	207	84	46	337	73	4.591	67, 82	0.5537	0.103

Potato Creek, 2000 – sub-yearling steelhead (0)

Reach	Unit #	hab type	Pass 1	Pass 2	Pass 3	Total	Estimate	SE	Conf. Int.	Capture P	Density per m^2
1	1	LGR	7	3	6	16	31	28.722	16, 90	0.2105	0.360653
1	2	MCP	6	3	3	12	14	3.8	12, 22	0.4444	0.435625
1	3	LGR	4	2	0	6	6	0.376	6, 7	0.75	0.331647
1	4	MCP	0	0	0	0	0	0	0, 0	0	0
1	5	HGR	5	3	1	9	9	0.947	9, 11	0.6429	0.27456
1	6	MCP	3	7	4	14	21	0	0, 0	0	0.702883
2	7	LGR	10	3	4	17	19	3.199	17, 26	0.5	0.439807
2	8	MCP	4	2	0	6	6	0.376	6, 7	0.75	0.289061
2	9	LGR	6	0	1	7	7	0.327	7, 8	0.7778	0.163105
2	10	PP	2	0	0	2	2	0	2, 2	0	0.075811
2	11	HGR	12	5	6	23	29	7.295	23, 44	0.3966	0.423243
2	12	MCP	6	0	1	7	7	0.327	7, 8	0.7778	0.257549
		totals	65	28	26	119	151	14.634	119, 177	0.4161	0.336675

Potato Creek, 2000 – yearling + steelhead (1+)

Reach	Unit #	hab type	Pass 1	Pass 2	Pass 3	Total	Estimate	SE	Conf. Int.	Capture P	Density per m^2
1	1	LGR	0	0	0	0	0	0	0, 0	0	0
1	2	MCP	0	0	0	0	0	0	0, 0	0	0
1	3	LGR	0	0	0	0	0	0	0, 0	0	0
1	4	MCP	2	0	0	2	2	0	2, 2	0	0.096578
1	5	HGR	0	0	0	0	0	0	0, 0	0	0
1	6	MCP	1	0	0	1	1	0	1,	0	0.033471

									1		
2	7	LGR	0	0	0	0	0	0	0, 0	0	0
2	8	MCP	3	0	0	3	3	0	3, 3	0	0.144531
2	9	LGR	1	0	0	1	1	0	1, 1	0	0.023301
2	10	PP	1	1	1	3	3	1.271	3, 8	0.5	0.113717
2	11	HGR	0	1	0	1	1	0	1, 1	0	0.014595
2	12	MCP	0	0	0	0	0	0	0, 0	0	0
		totals	8	2	1	11	11	0.575	11, 12	0.7333	0.024526

EFNF Trinity, 2000 – sub-yearling steelhead (0)

Reach	Unit #	hab type	Pass 1	Pass 2	Pass 3	Total	Estimate	SE	Conf. Int.	Capture P	Density per m^2
1	1	LGR	0	0	0	0	0	0	0	0	0.000
1	2	MCP	5	2	2	9	9	1.228	9, 12	0.6	0.179
1	3	LGR	12	11	4	27	33	6.673	27, 47	0.4219	0.076
1	4	MCP	14	3	5	22	24	2.908	22, 30	0.5366	1.527
2	1	LGR	4	1	3	8	10	4.718	8, 21	0.381	0.074
2	2	MCP	11	6	2	19	20	1.899	19, 24	0.5938	0.117
2	3	MCP	8	1	1	10	10	0.419	10, 11	0.7692	0.058
2	4	LGR	13	3	2	18	18	0.809	18, 20	0.72	0.189
3	1	LGR	5	2	0	7	7	0.327	7, 8	0.7778	0.137
3	2	RUN	10	3	1	14	14	0.633	14, 15	0.7368	0.096
3	3	MCP	13	7	2	22	23	1.836	22, 27	0.6111	0.145
3	4	LGR	3	1	1	5	5	0.787	5, 7	0.625	0.053
		Totals	98	40	23	161	173	7.487	162, 192	0.5458	0.112

EFNF Trinity, 2000 – yearling + steelhead (1+)

Reach	Unit #	hab type	Pass 1	Pass 2	Pass 3	Total	Estimate	SE	Conf. Int.	Capture P	Density per m^2
1	1	LGR	0	0	0	0	0	0	0	0	0.000

1	2	MCP	4	1	0	5	5	0.168	5, 5	0.8333	0.100
1	3	LGR	5	3	2	10	11	2.434	10, 16	0.5	0.025
1	4	MCP	2	1	1	4	4	0.969	4, 7	0.5714	0.254
2	1	LGR	2	1	0	3	3	0.266	3, 4	0.75	0.022
2	2	MCP	2	0	0	2	2	0	2, 2	0	0.012
2	3	MCP	2	1	0	3	3	0.266	3, 4	0.75	0.017
2	4	LGR	2	0	0	2	2	0	2, 2	0	0.021
3	1	LGR	2	0	1	3	3	0.709	3, 6	0.6	0.059
3	2	RUN	7	0	0	7	7	0	7, 7	0	0.048
3	3	MCP	11	0	0	11	11	0	11, 11	0	0.069
3	4	LGR	3	1	0	4	4	0.205	4, 5	0.8	0.043
		Totals	42	8	4	54	54	0.956	54, 56	0.7714	0.035

Little Brown's Creek, 2000 – sub-yearling steelhead (0)

Reach	Unit #	hab type	Pass 1	Pass 2	Pass 3	Total	Estimate	SE	Conf. Int.	Capture P	Density per m^2
1	1	LGR	1	0	0	1	1	0	1, 1	0	0.024
1	2	MCP	5	1	0	6	6	0.142	6, 6	0.8571	0.089
1	3	LGR	1	2	0	3	3	0.709	3, 6	0.6	0.032
1	4	MCP	0	2	1	3	5	9.677	3, 32	0.2308	0.111
1	5	LGR	1	1	1	3	3	1.271	3, 8	0.5	0.069
2	1	MCP	0	2	1	3	5	9.677	3, 32	0.2308	0.056
2	2	STP	0	0	1	1	1	0	1, 1	0	0.080
2	3	HGR	1	5	1	7	11	10.572	7, 35	0.2692	0.394
2	4	LGR	4	2	1	7	7	0.869	7, 9	0.6364	0.099
3	1	MCP	9	2	1	12	12	0.532	12, 13	0.75	0.135
3	2	LGR	13	7	11	31	77	77.769	31, 232	0.1566	6.153
3	3	MCP	3	3	1	7	7	1.195	7, 10	0.5833	0.251

3	4	LGR	9	4	1	14	14	0.818	14, 16	0.7	0.198
3	5	MCP	4	2	4	10	20	25.403	10, 73	0.2	0.293
		totals	51	33	24	108	153	25.071	108, 203	0.3333	0.202

Little Brown's Creek, 2000 – yearling + steelhead (1+)

Reach	Unit #	hab type	Pass 1	Pass 2	Pass 3	Total	Estimate	SE	Conf. Int.	Capture P	Density per m^2
1	1	LGR	0	0	0	0	0	0	0, 0	0	0.000
1	2	MCP	3	2	1	6	6	1.002	6, 9	0.6	0.089
1	3	LGR	1	0	0	1	1	0	1, 1	0	0.011
1	4	MCP	3	0	0	3	3	0	3, 3	0	0.067
1	5	LGR	0	1	0	1	1	0	1, 1	0	0.023
2	1	MCP	2	3	2	7	11	10.572	7, 35	0.2692	0.124
2	2	STP	2	0	0	2	2	0	2, 2	0	0.160
2	3	HGR	3	4	1	8	9	2.612	8, 15	0.4706	0.322
2	4	LGR	2	1	0	3	3	0.266	3, 4	0.75	0.042
3	1	MCP	2	2	0	4	4	0.544	4, 6	0.6667	0.045
3	2	LGR	4	0	2	6	6	1.002	6, 9	0.6	0.479
3	3	MCP	2	1	0	3	3	0.266	3, 4	0.75	0.107
3	4	LGR	0	0	0	0	0	0	0, 0	0	0.000
3	5	MCP	1	2	0	3	3	0.709	3, 6	0.6	0.044
		totals	25	16	6	47	53	5.178	47, 63	0.5054	0.070

East Weaver Creek, 2000 – sub-yearling steelhead (0)

Reach	Unit #	hab type	Pass 1	Pass 2	Pass 3	Total	Estimate	SE	Conf. Int.	Capture P	Density per m^2
1	1	RUN	42	18	9	69	75	4.46	69, 84	0.561	0.780021
1	2	LGR	30	23	14	67	95	19.974	67, 135	0.3317	0.35232
1	3	MCP	2	5	3	10	49	226.785	10, 505	0.0725	1.155639
1	4	LGR	4	2	2	8	9	2.612	8, 15	0.4706	0.285788

2	1	LGR	18	10	7	35	42	6.858	35, 56	0.4375	1.062828
2	2	MCP	11	5	3	19	20	2.112	19, 24	0.5758	0.914269
2	3	HGR	9	9	1	19	20	2.112	19, 24	0.5758	0.802617
2	4	PP	9	1	3	13	13	1.088	13, 15	0.65	1.278586
2	5	LGR	12	1	4	17	17	1.215	17, 20	0.6538	0.249145
2	5.1	SC	2	1	2	5	6	3.572	5, 15	0.3846	0.451627
		totals	139	75	48	262	346	20.166	282, 362	0.4274	0.560158

East Weaver Creek, 2000 – yearling + steelhead (1+)

Reach	Unit #	hab type	Pass 1	Pass 2	Pass 3	Total	Estimate	SE	Conf. Int.	Capture P	Density per m^2
1	1	RUN	1	2	0	3	3	0.709	3, 6	0.6	0.031201
1	2	LGR	9	3	1	13	13	0.677	13, 14	0.7222	0.048212
1	3	MCP	4	3	2	9	10	2.704	9, 16	0.4737	0.235845
1	4	LGR	0	1	0	1	1	0	1, 1	0	0.031754
2	1	LGR	1	0	1	2	2	1.038	2, 15	0.5	0.050611
2	2	MCP	4	0	0	4	4	0	4, 4	0	0.182854
2	3	HGR	3	2	0	5	5	0.444	5, 6	0.7143	0.200654
2	4	PP	0	0	0	0	0	0	0, 0	0	0
2	5	LGR	1	1	1	3	3	1.271	3, 8	0.5	0.043967
2	5.1	SC	0	0	0	0	0	0	0, 0	0	0

Appendix 2: Individual Habitat Unit Catch Statistics 2001

Little Grass Valley Creek, 2001 – sub-yearling steelhead (0)

Reach	Unit #	hab type	Pass 1	Pass 2	Pass 3	Total	Estimate	SE	Conf. Int.	Capture P	Density per m^2
1	1	MCP	1	1	0	2	2	0.384	2, 7	0.6667	0.088518
1	2	HGR	1	0	0	1	1	0	1, 1	0	0.040405
1	3		1	1	0	2	2	0.384	2,	0.6667	0.022554

		RUN							7		
1	4	LGR	1	3	0	4	4	0.969	4, 7	0.5714	0.136165
2	1	MCP	4	1	2	7	7	1.195	7, 10	0.5833	0.246796
2	2	LGR	3	0	0	3	3	0	3, 3	0	0.16375
2	3	STP	2	3	1	6	6	1.381	6, 10	0.5455	0.088591
2	4	LGR	2	2	3	7	24	84.852	7, 200	0.1061	0.745547
3	1	MCP	1	0	0	1	1	0	1, 1	0	0.085836
3	2	LGR	2	1	2	5	6	3.572	5, 15	0.3846	0.171217
3	3	MCP	1	1	0	2	2	0.384	2, 7	0.6667	0.118479
3	4	STP	0	1	1	2	2	1.876	2, 26	0.4	0.02875
3	5	LGR	2	0	0	2	2	0	2, 2	0	0.102954
3	6	MCP	1	2	1	4	4	1.468	4, 9	0.5	0.156224
							66	14.13	48, 93	0.3556	0.134647

Little Grass Valley Creek, 2001 – yearling + steelhead (1+)

Reach	Unit #	hab type	Pass 1	Pass 2	Pass 3	Total	Estimate	SE	Conf. Int.	Capture P	Density per m^2
1	1	MCP	2	1	0	3	3	0.266	3, 4	0.75	0.132778
1	2	HGR	1	0	1	2	2	1.038	2, 15	0.5	0.08081
1	3	RUN	5	0	0	5	5	0	5, 5	0	0.056385
1	4	LGR	1	0	0	1	1	0	1, 1	0	0.034041
2	1	MCP	1	0	0	1	1	0	1, 1	0	0.035257
2	2	LGR	1	0	1	2	2	1.038	2, 15	0.5	0.109167
2	3	STP	5	0	1	6	6	0.376	6, 7	0.75	0.088591
2	4	LGR	2	0	0	2	2	0	2, 2	0	0.062129
3	1	MCP	1	0	0	1	1	0	1, 1	0	0.085836
3	2	LGR	1	0	0	1	1	0	1, 1	0	0.028536
3	3	MCP	0	2	0	2	2	1.038	2, 15	0.5	0.118479
3	4	STP	5	0	0	5	5	0	5, 5	0	0.071874

3	5	LGR	0	0	0	0	0	0	0, 0	0	0
3	6	MCP	2	0	0	2	2	0	2, 2	0	0.078112
							33	0.666	33, 34	0.7857	0.067324

Big Creek, 2001 – sub-yearling steelhead (0)

Reach	Unit #	hab type	Pass 1	Pass 2	Pass 3	Total	Estimate	SE	Conf. Int.	Capture P	Density per m^2
1	1	MCP	20	10	1	31	31	1.055	31, 33	0.7209	0.225276
1	2	LGR	31	12	3	46	47	1.638	46, 50	0.6866	0.232748
1	3	MCP	17	8	3	28	29	1.928	28, 33	0.6222	0.362419
1	4	HGR	10	0	1	11	11	0.218	11, 11	0.8462	0.255403
2	1	LSP	4	2	2	8	9	2.612	8, 15	0.4706	0.085882
2	2	MCP	2	2	2	6	8	5.733	6, 22	0.3333	0.146831
2	3	HGR	6	4	3	13	16	5.107	13, 27	0.4063	0.149498
2	4	MCP	4	3	1	8	8	1.056	8, 10	0.6154	0.107263
3	1	MCP	4	4	1	9	9	1.228	9, 12	0.6	0.248015
3	2	LGR	2	1	1	4	4	0.969	4, 7	0.5714	0.190747
3	3	MCP	4	1	0	5	5	0.168	5, 5	0.8333	0.122707
3	4	LGR	1	2	1	4	4	1.468	4, 9	0.5	0.095679
3	5	STP	6	4	1	11	11	1.02	11, 13	0.6471	0.16714
		totals					192	7.066	186, 214	0.5662	0.19026

Big Creek, 2001 – yearling + steelhead (1+)

Reach	Unit #	hab type	Pass 1	Pass 2	Pass 3	Total	Estimate	SE	Conf. Int.	Capture P	Density per m^2
1	1	MCP	6	4	0	10	10	0.627	10, 11	0.7143	0.07267
1	2	LGR	5	3	0	8	8	0.512	8, 9	0.7273	0.039617
1	3	MCP	9	2	0	11	11	0.218	11, 11	0.8462	0.137469
1	4	HGR	0	0	1	1	1	0	1, 1	0	0.023218
2	1	LSP	2	4	0	6	6	1.002	6,	0.6	0.057254

									9		
2	2	MCP	3	0	0	3	3	0	3, 3	0	0.055062
2	3	HGR	5	1	0	6	6	0.142	6, 6	0.8571	0.056062
2	4	MCP	2	0	0	2	2	0	2, 2	0	0.026816
3	1	MCP	0	0	0	0	0	0	0, 0	0	0
3	2	LGR	1	1	1	3	3	1.271	3, 8	0.5	0.14306
3	3	MCP	3	1	0	4	4	0.205	4, 5	0.8	0.098165
3	4	LGR	1	0	0	1	1	0	1, 1	0	0.02392
3	5	STP	3	0	0	3	3	0	3, 3	0	0.045584
		totals					59	1.505	58, 62	0.716	0.058465

Soldier Creek, 2001 – sub-yearling steelhead (0)

Reach	Unit #	hab type	Pass 1	Pass 2	Pass 3	Total	Estimate	SE	Conf. Int.	Capture P	Density per M^2
1	1	MCP	5	1	3	9	10	2.704	9, 16	0.4737	0.664435
1	2	LSP	1	3	2	6	18	57.638	6, 140	0.1224	0.842387
1	3	LGR	23	9	8	40	46	5.528	40, 57	0.4819	0.592269
1	4	HGR	6	2	1	9	9	0.69	9, 11	0.6923	0.331195
1	5	MCP	6	1	3	10	11	2.434	10, 16	0.5	0.433708
2	1	MCP	3	2	3	8	13	12.52	8, 40	0.2581	0.726909
2	2	LGR	4	4	1	9	9	1.228	9, 12	0.6	0.346599
2	3	MCP	2	3	1	6	6	1.381	6, 10	0.5455	0.434903
2	4	LGR	4	4	3	11	16	9.797	11, 37	0.3056	0.384423
2	5	MCP	6	2	1	9	9	0.69	9, 11	0.6923	0.33637
2	6	LGR	6	0	1	7	7	0.327	7, 8	0.7778	0.209297
2	7	MCP	12	0	3	15	15	0.768	15, 17	0.7143	0.442956
3	1	LGR	4	2	4	10	20	25.403	10, 73	0.2	0.476804
3	2	MCP	8	5	2	15	16	2.126	15, 21	0.5556	0.924431
3	3	SRN	13	5	3	21	22	1.919	21, 26	0.6	0.320352

3	4	P.P.	7	0	0	7	7	0	7, 7	0	0.268329
3	5	MCP	6	1	0	7	11	1.02	11, 13	0.6471	0.903144
3	6	HGR	6	4	1	11	11	1.02	11, 13	0.6471	0.256448
		totals					256	14.92	225, 283	0.4582	0.449877

Soldier Creek, 2001 – yearling + steelhead (1+)

Reach	Unit #	hab type	Pass 1	Pass 2	Pass 3	Total	Estimate	SE	Conf. Int.	Capture P	Density per M^2
1	1	MCP	2	1	0	3	3	0.266	3, 4	0.75	0.19933
1	2	LSP	0	0	0	0	0	0	0, 0	0	0
1	3	LGR	3	0	0	3	3	0	3, 3	0	0.038626
1	4	HGR	1	0	0	1	1	0	1, 1	0	0.036799
1	5	MCP	1	0	0	1	1	0	1, 1	0	0.039428
2	1	MCP	3	0	0	3	3	0	3, 3	0	0.167748
2	2	LGR	2	1	0	3	3	0.266	3, 4	0.75	0.115533
2	3	MCP	1	0	0	1	1	0	1, 1	0	0.072484
2	4	LGR	1	0	0	1	1	0	1, 1	0	0.024026
2	5	MCP	0	1	0	1	1	0	1, 1	0	0.037374
2	6	LGR	0	0	1	1	1	0	1, 1	0	0.0299
2	7	MCP	1	1	0	2	2	0.384	2, 7	0.6667	0.059061
3	1	LGR	1	0	0	1	1	0	1, 1	0	0.02384
3	2	MCP	4	0	0	4	4	0	4, 4	0	0.231108
3	3	SRN	5	1	0	6	6	0.142	6, 6	0.8571	0.087369
3	4	P.P.	1	0	0	1	1	0	1, 1	0	0.038333
3	5	MCP	2	0	0	2	3	0	3, 3	0	0.246312
3	6	HGR	3	0	0	3	3	0	3, 3	0	0.06994
		totals					38	0.413	38, 39	0.8444	0.066779

Potato Creek, 2001 – sub-yearling steelhead (0)

Reach	Unit #	hab type	Pass 1	Pass 2	Pass 3	Total	Estimate	SE	Conf. Int.	Capture P	Density per m^2
1	1	LGR	16	6	3	25	25	1.795	25, 30	0.625	0.267571
1	2	MCP	14	5	6	25	25	4.904	25, 39	0.463	1.070645
1	3	LGR	9	3	1	13	13	0.677	13, 14	0.7222	0.526686
1	4	MCP	5	2	4	11	11	9.797	11, 37	0.3056	0.486531
1	5	HGR	3	2	1	6	6	1.002	6, 9	0.6	0.271586
1	6	MCP	25	8	6	39	39	2.62	39, 46	0.6	0.869922
2	1	LGR	15	11	5	31	31	6.235	31, 50	0.4429	0.496251
2	2	MCP	8	4	2	14	14	1.229	14, 17	0.6364	0.66975
2	3	LGP	9	0	2	11	11	0.575	11, 12	0.7333	0.214497
2	4	PP	2	2	0	4	4	0.544	4, 6	0.6667	0.144326
2	5	HGR	13	4	0	17	17	0.389	17, 18	0.8095	0.24681
2	6	MCP	1	2	4	7	7	0	0, 0	0	0.24527
		totals					203	10.994	203, 253	0.5025	0.413621

Potato Creek, 2001 – yearling + steelhead (1+)

Reach	Unit #	hab type	Pass 1	Pass 2	Pass 3	Total	Estimate	SE	Conf. Int.	Capture P	Density per m^2
1	1	LGR	0	0	0	0	0	0	0, 0	0	0
1	2	MCP	1	0	1	2	2	1.038	2, 15	0.5	0.085652
1	3	LGR	0	0	0	0	0	0	0, 0	0	0
1	4	MCP	2	0	0	2	2	0	2, 2	0	0.08846
1	5	HGR	0	0	0	0	0	0	0, 0	0	0
1	6	MCP	3	0	0	3	3	0	3, 3	0	0.066917
2	1	LGR	4	0	0	4	4	0	4, 4	0	0.064032
2	2	MCP	5	1	0	6	6	0.142	6, 6	0.8571	0.287036
2	3	LGP	2	0	0	2	2	0	2, 2	0	0.038999
2	4	PP	3	1	0	4	4	0.205	4, 5	0.8	0.144326
2	5		2	0	0	2	2	0	2,	0	0.029037

		HGR							2		
2	6	MCP	5	1	1	7	7	0.578	7, 8	0.7	0.24527
		totals					32	0.482	32, 33	0.8205	0.065201

EFNF Trinity River, 2001 – sub-yearling steelhead (0)

Reach	Unit #	hab type	Pass 1	Pass 2	Pass 3	Total	Estimate	SE	Conf. Int.	Capture P	Density per m^2
1	1	LGR	6	3	0	9	9	0.461	9, 10	0.75	0.417563
1	2	MCP	12	1	5	18	19	2.225	18, 24	0.5625	0.399439
1	3	LGR	28	9	5	42	44	2.309	42, 49	0.6269	0.13086
1	4	MCP	7	2	2	11	11	1.02	11, 13	0.6471	0.07629
2	1	LGR	9	5	1	15	15	0.955	15, 17	0.6818	0.125355
2	2	MCP	13	4	3	20	21	1.809	20, 25	0.6061	0.192211
2	3	MCP	16	8	0	24	24	0.752	24, 26	0.75	0.215816
2	4	LGR	12	2	2	16	16	0.725	16, 18	0.7273	0.15432
3	1	LGR	15	9	1	25	25	1.134	25, 27	0.6944	0.427136
3	2	RUN	25	10	4	39	41	2.337	39, 46	0.619	0.340523
3	3	MCP	42	12	16	70	82	8.069	70, 98	0.4667	0.583753
3	4	LGR	33	16	3	52	54	2.218	52, 58	0.65	0.230654
		totals					361	8.625	350, 384	0.5839	0.233375

EFNF Trinity River, 2001 – yearling + steelhead (1+)

Reach	Unit #	hab type	Pass 1	Pass 2	Pass 3	Total	Estimate	SE	Conf. Int.	Capture P	Density per m^2
1	1	LGR	0	0	0	0	0	0	0, 0	0	0
1	2	MCP	3	0	0	3	3	0	3, 3	0	0.063069
1	3	LGR	11	5	0	16	16	0.561	16, 17	0.7619	0.047585
1	4	MCP	6	3	1	10	10	0.859	10, 12	0.6667	0.069355
2	1	LGR	0	0	0	0	0	0	0, 0	0	0
2	2	MCP	2	1	0	3	3	0.266	3, 4	0.75	0.027459
2	3	MCP	1	1	0	2	2	0.384	2, 7	0.6667	0.017985
2	4	LGR	1	0	0	1	1	0	1,	0	0.009645

									1		
3	1	LGR	0	0	0	0	0	0	0, 0	0	0
3	2	RUN	3	0	0	3	3	0	3, 3	0	0.024916
3	3	MCP	6	0	0	6	6	0	6, 6	0	0.042714
3	4	LGR	10	2	1	13	13	0.495	13, 14	0.7647	0.055528
		totals					57	0.911	57, 59	0.7808	0.036849

Appendix 3: Reach Descriptions

Soldier Creek

Reach	1	2	3	total
Location	N40 41.418, W123 02.276	N40 41.418, W123 02.997	N40 41.469, W123 03.165	
Directions to:	3.5 MILES up Dutch Creek to Soldier Pass then proceed up 1/4 mile.	Go up Soldier Pass Rd about 2 miles. Pull out at grass turn out on left, start at entry to creek.	Go up Soldier Pass Rd. to 1st culvert, go down stream 100yds flag before culvert	
Length (ft)	188.5	214.3	259.6	662.4
Area (sq. ft)	2194.14	2433.8	3764.2	8392.14
Volume (cu. Ft)	1711.42	1776.67	2446.73	5934.83
Mean Width	11.64	11.36	14.5	12.48
Mean Depth	0.78	0.72	0.87	0.72
Max Pool Depth	2.0	1.7	2.4	2.4
Mean Residual Pool Depth	1.2	0.91	1.2	1.085
Dominant substrate	Boulder	Cobble	Boulder	Boulder
Sub-dominant substrate	Gravel	Gravel	Sand	Gravel
% instream cover	36%	29.0%	37.5%	33.89%
Dominant cover	Boulder/cobble	Boulder/cobble	Boulder/cobble	Boulder/cobble
% Canopy cover	76%	75.7%	71.7%	74.5%
Mean Water Temp. (°C)*	14.90	14.33	13.75	14.33
Max Water	19.01	17.45	16.79	19.01

Temp. (°C)*				
Major changes 2000 to 2001				No major changes in 2001

*Water temperatures are for August-September, 2001.

Big Creek

Reach	1	2	3	total
Location	N40 36.909, W123 09.679	N40 37.975, W123 09.764	N40 39.212, W123 09.425	
Directions to:	200 ft before 32N23 turn off Big Creek Rd.	Below Donaldson Creek confluence	Upstream of Packer's Creek confluence	
Length (ft)	269.1	213.6	323.3	806.0
Area (sq. ft)	4592.6	3466.87	3553.4	11612.9
Volume (cu. Ft)	4018.6	3553.5	2771.6	10257.1
Mean Width	16.375	16.25	11.2	14.13
Mean Depth	0.875	1.025	0.78	0.88
Max Pool Depth	2.0	1.9	2.0	2.0
Mean Residual Pool Depth	1.15	0.57	1.21	0.81
Dominant substrate	Boulder	Boulder	Bedrock	Boulder
Sub-dominant substrate	Cobble	Cobble	Gravel	Cobble
% instream cover	36.25%	31.25%	32.5%	33.2%
Dominant cover	Boulder/cobble	Boulder/cobble	Boulder/cobble	Boulder/cobble
% Canopy cover	78.75%	80.0%	70.5%	75.6%
Mean Water Temp. (°C)*	13.61	13.29	13.54	13.48
Max Water Temp. (°C)*	18.42	17.41	17.94	18.42
Major changes 2000 to 2001			Dropped upper 2 units in 2001	

*Water temperatures are for August-September, 2001.

East Fork North Fork Trinity River

Reach	1	2	3	total
Location	N40 48.780, W123 07.227	N40 49.620, W123 07.528	N40 50.870, W123 07.969	
Directions to:	Funky Nugget mine 3.5 miles from Hwy 299	Turn left @ mile marker 5, 7/10 of a mile above 2nd bridge	N.Fork Rd to the end, access rd. to gate	
Length (ft)	308.3	223.3	214.7	746.3
Area (sq. ft)	5659.8	6180.2	4840.8	16680.8
Volume (cu. Ft)	6933.3	5871.2	5203.8	17954.3
Mean Width	20.65	27.93	22.13	23.56
Mean Depth	1.23	0.95	1.08	1.08
Max Pool Depth	2.7	1.6	2.6	2.7
Mean Residual Pool Depth	1.4	0.9	1.8	1.28
Dominant substrate	Boulder	Boulder	Boulder	Boulder
Sub-dominant substrate	Cobble	Cobble	Cobble	Cobble
% instream cover	29.0%	44.0%	35.0%	35.8%
Dominant cover	Boulder/cobble	Boulder/cobble	Boulder/cobble	Boulder/cobble
% Canopy cover	68.0%	54.0%	55.0%	58.75%
Mean Water Temp. (°C)*	17.51	17.47	16.69	17.23
Max Water Temp. (°C)*	23.83	22.53	21.63	23.83
Major changes 2000 to 2001	Surface area diminished due to low water			

*Water temperatures are for August-September, 2001.

Potato Creek

Reach	1	2	total
Location	N40 30.091, W123 02.350	N40 29.468, W123 01.719	

Directions to:	East Fork rd. to Potato Crk. Bridge- upstream 120 yds up Potato Crk. Rd.	Potato Crk. Rd. to first creek crossing, 50 ft. up stream	
Length (ft)	248.5	255.6	504.1
Area (sq. ft)	2362.25	2463.5	4825.75
Volume (cu. Ft)	1653.75	2143.2	3797.0
Mean Width (ft)	9.14	10.1	9.62
Mean Depth (ft)	0.70	0.87	0.79
Max Pool Depth	2.05	2.75	2.75
Mean Residual Pool Depth	1.5	1.9	1.7
Dominant substrate	Cobble	Cobble	Cobble
Sub-dominant substrate	Boulder	Boulder	Boulder
% instream cover	35.0%	41.7%	38.3%
Dominant cover	Boulder/cobble	Boulder/cobble	Boulder/cobble
% Canopy cover	61.7%	66.3%	64.0%
Mean Water Temp. (°C)*	15.00	14.31	14.65
Max Water Temp. (°C)*	20.22	17.92	20.22
Major changes 2000 to 2001		Large tree fell in unit	

*Water temperatures are for August-September, 2001.

East Weaver Creek

Reach	1	2	total
Location	N40 44.091, W122 55.703	N40 46.427, W122 55.448	
Directions to:	Browns Ranch Rd. to swimming hole, up stream 100 yds	East Weaver campground bridge, upstream 100 yds	

Length (ft)	299.9	178.0	477.9
Area (sq. ft)	4041.15	1981.72	6022.9
Volume (cu. Ft)	2626.75	1255.03	3881.7
Mean Width (ft)	13.48	11.13	12.07
Mean Depth (ft)	0.65	0.63	0.64
Max Pool Depth	1.6	1.3	1.6
Mean Residual Pool Depth	0.8	0.9	0.87
Dominant substrate	Cobble	Boulder	Cobble
Sub-dominant substrate	Boulder	Cobble	Boulder
% instream cover	28%	34%	31.5%
Dominant cover	Boulder/cobble	Boulder/cobble	Boulder/cobble
% Canopy cover	31%	44%	39.4%
Mean Water Temp. (°C)*	18.77	15.40	17.08
Max Water Temp. (°C)*	29.38	21.12	29.38
Major changes 2000 to 2001	Creek dry due to diversions	Extremely low flow	Not Electrofished in 2001

*Water temperatures are for August-September, 2001.

Rattlesnake Creek

Reach	1	2	3	total
Location	N40 22.235, W123 18.763	N40 23.166, W123 17.499	N40 23.465, W123 16.713	
Directions to:	100 yds up stream of the confluence with South Fork at Hell Gate campground	Hwy 36 & USFS road 14, turn east @ road 14, u-turn and drive on old dirt/pavement rd 0.2 miles to end. Walk up about 75yds.	Hwy 36 and Rattlesnake Rd., drive up Rattlesnake Rd. .2 miles, site is on right, also about .2 miles below confluence of Post Crk.	

Length (ft)	259.9	202.3	218.1	680.3
Area (sq. ft)	4035.3	2189.3	2686.2	8910.8
Volume (cu. Ft)	4559.8	2233.1	1879.6	8672.5
Mean Width	15.6	11.54	11.91	12.88
Mean Depth	1.13	1.02	0.70	0.92
Max Pool Depth	2.5	3.0	2.8	3.0
Mean Residual Pool Depth	1.82	2.4	1.56	1.76
Dominant substrate	Boulder	Boulder	Boulder	Boulder
Sub-dominant substrate	Bedrock	Bedrock	Cobble	Bedrock
% instream cover	37.0%	30.0%	37.1%	35.0%
Dominant cover	Boulder/cobble	Boulder/cobble	Boulder/cobble	Boulder/cobble
% Canopy cover	53.0%	44.0%	70.7%	57.6%
Mean Water Temp. (°C)*	16.12	15.62	15.37	15.70
Max Water Temp. (°C)*	23.12	21.17	19.99	23.12
Major changes 2000 to 2001	Considerably lower flow	Stagnant pools, with algal sheen	Reach is dry	Not Electrofished in 2001 due to critically-dry water year

*Water temperatures are for August-September, 2001.

Little Brown's Creek

Reach	1	2	3	total
Location	N40 41.303, W122 56.144	N40 41.816, W122 55.400	N40 42.027, W122 55.238	
Directions to:	Little Browns Creek bridge on hwy 299, 100 ft. upstream	Little Browns Mt. Rd. to Browns Mt. Rd. to 1st bridge, 100yds. Up stream from bridge	.5 miles up Little Browns Mtn. Rd. to 1st dirt rd. on right after Browns Mtn. Rd.	
Length (ft)	282.2	263.8	353.7	899.7

Area (sq. ft)	3125.7	2125.2	2887.5	8138.4
Volume (cu. Ft)	2000.4	2023.1	1645.8	5669.3
Mean Width	11.36	10.2	13.52	11.52
Mean Depth	0.64	0.94	0.57	0.72
Max Pool Depth	2.0	2.7	1.8	2.7
Mean Residual Pool Depth	1.53	1.96	1.37	1.63
Dominant substrate	Cobble	Bedrock	Cobble	Cobble
Sub-dominant substrate	Sand	Boulder	Gravel	Gravel
% instream cover	26.0%	38.0%	18.0%	27.0%
Dominant cover	Boulder/cobble	Boulder/cobble	Boulder/cobble	Boulder/cobble
% Canopy cover	76%	38%	69%	60.3%
Mean Water Temp. (°C)*	16.16	18.70	16.2	17.06
Max Water Temp. (°C)*	23.79	35.74**	28.57	35.74**
Major changes 2000 to 2001	Dry due to over-diversion			Not electrofished in 2001 due to critically-dry water year

*Water temperatures are for August-September, 2001.
**Extremely high water temperature probably due to thermograph de-watering.

Little Grass Valley Creek

Reach	1	2	3	total
Location	N40 39.660, W122 46.835	N40 39.194, W122 45.420	N40 38.751, W122 44.822	
Directions to:	Mile Post 68.63 on Hwy 299, turn out on right side of Hwy near 40mph sign	Mile Post marker 70, Hwy 299 downstream of drive way to Ludden Tree Farm	Mile Post 70.73, Hwy 299 Large pull-out left side of hwy	
Length (ft)	218.0	202.0	213.0	633.0

Area (sq. ft)	1779.5	1577.4	1917.1	5274.0
Volume (cu. Ft)	1156.7	946.5	1303.6	3406.8
Mean Width	8.1	7.8	8.82	8.3
Mean Depth	0.65	0.60	0.68	0.65
Max Pool Depth	1.6	1.8	1.6	1.8
Mean Residual Pool Depth	1.2	1.13	1.2	1.17
Dominant substrate	Sand	Bedrock	Sand	Sand
Sub-dominant substrate	Sand	Sand	Boulder	Boulder
% instream cover	19.0%	21.0%	25.0%	22.1%
Dominant cover	Boulder/cobble	Boulder/cobble	Boulder/cobble	Boulder/cobble
% Canopy cover	84%	83%	86%	84.25%
Mean Water Temp. (°C)*	13.35	12.96	12.67	12.99
Max Water Temp. (°C)*	17.83	16.78	16.60	17.83
Major changes 2000 to 2001	Not surveyed in 2000	Not surveyed in 2000	Not surveyed in 2000	Not surveyed in 2000

*Water temperatures are for August-September, 2001.

Appendix 4: Trinity River Sampling Universe- 1st –4th order anadromous tributaries.

South Fork Basin	Anadromous distance (km)	Main-stem Trinity	Anadromous distance (km)
Upper South Fork	16.50	Deadwood	3.78
East Fork South Fork	14.97	Rush	14.48
Dark Canyon	1.21	Grass Valley	16.80
Prospect	1.01	Little Grass Valley	9.00
Smoky	5.79	Weaver	10.53
Silver	2.58	East Weaver	8.37
Farley	0.40	West Weaver	12.36
Rattlesnake	15.29	Little Browns	15.42
Little Rattlesnake	0.32	Reading	18.03
Post	5.90	Browns	38.63
North Post	0.09	East Fork Browns	11.01
Glade	0.97	Chanchellula	3.22
Glen	1.10	Maxwell	6.81
Little Bear Wallow	0.37	Dutch	5.55
Plummer	5.15	Maple Creek	0.40
Jims	0.76	Soldier	3.22

Butter	2.51	Canyon	31.06
Pelletreau	1.30	Big East Fork, Canyon	0.20
Kerlin	2.40	Clear Gulch, Canyon	0.80
Mill	1.61	Eagle Creek	0.23
Eltapom	1.30	Sailor Bar	0.40
Ammon	0.94	Big Bar	5.63
Madden	1.90	Price	4.83
Grouse	12.20	Manzanita	10.46
Mosquito	7.80	Prairie	2.60
Coon	2.00	Little French	3.70
		Big French	11.59
Hayfork Basin		E.F. Big French	3.20
Hayfork	86.10	Swede	3.10
Dubakella	3.14	Don Juan	0.87
Goods	1.60	Byron EFNF	1.21
Hall City	3.22	East Fork North Fork	21.73
Wilson	1.61	Grizzly	10.62
East Fork Hayfork	9.37	Rattlesnake N. F.	7.20
Potato	4.15	Middle Fork of Rattlesnake	0.64
Bridge Gulch	1.93	Whites	2.50
Carr	8.72	Backbone	2.30
West Fork Carr	0.40	East Branch	3.50
Summit	5.20	Yellow Jacket E.F	0.14
Duncan	4.02	Indian	18.60
Barker	5.91	Brock Gulch E.F.	5.95
Little Barker	3.73	Corral	1.50
Big	13.68	Cannon Ball	1.40
Packers	3.86	Mule	1.30
Donaldson	2.01	South Fork Indian	1.61
Kingsbury Gulch	7.50		
Salt	14.08		
Muldoon Gulch	0.74		
West Fork Salt Creek	0.40		
Panther Gulch	1.53		
Deer Gulch	0.90		
Ditch Gulch	1.09		
Dobbins Gulch	1.45		
Philpot	2.25		
North Philpot	1.61		
Tule	14.68		
West Tule	2.90		
East Tule	0.40		
Little	2.10		
Rusch	6.40		
Bear	3.86		
Miners	5.95		
West Fork Miners	0.97		
Olsen	2.10		
West Fork Bear	0.40		

Cable SF	0.23		
Cave SF	1.35		
Grassy Flat	0.61		
Packers	3.70		
Sheil gulch	0.84		