STREAM INVENTORY REPORT

LITTLE NORTH FORK GUALALA RIVER

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Project No. 395401

March 28, 1995

TABLE OF CONTENTS

LIST OF TABLES

STREAM INVENTORY REPORT LITTLE

NORTH FORK GUALALA RIVER

1.0 INTRODUCTION

A stream inventory was conducted during the fall of 1994 on the Little North Fork Gualala River to assess habitat conditions for anadromous salmonids. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in the Little North Fork Gualala River. This report serves to document the current habitat conditions as well as recommend options for the potential enhancement of habitat for coho salmon and steelhead trout. After analysis of the information and data gathered, stream restoration and enhancement recommendations are presented.

2.0 WATERSHED OVERVIEW

The Little North Fork Gualala River is tributary to the North Fork Gualala River, tributary to the Gualala River, located in Mendocino County, California. The Little North Fork Gualala River's legal description at the confluence with the North Fork Gualala River is TUN R15W S23. Its location is 33°47'28" N. latitude and 123°30'31" W. longitude. The Little North Fork Gualala River is a third order stream and has approximately 4.2 miles of perennial stream, according to the USGS Gualala 7.5 minute quadrangle. Elevations range from about 40 feet at the mouth of the Little North Fork to 1,000 feet in the headwater areas. Redwood, douglas fir, and mixed hardwoods dominate the watershed. The watershed is privately owned and is managed for timber production. Vehicle access exists via private roads on Gualala Redwoods property.

3.0 METHODS

The habitat inventory conducted in the North Fork Gualala River follows the methodology presented in the California Salmonid Stream Habitat Restoration Manual (Flosi and Reynolds 1991). The ENTRIX fisheries biologist that conducted the inventory has extensive experience conducting habitat inventories utilizing the methodologies of the California Department of Fish and Game (CDFG) and Region 5 of the U.S. Forest Service (USFS). This inventory was performed by a two person team.

3.1 HABITAT INVENTORY COMPONENTS

A standardized habitat inventory form has been developed for use in California stream surveys and can be found in the California Salmonid Stream Habitat Restoration Manual. This form was used in the Little North Fork Gualala River to record measurements and observations. There are nine components to the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) at the bottom of the stream survey reach using standard flow measuring equipment, if available. In some cases flows are estimated. Flows also are measured or estimated at major tributary confluences.

2. Channel Type:

Channel typing was conducted according to the classification system developed by David Rosgen (1985). This methodology is described in the California Salmonid Stream Habitat Restoration Manual. Channel typing follows a standard form to record measurements and observations. There are four measured parameters used to determine channel type: 1) water slope gradient, 2) channel confinement, 3) width/depth ratio, 4) substrate composition.

3. Temperatures:

Both water and air temperatures were measured and recorded at each tenth unit typed. The time of the measurement was also recorded. Both temperatures were taken in fahrenheit at the middle of the habitat unit and within one foot of the water surface.

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain et al. (1988). Habitat units were numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types (See Appendix B). Dewatered units are labeled "dry". The Little North Fork Gualala River habitat typing used standard basin level measurement criteria. These parameters require that the minimum length of a described habitat unit must be equal to or greater than the stream's mean wetted width. Channel dimensions were measured using hip chains, range finders, tape measures, and stadia rods. Unit measurements included mean length, mean width,

mean depth, and maximum depth. Pool tail crest depth at each pool unit was measured in the thalweg. All measurements were taken in feet to the nearest tenth. Additionally, every tenth habitat unit was marked in the field using survey flagging in order to facilitate relocation of any unit(s) in the future.

5. Embeddedness:

The depth of substrate embeddedness in pool tail-out was measured by the percent of the cobble that is surrounded or buried by fine sediment. In the Little North Fork Gualala River, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3), 76 -100% (value 4).

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition. The shelter rating is calculated for each habitat unit by multiplying shelter value and percent cover. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is then classified according to a list of nine cover types. In the Little North Fork Gualala River, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. Thus, shelter ratings can range from 0-300, and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

Substrate composition ranges from silt/clay sized particles to boulders and bedrock elements. In all habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes.

8. Canopy:

Stream canopy is a measure of the water surface shaded during periods of high sun. In the Little North Fork Gualala River, an estimate of the percentage of the habitat unit covered by canopy was made from the center of each unit both ocularly and using a handheld spherical densiometer. The area of canopy was further analyzed to estimate its percentages of coniferous or deciduous trees, and the results recorded.

9. Bank Composition:

Bank composition elements range from bedrock to bare soil. However, the stream banks are usually covered with grass, brush, or trees. These factors influence the ability of stream banks to withstand winter flows. In the Little North Fork Gualala River, the dominant composition type in both the right and left banks was selected from a list of eight options on the habitat inventory form. Additionally, the percent of each bank covered by vegetation was estimated and recorded.

3.2 DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat Runtime, a dBASE 4.1 data entry program developed by the California Department of Fish and Game. This program processes and summarizes the data, and produces the following six tables:

- Riffle, flatwater, and pool habitat types
- Habitat types and measured parameters
- Pool types
- Maximum pool depths by habitat types
- Dominant substrates by habitat types
- Mean percent shelter by habitat types

Graphics are produced from the data using Quattro Pro. Graphics developed for the Little North Fork Gualala River include.

- Riffle, flatwater, pool habitats by percent occurrence
- Riffle, flatwater, pool habitats by total length
- Total habitat types by percent occurrence
- Pool types by percent occurrence
- Total pools by maximum depths
- Embeddedness

- Pool cover by cover type
- Dominant substrate in low gradient riffles
- Percent canopy
- Bank composition by composition type

4.0 HABITAT INVENTORY RESULTS

The habitat inventory on the Little North Fork Gualala River was performed on October 6-7, 1994 and October 10-11, 1994 by Dan Gale and Dan Lipman of ENTRIX. The survey began at the confluence with the North Fork Gualala River and extending up the Little North Fork to the confluence with Doty Creek. The total length of the stream surveyed was 15,787 feet, with an additional 266 feet of side channel and backwater habitat. Upstream of the Doty Creek confluence, the Little North Fork contained insufficient flows at the time of the survey to allow for meaningful quantitative assessment of the habitat in this portion of the drainage. A qualitative inspection was performed in this area as well as in the lower portion of Log Cabin Creek, and the observations are listed in Appendix A.

Flows were estimated to be 4-5 cfs at the mouth of the Little North Fork during the survey period, with no sections of dry channel encountered downstream of the confluence with Doty Creek.

Six reaches comprised of three different channel types were identified in the surveyed portion of the Little North Fork Gualala River. Reach 1 began at the confluence with the North Fork Gualala River and is a C3 channel type which totals 7,307 feet in length. C3 streams have low gradient (0.5-1.0%), meandering gravel bed channels. Reach 2 is a F5 channel type totaling 763 feet in length. F5 stream types are low gradient (<1%) with totally confined and deeply entrenched channels dominated by silt or clay substrate. The channel in reach 2 has been deeply incised and channelized by the hydraulic action of the stream, with vertical clay banks ranging from 5-10 feet in height confining the channel throughout the reach. Remnants of the original meandering C3 channel type can be observed on top of the entrenched streambanks at various locations throughout the reach. Reach 3 is a C3 channel type totaling 770 feet in length which has similar characteristics to those found in Reach 1.

Reach 4 is a D2 channel type which totals 862 feet in length. D2 channel types are low gradient (<1%) streams which are unconfined and highly braided and are dominated by a mixture of fine textured sediment. Reach 4 is a large marsh-like portion of the river which is unconfined and has no distinct channel. The vegetation in this reach is dominated by sedge and successional young

alders as well as numerous large conifers which appear to have been killed by the formation of this marsh. Reach 5 is a F5 channel type totaling 400 feet in length which is similar in composition to Reach 2. A dry section of C3 channel is located adjacent to Reach 5 which also enters Reach 4 at its downstream end, but incising and channelization in this area has caused the active channel to flow via the F5 channel type rather than via the original C3 channel. Reach 6 is a C3 channel type totalling 5,685 feet in length. Reach 6 begins at the divergence of the dry C3 channel and active F 5 channel in Reach 5 and ends upstream at the confluence with Doty Creek.

Water temperatures in the Little North Fork Gualala River during the survey ranged from 50.0 to 57.5 degrees Fahrenheit. Air temperatures ranged from 54.0 to 82.5 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent occurrence, pools made up 49%, flatwater types 31%, and riffles 20% (Figure 1). Pool habitat types also made up 49% of the total survey length, while flatwater types comprised 42%, and riffles 10% (Figure 2).

Fifteen Level IV habitat types were identified. The data are summarized in Table 2. The most frequent habitat types by percent occurrence were low gradient riffles, 19%; mid-channel pools, 18%; and runs, 16% (Figure 3). By percent total length, step runs made up 27%, Mid-channel pools 21%, and runs 14%.

A total of 172 pools were identified (Table 3). scour pools were most often encountered at 59%, and comprised 49% of the total length of pools (Figure 4). Mid-channel pools accounted for 40% of the pools encountered, yet they comprised 50% of the total length of pools.

Table 4 is a summary of maximum pool depths by pool habitat types. Depth is an indicator of pool quality. Eighty-one of the 172 pools (47.1%) had a depth of two feet or greater (Figure 5).

The substrate embeddedness was estimated at main and scour pool tail-outs. Of the 168 pool tail-outs measured, one had a value of 1 (0.5%); 58 had a value of 2 (34.5%); 78 had a value of 3 (46.4%); and 31 had a value of 4 (18.5%). On this scale, a value of one is the best for fisheries (Figure 6).

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Pool habitats had the highest shelter rating at 70 (Table 1). Flatwater habitat types followed with a rating of 33. Of the pool types, the Backwater pools had the highest mean shelter rating at 80, scour pools rated 78, and mid-channel pools rated 59 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Undercut banks and terrestrial vegetation are the dominant cover type in the Little North Fork Gualala River, with root masses, large woody debris, and small woody debris comprising the subdominant cover types. Figure 7 describes the pool cover in the Little North Fork Gualala River.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 42 of the 69 low gradient riffles (60.9%). Small cobble was the next most frequently observed dominant substrate type, and occurred in 30.4% of the low gradient riffles (Figure 8).

The mean percent of open canopy for the entire portion of the stream surveyed was 9.0%. Of the 91.0% of the stream covered with canopy, 31.3% was composed of deciduous trees, and 68.7% was composed of coniferous trees. Figure 9 describes the canopy composition in the Little North Fork Gualala River.

Table 2 summarizes the mean percentage of the right and left stream banks covered with vegetation by habitat type. For the stream reach surveyed, the mean percent right bank vegetated was 50.2%. The mean percent left bank vegetated was 50.5%. The dominant substrate elements composing the structure of the stream banks consisted of 0.6% boulder, 39.1% cobble/gravel, and 60.3% silt/clay/sand, with no bedrock encountered in any of the survey reaches. Additionally, 45.5% of the banks were covered with deciduous trees, and 30.7% with coniferous trees, including downed trees, logs, and root wads (Figure 10).

5.0 DISCUSSION

Three channel types were encountered in the surveyed portion of the Little North Fork Gualala River: C3, F5, and D2. C3 channels are meandering stream types on noncohesive gravel beds which have poorly consolidated and unstable stream banks. They are generally not suitable for instream enhancement structures. However, bank placed boulders, bank cover, overhead log cover and shelter structures in straight reaches are often appropriate. Any work considered will require careful design, placement, and construction that must include protection for the unstable banks. F5 channel types are not typically suitable for habitat improvement structures due to the instability of the stream banks and the susceptibility of the channel to migrate laterally. This may not be the case with the deeply entrenched clay banks in reaches 2 and 5, and the feasibility and effectiveness of structures which would aid in re-aggrading the channel in these areas should be investigated. D2 channel types are also not typically suitable for habitat improvement structures due to the lack of any channel confinement or bank armoring. The marsh area in Reach 4 is likely the result of excessive channel aggradation and subsequent loss of stream gradient and a single main channel. This problem may be remedied naturally as a result of high flows and/or the

Little N.F. Gualala River

Drainage: North Fork Gualala River

Table 1 – SUMMARY OF RIFFLE, FLATWATER, AND POOL HABITAT TYPES

Survey Dates: October 6-10, 1994

Confluence: QUAD: Gualala LEGAL DESCRIPTION: T11NR15WS23 LATITUDE: 38°

UNITS MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	MEAN LENGTH (ft.)	TOTAL LENGTH (ft.)	PERCENT TOTAL LENGTH	MEAN WIDTH (ft.)	MEAN DEPTH (ft.)	MEAN AREA (sq.ft.)	TOTAL AREA (sq.ft.)	MEAN VOLUME (cu. ft.)	TOTAL VOLUME (cu. ft)	MEAN RESIDUAL POOL VOL (cu. ft.)	MEAN SHELTER RATING
71	RIFFLE	20	22	1572	10	8.2	0.2	130	9260	26	1823	0	8
111	FLATWATER	31	60	6684	42	8.8	0.3	485	53816	170	18885	0	33
172	POOL	49	45	7797	49	10.7	0.9	496	85282	514	88466	375	70

TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq. ft.)	TOTAL VOL. (cu. ft.)
354	16053	148358	109174

Little N.F. Gualala River Drainage: North Fork Gualala River

Table 2 - SUMMARY OF HABITAT TYPES AND MEASURED PARAMETERS Survey Dates: October 6-10, 1994

Confluence: QUAD: Gualala LEGAL DESCRIPTION: T11NR15WS23 LATITUDE: 38°47'30" LONGITUDE: 123°30'30"

UNITS MEASURED	HABITAT TYPE	HABITAT OCCURRENCE	MEAN LENGTH	TOTAL LENGTH	TOTAL LENGTH	MEAN WIDTH	MEAN DEPTH	MAXIMUM DEPTH	MEAN AREA	TOTAL AREA	MEAN VOLUME	TOTAL VOLUME	MEAN RESIDUAL POOL VOL	MEAN SHELTER RATING	MEAN RT. BANK VEGETATED	MEAN LT. BANK VEGETATED	MEAN CANOPY
#		%	ft.	ft.	%	ft.	ft.	ft.	sq. ft.	sq. ft.	cu. ft.	cu. ft.	cu. ft.		%	%	%
69	LGR	19	23	1562	10	8	0.2	0.7	134	9227	26	1819	0	8	51	50	92
1	HGR	0	5	5	0	16	0.1	0.4	28	28	3	3	0	0	40	90	95
1	CAS	0	5	5	0	1	0.3	0.5	5	5	2	2	0	0	40	70	85
2	POW	1	40	80	0	15	0.4	1.0	372	744	130	259	0	70	35	28	83
57	RUN	16	40	2263	14	8	0.3	1.6	323	18384	112	6395	0	25	50	50	89
52	SRN	15	83	4341	27	9	0.3	1.5	667	34687	235	12231	0	40	56	54	93
4	TRP	1	127	509	3	11	2.2	4.4	1409	5634	3090	12359	2603	50	45	45	99
63	MCP	18	53	3369	21	11	0.8	6.0	575	36228	547	34449	370	58	51	55	90
1	STP	0	39	39	0	6	0.7	1.5	222	222	156	156	111	105	70	55	95
19	CRP	5	47	884	6	10	0.9	4.3	508	9647	474	9006	350	83	31	42	93
26	LSL	7	34	883	6	12	0.9	3.6	420	10910	427	11093	330	91	51	54	90
50	LSR	14	36	1818	11	11	0.9	4.2	395	19754	380	19000	276	69	51	45	92
2	LSBo	1	24	47	0	8	0.5	1.5	174	349	80	160	35	30	35	53	63
5	PLP	1	42	209	1	11	1.3	4.1	455	2276	420	2102	316	102	48	51	90
2	BPL	1	20	39	0	7	0.6	1.4	131	262	71	142	0	80	33	23	80
TOTAL				LENGTH						AREA							TOTAL VOL.
UNITS				(ft.)						(sq. ft)		(cu. ft)					
354				16053						148358		109174					

Little N.F. Gualala River

Drainage: North Fork Gualala River

Table 3 - SUMMARY OF POOL TYPES

Survey Dates: October 6-10, 1994

Confluence: QUAD: Gualala LEGAL DESCRIPTION: T11NR15WS23 LATITUDE: 38°47'30" LONGITUDE: 123°30'30"

UNITS MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	MEAN LENGTH (ft.)	TOTAL LENGTH (ft.)	PERCENT TOTAL LENGTH	MEAN WIDTH (ft.)	MEAN DEPTH (ft.)	MEAN AREA (sq. ft)	TOTAL AREA (sq. ft.)	MEAN VOLUME (cu. ft.)	TOTAL VOLUME (cu. ft)	MEAN RESIDUAL POOL VOL (cu. ft.)	MEAN SHELTER RATING
68	MAIN	40	58	3917	50	10.6	0.9	619	42084	691	46963	498	59
102	SCOUR	59	38	3841	49	10.9	0.9	421	42936	406	41361	301	78
2	BACKWATER	1	20	39	1	7.0	0.6	131	262	71	142	0	80

TOTAL MEASURED	TOTAL LENGTH (ft.)	TOTAL AREA (sq.ft.)	TOTAL VOL. (cu. ft.)
172	7797	85282	88466

Little N.F. Gualala River Drainage: North Fork Gualala River

Table 4 - SUMMARY OF MAXIMUM POOL DEPTHS BY POOL HABITAT TYPES Survey Dates: October 6-10, 1994

Confluence: QUAD: Gualala LEGAL DESCRIPTION: T11NR15WS23 LATITUDE: 38°47'30" LONGITUDE: 123°30'30"

UNITS MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	<1 FOOT MAXIMUM DEPTH	<1 FOOT PERCENT OCCURRENCE	1-<2 FT. MAXIMUM DEPTH	1-<2 FOOT PERCENT OCCURRENCE	2-<3 FT. MAXIMUM DEPTH	2-<3 FOOT PERCENT OCCURRENCE	3-<4 FT. MAXIMUM DEPTH	3-<4 FOOT PERCENT OCCURRENCE	>=4 FEET MAXIMUM DEPTH	>=4 FEET PERCENT OCCURRENCE
4	TRP	2	0	0	0	0	2	50	0	0	2	50
63	MCP	37	7	11	33	52	19	30	3	5	1	2
1	STP	1	0	0	1	100	0	0	0	0	0	0
19	CRP	11	2	11	4	21	11	58	1	5	1	5
26	LSL	15	1	4	12	46	10	38	3	12	0	0
50	LSR	29	1	2	23	46	21	42	4	8	1	2
2	LSBo	1	0	0	2	100	0	0	0	0	0	0
5	PLP	3	0	0	3	60	0	0	1	20	1	20
2	BPL	1	0	0	2	100	0	0	0	0	0	0

TOTAL UNITS
172

Little N.F. Gualala River Drainage: North Fork Gualala River

Table 5 - SUMMARY OF MEAN PERCENT COVER BY HABITAT TYPE Survey Dates: October 6-10, 1994

Confluence: QUAD: Gualala LEGAL DESCRIPTION: T11NR15WS23 LATITUDE: 38°47'30" LONGITUDE: 123°30'30"

UNITS MEASURED	HABITAT TYPE	MEAN % UNDERCUT BANKS	MEAN % SWD	MEAN % LWD	MEAN % ROOT MASS	MEAN % TERR. VEGETATION	MEAN % AQUATIC VEGETATION	MEAN % WHITE WATER	MEAN % BOULDERS	MEAN % BEDROCK LEDGES
69	LGR	4	17	4	1	24	0	0	0	0
1	HGR	0	0	0	0	0	0	0	0	0
1	CAS	0	0	0	0	0	0	0	0	0
2	POW	15	15	30	40	0	0	0	0	0
57	RUN	14	15	10	6	24	2	0	2	0
52	SRN	22	15	9	15	35	3	0	0	0
4	TRP	60	5	8	15	13	0	0	0	0
63	MCP	34	11	20	14	15	5	0	0	0
1	STP	30	10	30	30	0	0	0	0	0
19	CRP	43	10	17	19	12	0	0	0	0
26	LSL	8	24	43	13	10	3	0	0	0
50	LSR	29	11	10	40	10	1	0	0	0
2	LSBo	0	0	0	0	0	0	0	100	0
5	PLP	14	20	34	4	12	0	16	0	0
2	BPL	0	18	20	15	10	38	0	0	0

Little N.F. Gualala River Drainage: North Fork Gualala River

Table 6 - SUMMARY OF DOMINANT SUBSTRATES BY HABITAT TYPE Survey Dates: October 6-10, 1994

Confluence: QUAD: Gualala LEGAL DESCRIPTION: T11NR15WS23 LATITUDE: 38°47'30" LONGITUDE: 123°30'30"

UNITS MEASURED	HABITAT TYPE	# UNITS SILT/CLAY DOMINANT	% TOTAL SILT/CLAY DOMINANT	# UNITS SAND DOMINANT	% TOTAL SAND DOMINANT	# UNITS GRAVEL DOMINANT	% TOTAL GRAVEL DOMINANT	# UNITS SM COBBLE DOMINANT	% TOTAL SM COBBLE DOMINANT	# UNITS LG COBBLE DOMINANT	% TOTAL LG COBBLE DOMINANT	# UNITS BOULDER DOMINANT	% TOTAL BOULDER DOMINANT	# UNITS BEDROCK DOMINANT	% TOTAL BEDROCK DOMINANT
69	LGR	3	4	0	0	42	61	21	30	3	4	0	0	0	0
1	HGR	1	100	0	0	0	0	0	0	0	0	0	0	0	0
1	CAS	1	100	0	0	0	0	0	0	0	0	0	0	0	0
2	ROW	0	0	0	0	1	50	1	50	0	0	0	0	0	0
57	RUN	6	11	1	2	45	79	5	9	0	0	0	0	0	0
52	SRN	7	13	0	0	41	79	4	8	0	0	0	0	0	0
4	TRP	4	100	0	0	0	0	0	0	0	0	0	0	0	0
63	MCP	33	52	4	6	25	40	1	2	0	0	0	0	0	0
1	STP	1	100	0	0	0	0	0	0	0	0	0	0	0	0
19	CRP	4	21	4	21	11	58	0	0	0	0	0	0	0	0
26	LSL	10	38	3	12	13	50	0	0	0	0	0	0	0	0
50	LSR	16	32	3	6	31	62	0	0	0	0	0	0	0	0
2	LSBo	0	0	0	0	1	50	1	50	0	0	0	0	0	0
5	PLP	5	100	0	0	0	0	0	0	0	0	0	0	0	0
2	BPL	2	100	0	0	0	0	0	0	0	0	0	0	0	0

Figure 1. Little North Fork Gualala River Habitat Types by Percent Occurence

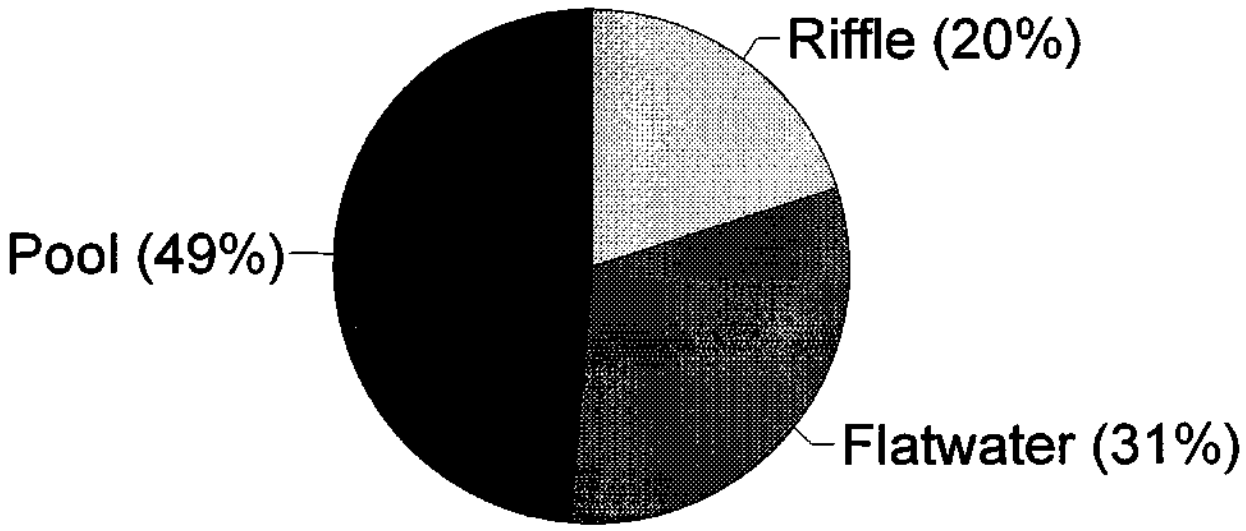


Figure 2. Little North Fork Gualala River Habitat Types by Percent Total Length

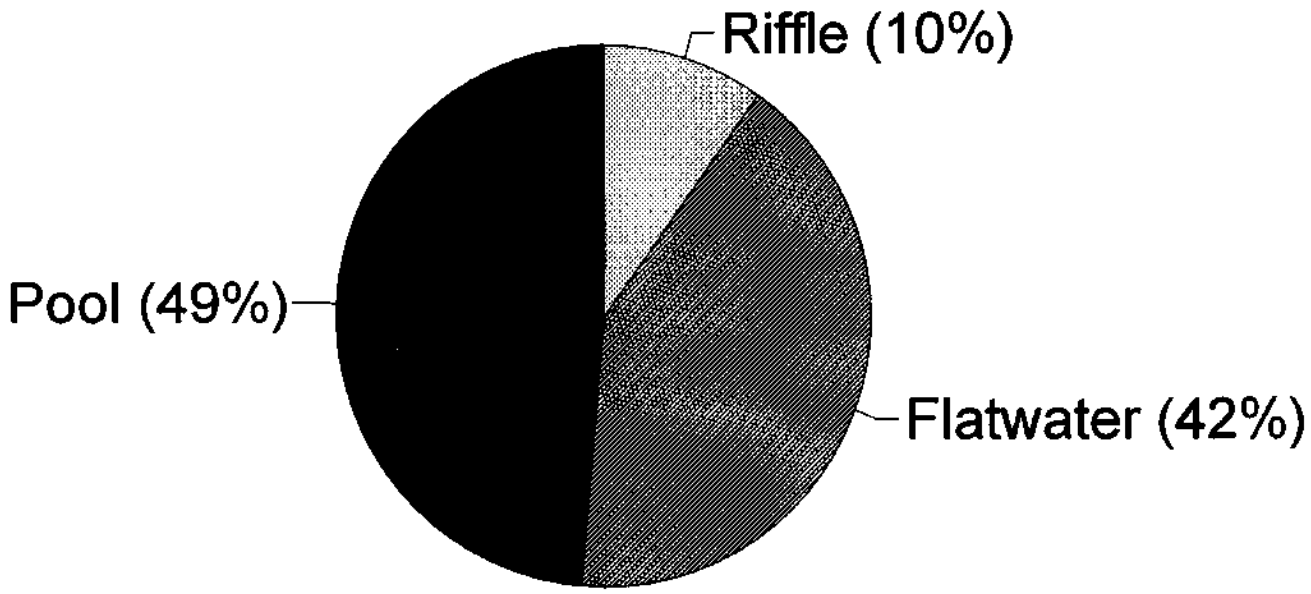


Figure 3. Little North Fork Gualala River Level IV Habitat Types by Percent Occurence

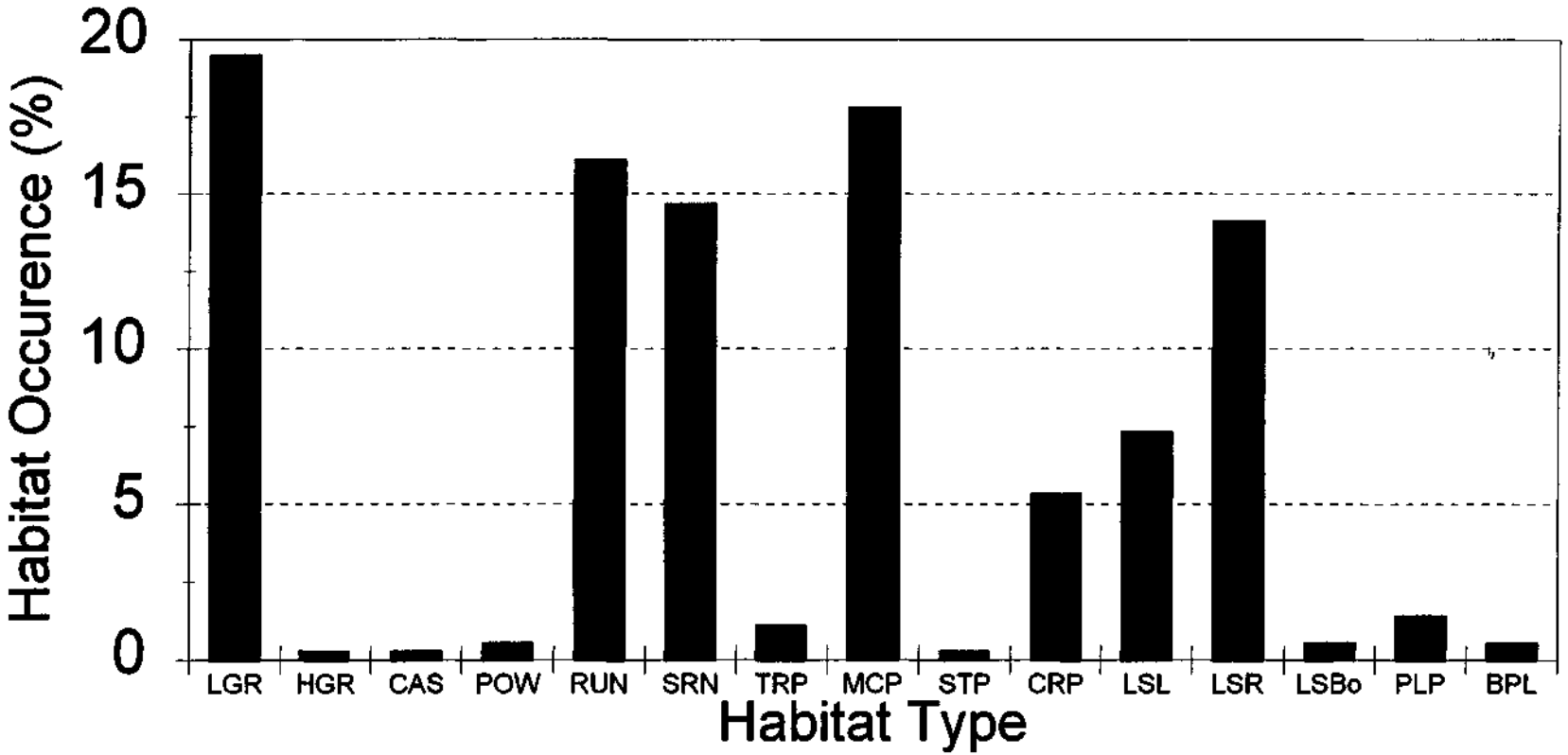


Figure 4. Little North Fork Gualala River Pool Types by Percent Occurence

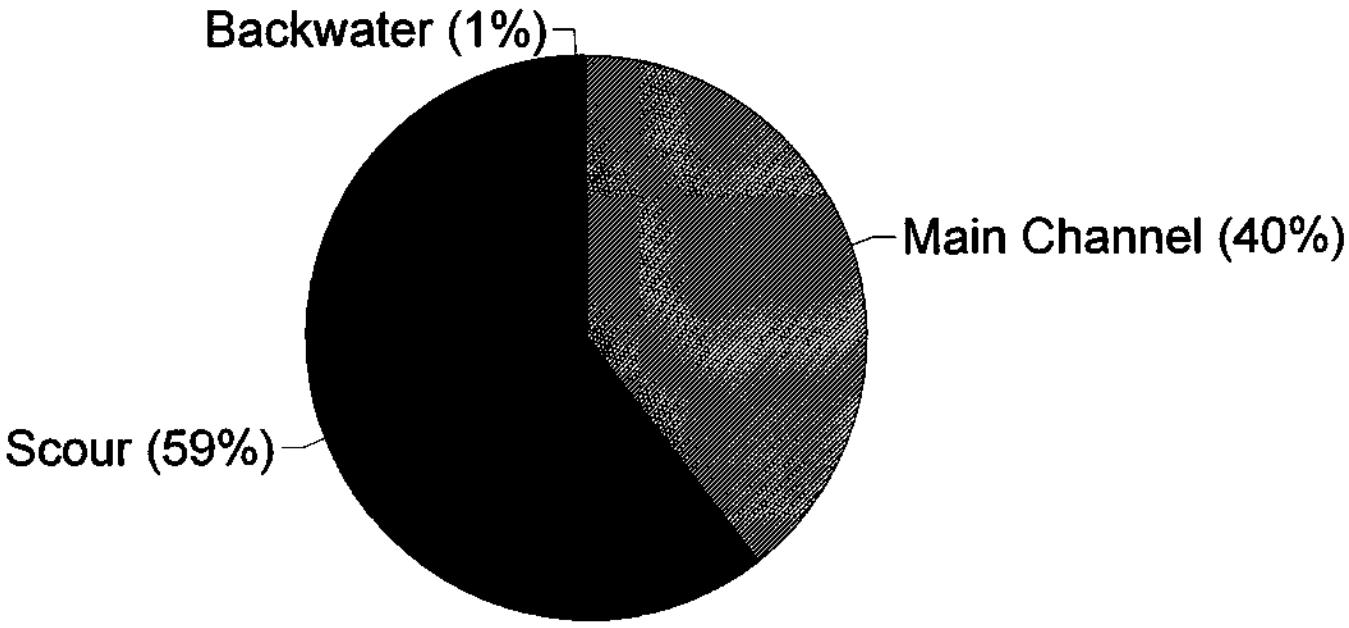


Figure 5. Little North Fork Gualala River

Total Pools by Maximum Depth

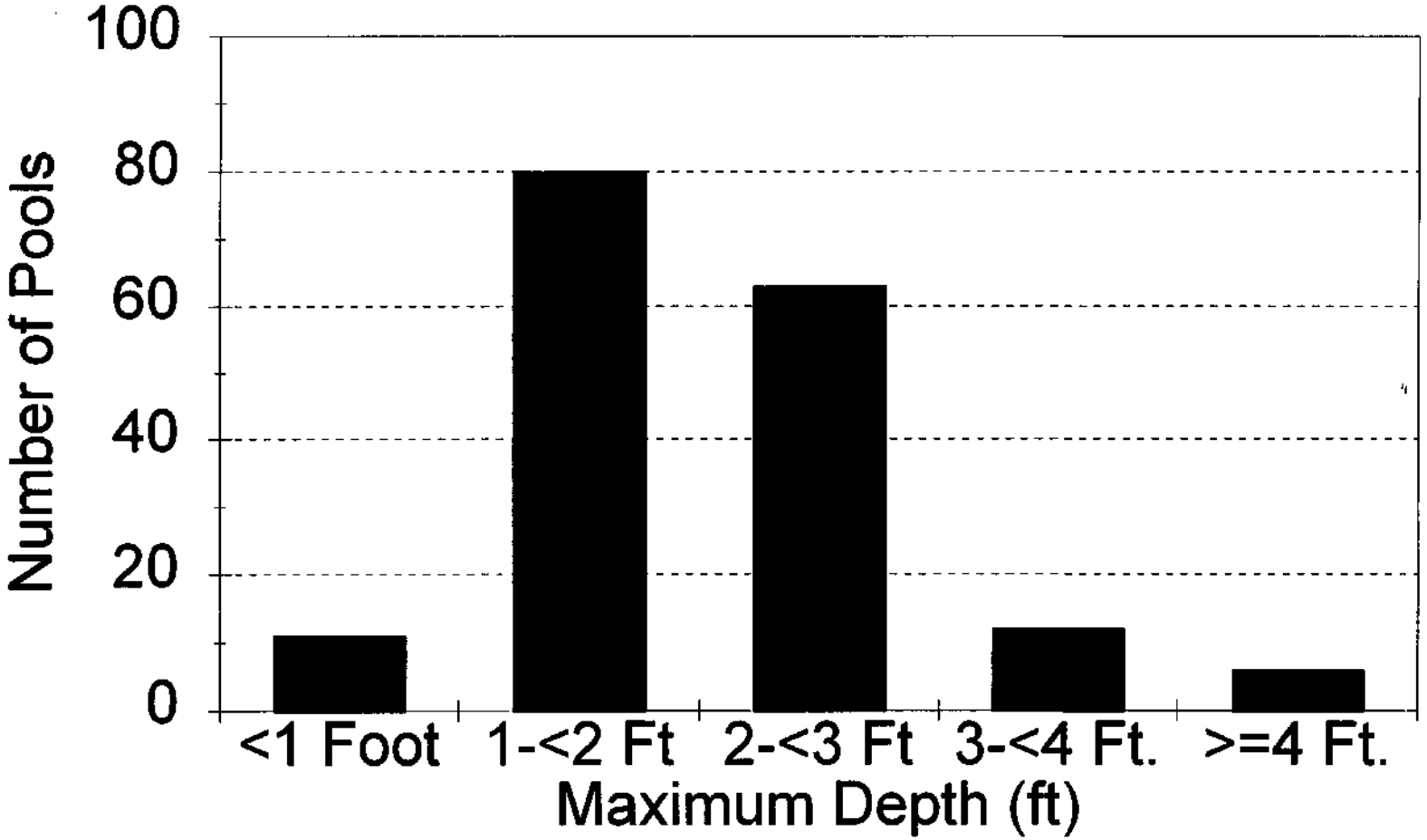


Figure 6. Little North Fork Gualala River Pool Tail-out Embeddedness

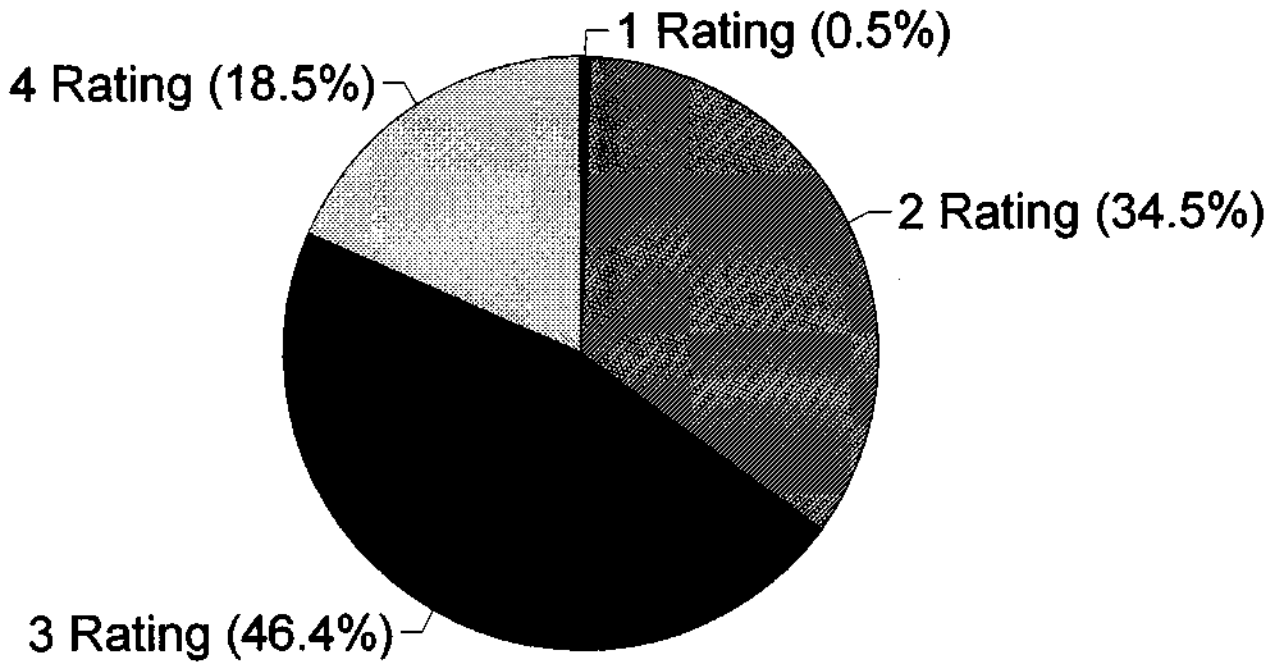


Figure 7. Little North Fork Gualala River Pool Cover by Cover Type

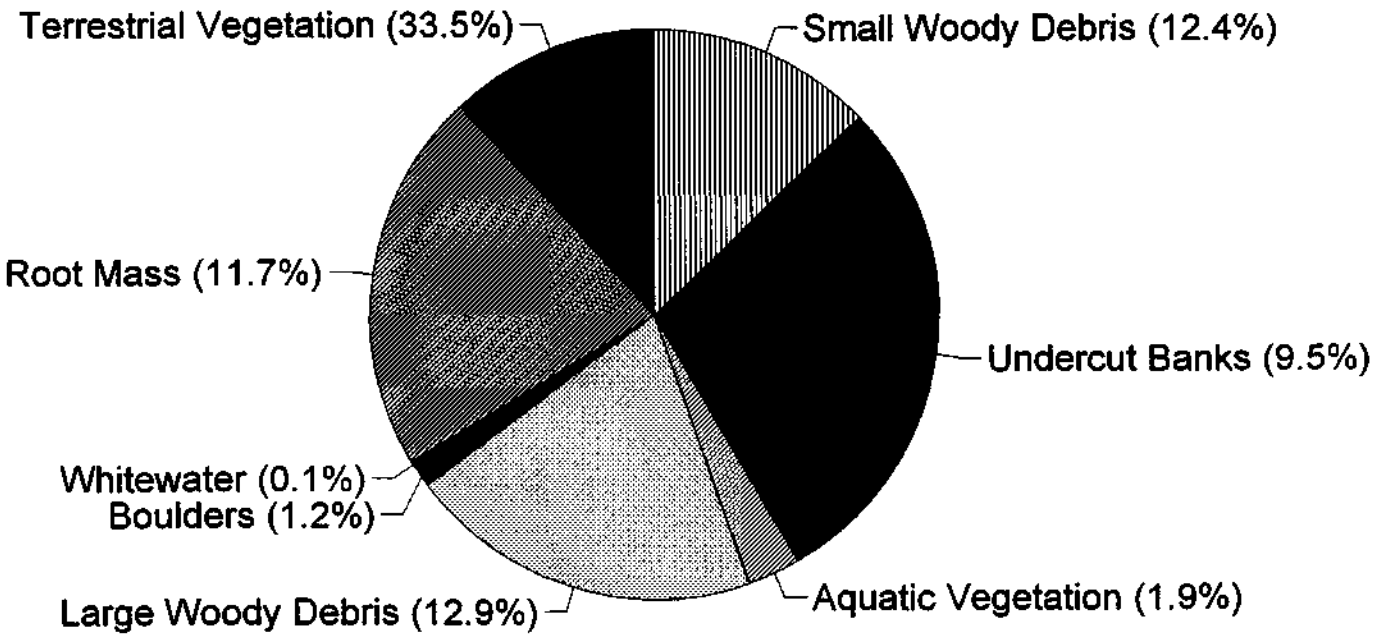


Figure 9. Little North Fork Gualala River Canopy Composition

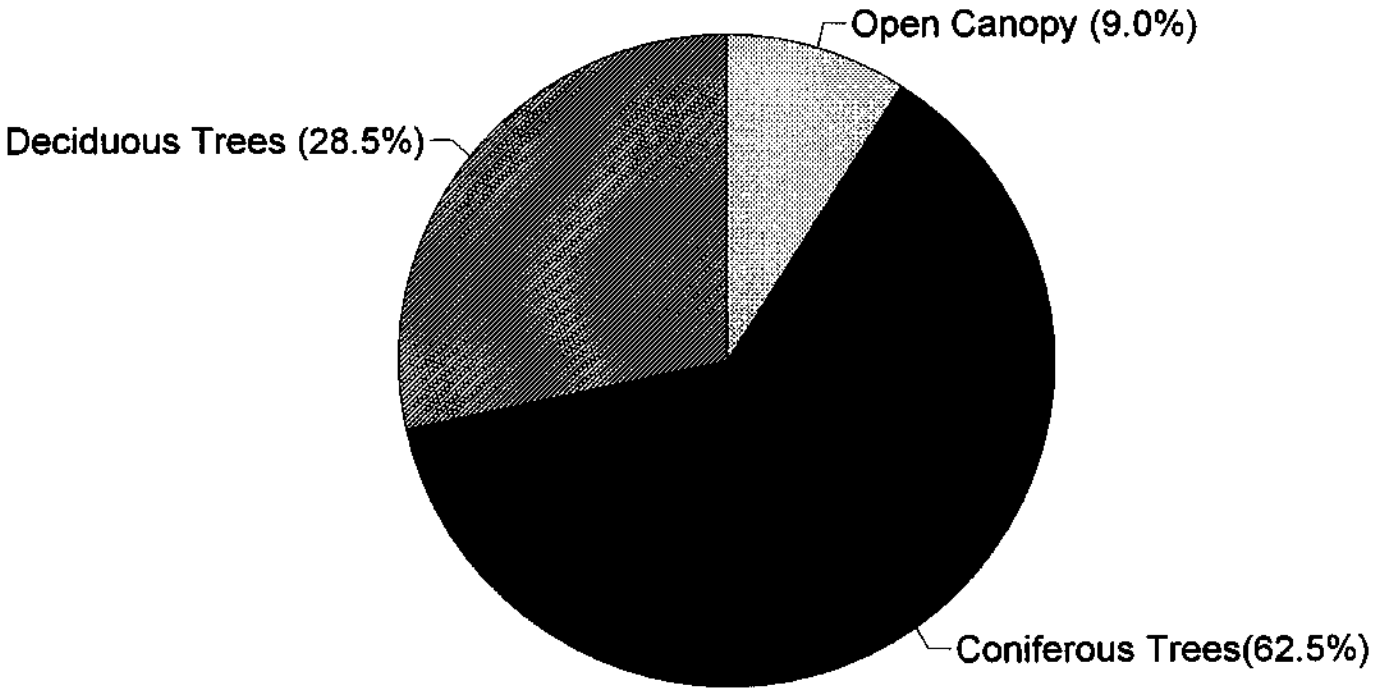
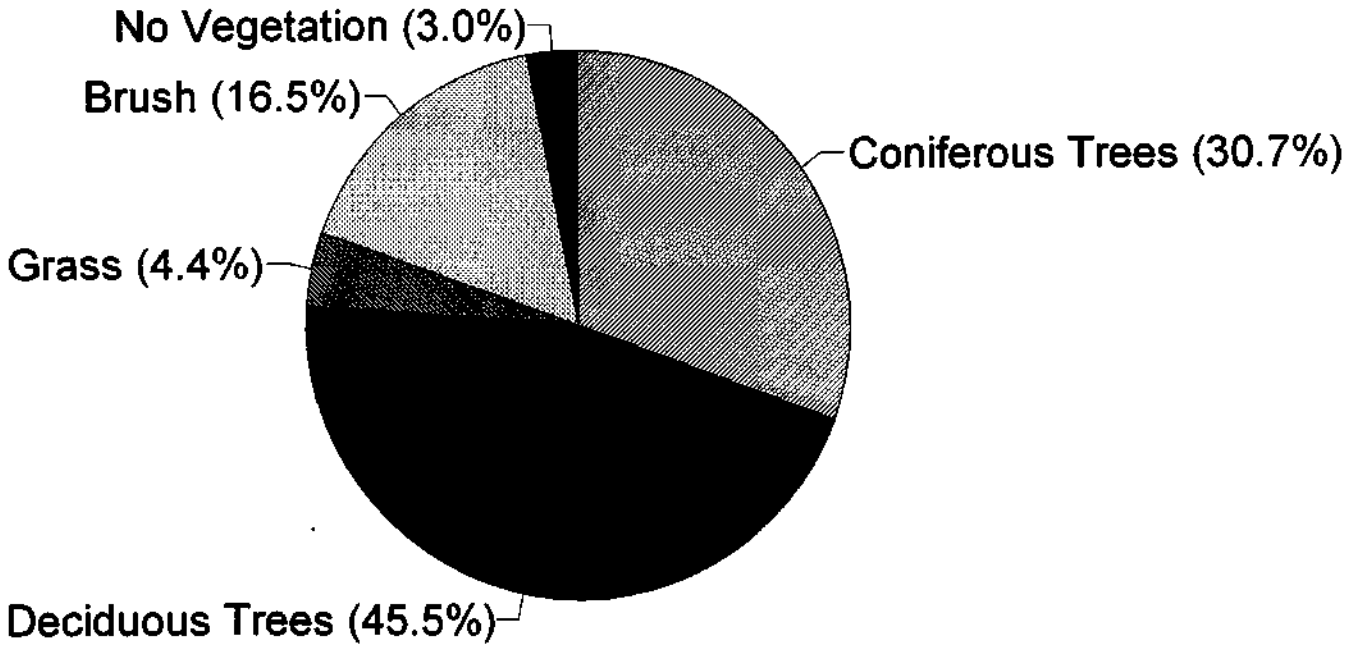


Figure 10. Little North Fork Gualala River Bank Composition by Dominant Vegetation Type



regeneration of deciduous and coniferous trees in the area resulting in the incising of a main channel. The feasibility of aiding or accelerating this process should be investigated.

The water temperatures in the Little North Fork Gualala River during the survey ranged from 50.0°-57-5°F. Air temperatures ranged from 54.0°-82.5°F. Bell (1984) identifies the preferred temperature range for steelhead as 45°-58°F with an optimum range of 50°-55°F and an upper lethal limit of 75°F, while the preferred range for coho salmon is 38°-69°F with an optimum range of 53°-58°F and an upper lethal limit of 78.5°F. The water temperatures observed in the Little North Fork Gualala River during the survey fall well within the preferred range and for the most part within the optimum range of both species, indicating that the Little North Fork has an excellent water temperature regime for salmonids. To make any further conclusions, water temperatures should be monitored throughout the warm summer months during low flow conditions.

Flatwater habitat types comprised 42% of the total length of this survey, riffles 10%, and pools 49%. The pools are relatively deep with 47.1% of the pools having a maximum depth greater than 2 feet. However, in coastal coho and steelhead streams, it is generally desirable to have primary pools comprise approximately 50% of total habitat. In first and second order streams a primary pool is defined to have a maximum depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Therefore, installing structures that will increase or deepen pool habitat is recommended for locations where their installation will not be threatened by high stream energy, cause streambank erosion, or conflict with the modification of the numerous log debris accumulations (LDA's) in the stream. The LDA's in the system are retaining needed gravels. Any necessary modifications to them should be done with the intent of metering the gravels out to downstream reaches that will trap the gravel for future spawning use. Therefore, gravel retention features may need to be developed prior to any LDA modification.

Of the 168 pool tail-outs measured, 109 had embeddedness ratings of 3 or 4. Only one had a 1 rating. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered best for the needs of salmon and steelhead. In the Little North Fork Gualala River, sediment sources should be mapped and rated according to their potential sediment yields, and control measures taken.

The mean shelter rating for riffles and flatwater habitats was low with ratings of 8 and 33 respectively. The shelter rating in the pool habitats was improved at 70. However, a pool shelter rating of approximately 100 is desirable. The moderate amount of cover that now exists is being provided primarily by undercut banks and terrestrial vegetation in all habitat types. Additionally, root masses as well as large and small woody debris contribute a small amount. Log, root wad, and boulder cover structures in the pool and flatwater habitats are needed to improve both

summer and winter salmonid habitat. Cover structures provide rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

Sixty-two of the 69 low gradient riffles (89.9%) had gravel or small cobble as the dominant substrate. This is generally considered excellent for spawning salmonids.

The mean percent canopy for the stream was 91.0%. This is a relatively high percentage of canopy, since 80 percent is generally considered optimum in these north coast streams. In areas of stream bank erosion, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

6.0 RECOMMENDATIONS

1) The Little North Fork Gualala River should be managed as an anadromous, natural production stream.

2) The channel conditions in reaches 2, 4 and 5 should be further analyzed and any feasible restoration measures should be implemented.

3) Temperatures in this section of the Little North Fork Gualala River, as well as upstream, were being monitored at the time of the survey. This data should be acquired and analyzed to determine if they are having a deleterious effect upon juvenile salmonids. To achieve this, biological sampling is also required.

4) Where feasible, design and engineer pool enhancement structures to increase the number and depth of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion. The lower portion of Log Cabin Creek should also be considered for pool enhancement structures.

5) Increase woody cover in the pools and flatwater habitat units where it is not already present. Adding high quality complexity with woody cover is desirable and in some areas the material is at hand.

6) Inventory and map sources of stream bank erosion, and prioritize them according to present and potential sediment yield. Identified sites, like the sites at 12,981' and 13,708' as well as reaches 2 and 5, should then be treated to reduce the amount of fine sediments entering the stream.

7) Active and potential sediment sources related to the road system need to be identified, mapped, and treated according to their potential for sediment yield to the stream and its tributaries.

8) Spawning gravels on the Little North Fork Gualala River are limited to portions of reaches 1 and 6, as well as some reduced spawning potential upstream of the confluence with Doty Creek. Projects should be designed at suitable sites to trap and sort spawning gravels in order to expand redd site distribution in the stream.

9) There are several log debris accumulations present on the Little North Fork Gualala River that are retaining large quantities of fine sediment. The modification of these debris accumulations is desirable, but must be done carefully, over time to avoid excessive sediment loading in downstream reaches.

10) The lack of any distinct channel in reach 4 as well as the braided nature of the channel in the areas immediately upstream and downstream of this reach may result in stranding and reduced emigration success for juvenile salmonids. Fish outmigration and stranding problems should be monitored, and improved where possible.

7.0 LITERATURE CITED

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APPENDIX A

PROBLEM SITES AND LANDMARKS

The following observations, comments, landmarks and possible problem sites were noted. All the distances are approximate and taken from the beginning of the survey reach. All references to "right" and "left" are oriented when facing downstream.

Stream Length (ft)	Comment
147	Begin Survey at confluence with North Fork Gualala River.
315	Ford Crossing Over Top of Unit.
330	Bridge Crossing over unit (Main North Fork Road).
514	Unit flagged at Upstream End.
859	Unit Flagged at Upstream End.
1191	Unit Flagged at Upstream End.
1548	Channel confined by clay/mud banks 1-5 ft high with no vegetation until top of banks - begins with unit #38.
1637	Unit flagged at Upstream End.
2024	Upper half of unit flows through "tunnel" in bank - mud + roots. Upstream End of Unit Flagged.
2233	Upper half of unit flow under undercut bank.
2331	Upstream end of unit flagged.
2768	Deep redwood canopy over unit. Photo *#1* (Camera #2).
2874	Photo *#2*. Upstream end of unit flagged.
2909	Photo #3.
3070	Short (3ft L) riffle between units #73+74. Photo #4.

3256 Upstream end of unit flagged.

3694 Great fish cover. Photo #5.

4066 Major logjam over unit - possible migration hinderance. Depths uncertain due to quantity of wood over/in unit. Photo #6 - View from upstream end. Photo #1 - View from downstream end. Unit flagged at upstream end.

4367 Metal pipe (2.5 ft diameter) sticks out of left bank in middle of unit.

4438 Upstream end of unit flagged.

4475 Raw hardpan bank on right - Photo #8.

4625 Large exposed roots growing across/over unit.

4684 Two 27 ft long culverts located under road crossing at upstream end of unit. End of survey for 10/6/94.

4804 Tailcrest measurements taken at outflow into culvert.

4935 Upstream end of unit flagged.

5006 Spring enters on left bank. Water temp in spring - 14 C @ 0950.

5055 Unnamed tributary enters on left bank. Water temperature in tributary - 13 C @1000 hrs.

5198 Road adjacent to right bank at top of unit.

5470 Photo.

5560 Unit flagged at Upstream end.

5735 2 Photos.

5884 Side channel re-enters main channel at top of unit.

6038 Side channel - exits unit #131 at Upstream end.

6038 Side channel re-enters main channel at upstream end of unit #127.

6088	Small logjam over middle of unit. Two photos.
6187	One 3" salmonid observed in cover.
6309	Photo downstream through unit, including incised bank.
6345	Large incised "cove" behind large stump on left side of unit - Photo.
6427	Photo of channel, facing upstream through unit. Channel becomes less confined, with alternating gravel bars.
6527	Upstream end of unit flagged - Unit labeled as #140 on flagging in field.
6627	Small logjam on gravelbar on right bank. 3.5 ft deep undercut bank on left with active channel flowing completely under bank at downstream end of unit.
6740	4 ft deep undercut bank on right.
6839	Unit flagged at Upstream end. Unit labeled as "unit #150" on flagging in the field.
6924	Two juvenile salmonids (~3"L) observed at downstream end of unit.
7024	Small fish observed in unit - appeared to be salmonids.
7090	Photo of top of unit and further upstream.
7211	Majority of substrate is clay hardpan or silt. Upstream end of unit flagged - Unit labeled as "Unit #160" on flagging in the field.
7307	Alternating gravel bar channel type ends at upstream end of unit.
7436	Begin confined channel type with icised clay banks on both sides. Photo. Unit is a trench with vertical clay banks.
7609	Tributary enters on right at downstream end of unit. Water temp in tributary -12.5C@1610 hrs. Unit is a trench with vertical clay banks - Photo.
7683	Channel incised to hardpan in bed as well as banks. Unit flagged at upstream end - Unit labeled "Unit #170" on flagging in field.

7889	Cascade is 5 ft tall waterfall off of original river bed height into claybank incised trench.
7952	Channel still consists primarily of incised claybanks.
8017	Upstream end of unit flagged - Unit labelled "Unit #180" on flagging in the field.
8030	Medium size logjam over top of unit.
8070	Channel now has wide gravel bar on right bank - channel used to meander around trees, but now new channel goes straight between trees through the upper portion of the incised clay bank area.
8115	Alternating gravel bars resumes.
8328	One juvenile salmonid observed darting in unit. Medium size logjam over top of unit. Unit flagged at upstream end - unit labeled as "Unit #190" on flagging in the field.
8328	Side channel exits on left at upstream end of unit #191. Both banks in this channel incised 2-3 feet.
8328	Side channel reenters main channel @ upstream end of unit #195.
8576	End of survey for 10/7/94. Side channel reenters main channel at upstream end of unit.
8640	Incised side channel (barely flowing) enters unit on left at upstream end. Photo #1, Camera #3.
8739	Substrate very embedded and covered with silt and brown algae. Photo #2. Approximately 20 juvenile salmonids observed in unit.
8780	Entire unit covered with brown algae. Approximately 20 more juvenile salmonids observed in unit - appear to be age 0+ steelhead.
8840	Large logjam over top of unit. Photo #3 - Algae. Photo #4 - Logjam. Upstream end of unit flagged - unit labelled "Unit #200" on flagging in the field.
8994	Unit covered with algae and aquatic vegetation. Surrounding vegetation adjacent to unit is marsh-like, with the conifers present either dying or

dead. Photo *#5* - Logjam viewed from upstream end. Photo *#6* - View upstream through unit #201. Photo #7 - View upstream through upper half of unit.

9018 Intermittent channel enters on left.

9057 Dense alders (small-medium in size), brush, and aquatic vegetation dominate banks and surrounding vegetation.

9369 Channel enters marshy area and braids throughout area with no distinct channel. Numerous large redwoods in the area which are virtually all dead, presumably from excessive water. Needles still present on dead trees, so it appears that this marshy area was formed fairly recently.

9419 Single channel forms again, with other smaller channels present in the area. Age 0+ steelhead and stickleback observed in unit. Photo #8.

9881 Several age 0+ steelhead and a age 1+ size salmonid observed in unit. Channel enters forest and leaves marshy habitat. Photo #9.

9881 Backwater Pool on left at tailout of unit #211. One age 0+ steelhead observed in unit.

9964 Channel confined by 3-8 ft high mud/clay banks which are densely vegetated in units #212-214.

10087 Channel confined by incised banks 4-6 ft tall in units #215-216.

10102 Flow enters pool from underneath undercut bank at upstream end of unit. Water flows from unit #217 via a "tunnel" underneath trees: Unit #217 and further upstream are located in an old established channel consisting of alternating gravel bars and a gravel dominated substrate (channel type C3). This channel continues below unit #217, adjacent to hillside on east side of area, eventually entering the marshy area in the vicinity of units #206-209. The surrounding area adjacent to the older channel has a lower elevation than the channel itself downstream of unit #217, and rather than the flow continuing along this older established channel, it has scoured it's way under the trees and surrounding soil into unit #216 which is the beginning of the claybank incised channel (channel type F5). This channel type is incised 4-6 ft below the surrounding area and thus at lower flows is the path of choice for the flowing water. The older established channel now only contains isolated pools, some of which

contain stranded juvenile salmonids. At higher flows, both channels presumably contain flow, with the entire area apparently becoming flooded in the vicinity of the marshy area. The marshy area appears relatively new based on the state of the dead/dying conifers and the height of the dense alders and other successional vegetation in the area. The marshy area and the numerous braided channels above/below this area pose a possible migrational hinderance for upstream migrating salmonids, and in addition, this area is likely the source of increased mortality of juvenile salmonids emigrating through this area due to the lack of a single established channel. See map and notes written on the back of data sheet #24 of 37 for more information, along with four photos taken of the area around the "tunnel".

10125 Noticeably less sediment in substrate than observed in units downstream of the marshy area - Units #217-219.

10164 Photo - "new" channel type (C3)

10256 Tailcrest noticeably less embedded. Two juvenile salmonids observed in unit. Unit flagged at upstream end - unit labeled "Unit #220" on flagging in the field.

10509 Four Age 0+ steelhead and one crayfish observed in unit.

10643 Unit flagged at Upstream end - Unit labeled "Unit #230" on flagging in the field.

10689 Photo - View upstream through unit.

10758 Small logjam on left side of unit.

10858 Several juvenile salmonids and crayfish observed in units #236-240.

10998 Unit flagged at upstream end - unit labeled "Unit #240" on flagging in the field. Gradient appears to increase upstream of unit #240.

11065 Small logjam (mostly SWD) on right bank.

11427 Ford crossing over unit. Approximately 20 age 0+ steelhead observed in unit. Bridge crossing over upstream end of unit.

11458 Approximately20 age 0+ steelhead observed in unit. Boulder riprap on both banks to prevent scouring around bridge.

11621 Unit flagged at upstream end - Unit labeled "Unit # 250" on flagging in the field.

11823 Two Photos - Views from D/S and U/S ends of unit.

11846 Gravel banks in area worked recently by wild pigs.

12233 Log Cabin Creek enters on left in middle of unit. Water temperature in Log Cabin Creek @1715 hrs - 13.5 C. End of Survey for 10/8/94.

Lower Log Cabin Creek was inspected from the mouth to the culvert/road crossing approximately 150 yards upstream. The creek is barely flowing with some short subsurface flow sections. Very few pools observed in this section (5 pools observed, most were 3"-6" max depth). All of the pools however, contained 3-5 age 0+ steelhead, and the plunge pool immediately below the culvert contained « 10 age 0+ steelhead and four age 1+ size steelhead, along with several fish which appeared to be California Roach. The culvert appeared to not present any passage problems, although it should be inspected at higher flows. The stretch inspected was mostly run/riffle habitat and could benefit from some habitat structures to create rearing habitat and back up some spawning gravel.

12390 Photo - View upstream through units #265-267.

12587 Age 1+ size steelhead observed in unit. Unit flagged at upstream end - unit labeled "Unit #270" on flagging in the field.

12802 Two photos - unit viewed from D/S and U/S ends. Several age 0+ steelhead observed throughout unit - unit appears to have potential as a spawning ground, although there is lots of cobble mixed in with the gravel.

12894 Three large redwoods (« 36"dbh) on right bank are dead - overflow channels exist across bank in several directions and many roots are exposed. Photo.

12969 Small Acacia trees growing on incised left gravel bank.

12981 Both banks incised 5 feet along units #277-278. Photo - View D/S through units #276-278.

13047	6 ft diameter old growth log across top of unit - well anchored with another piece of LWD below it -Photo. Unit flagged at upstream end -unit labeled "Unit #280" on flagging in the field.
13603	Age 0+ steelhead observed in unit.
13641	Unit flagged at upstream end - unit labeled "Unit #290" on flagging in the field.
13708	Creek turns quick "S-turn" and is actively incising left bank trying to straighten out curves. Two Photos - Both are a view from upstream in next unit.
13979	2-3 Age 0+ steelhead observed in unit. Unit flagged at upstream end - unit labeled "Unit #300" on flagging in the field.
14005	Medium size logjam over unit, including 2 redwood trees which have sprouted several 12-25 foot tall trees - Photo.
14095	Substrate noticeably less embedded with much less sediment in this area. Final Photo on Camera #3 - View U/S through unit.
14134	Road now -60 feet from left bank.
14259	Several age o+ steelhead observed in unit.
14349	Dense overhanging redwood limbs over upper half of unit. Upstream end of unit flagged - unit labeled "Unit #310" on flagging in the field.
14381	Area still has lower embeddedness and sediment than downstream areas. Gradient is higher in this portion of creek versus downstream, although it is still relatively low gradient.
14540	Road located -50 feet from left bank. Small dry tributary enters on left via a culvert under the road and a short channel.
14995	Upstream end of unit flagged - unit labelled "Unit #320" on flagging in the field.
14995	Backwater pool in corner on left bank.

15026 Two pieces LWD over unit at top and 2 pieces LWD over unit at bottom, plus 1 piece of LWD against both the left and right banks.

15198 Main road is -45 feet from left bank - secondary road heads uphill to the North from main road, with small tributary entering through a culvert.

Tributary flowing at culvert but not at mouth. Water temperature in tributary at 1715 hrs - 13 C.

15215 Unit flagged at upstream end - unit labeled "Unit #330" on flagging in the field.

15302 Large logjam over unit - Jam is only complex on left half of unit.

15414 Temperature recorder anchored in the middle of unit with rebar.

15501 Dry channel/tributary enters on right at top of unit. Mouth of creek has a piece of LWD anchored across it.

15525 Unit flagged at upstream end - Unit labelled "Unit #340" on flagging in the field.

15787 Ford crossing over middle of unit. Doty Creek enters on left at U/S end of unit. Doty Creek has « 75% of the total flow downstream of the confluence. Water temperatures @ 1810 hrs:

Doty Creek, U/S of the confluence - 12° C
Little North Fork Upstream of the confluence - 12° C
Little North Fork downstream on the confluence - 12° C

- End of the Little North Fork Survey -

The lower ~l/4 mile of the Little North Fork Gualala River, upstream of the confluence with Doty Creek, was inspected at 1830 hrs. The channel has a steeper gradient than downstream of the confluence, and the channel in this portion is moderately to highly confined. The substrate was dominated throughout by a 50/50 mix of gravel and cobble. The habitat consisted of long riffles and runs which ranged from 0.05-0.4' in depth, averaging ~0. T in most. Shallow pools (most were 0.4-0.6' max) were located ~30-100 feet, with the deepest pool observed being 1.2 feet deep. The majority of the pools were 30-40 sq. feet in size. Small numbers of 2-4" fish were seen darting in this portion of the creek, with all observed fish being in the pools. Low light levels prevented me from identifying the fish

species. The flow level in the creek is too low to allow for a meaningful quantitative survey, so this qualitative assessment will have to suffice. The creek appears to have spawning potential for anadromous salmonids, along with some rearing habitat for at least some portion of the year. Presence/absence electroshocking is recommended to determine the current distribution offish in the remainder of this drainage. In addition, spawning surveys in the winter/spring could supply valuable information on both this area and in Doty Creek.

A temperature recorder is anchored in a shallow pool -150 feet upstream of the confluence in Little North Fork Gualala River.

APPENDIX B

LEVEL III and LEVEL IV HABITAT TYPE KEY

HABITAT TYPE	LETTER	NUMBER
RIFFLE		
Low Gradient Riffle	[LGR]	1.1
High Gradient Riffle	[HGR]	1.2
CASCADE		
Cascade	[CAS]	2.1
Bedrock Sheet	[BRS]	2.2
FLATWATER		
Pocket Water	[POW]	3.1
Glide	[GLD]	3.2
Run	[RUN]	3.3
Step Run	[SRN]	3.4
Edgewater	[EDW]	3.5
MAIN CHANNEL POOLS		
Trench Pool	[TRP]	4.1
Mid-Channel Pool	[MCP]	4.2
Channel Confluence Pool	[CCP]	4.3
Step Pool	[STP]	4.4
SCOURPOOLS		
Corner Pool	[CRP]	5.1
Lateral Scour Pool - Log Enhanced	[LSL]	5.2
Lateral Scour Pool - Root Wad Enhanced	[LSR]	5.3
Lateral Scour Pool - Bedrock Formed	[LSBk]	5.4
Lateral Scour Pool - Boulder Formed	[LSBo]	5.5
Plunge Pool	[PLP]	5.6

BACKWATER POOLS

Secondary Channel Pool	[SCP]	6.1
Backwater Pool - Boulder Formed	[BPB]	6.2
Backwater Pool - Root Wad Formed	[BPR]	6.3
Backwater Pool - Log Formed	[BPL]	6.4
Dammed Pool	[DPL]	6.5