Appendix C

Sonoma Creek Habitat Inventory

Southern Sonoma County Resource Conservation District

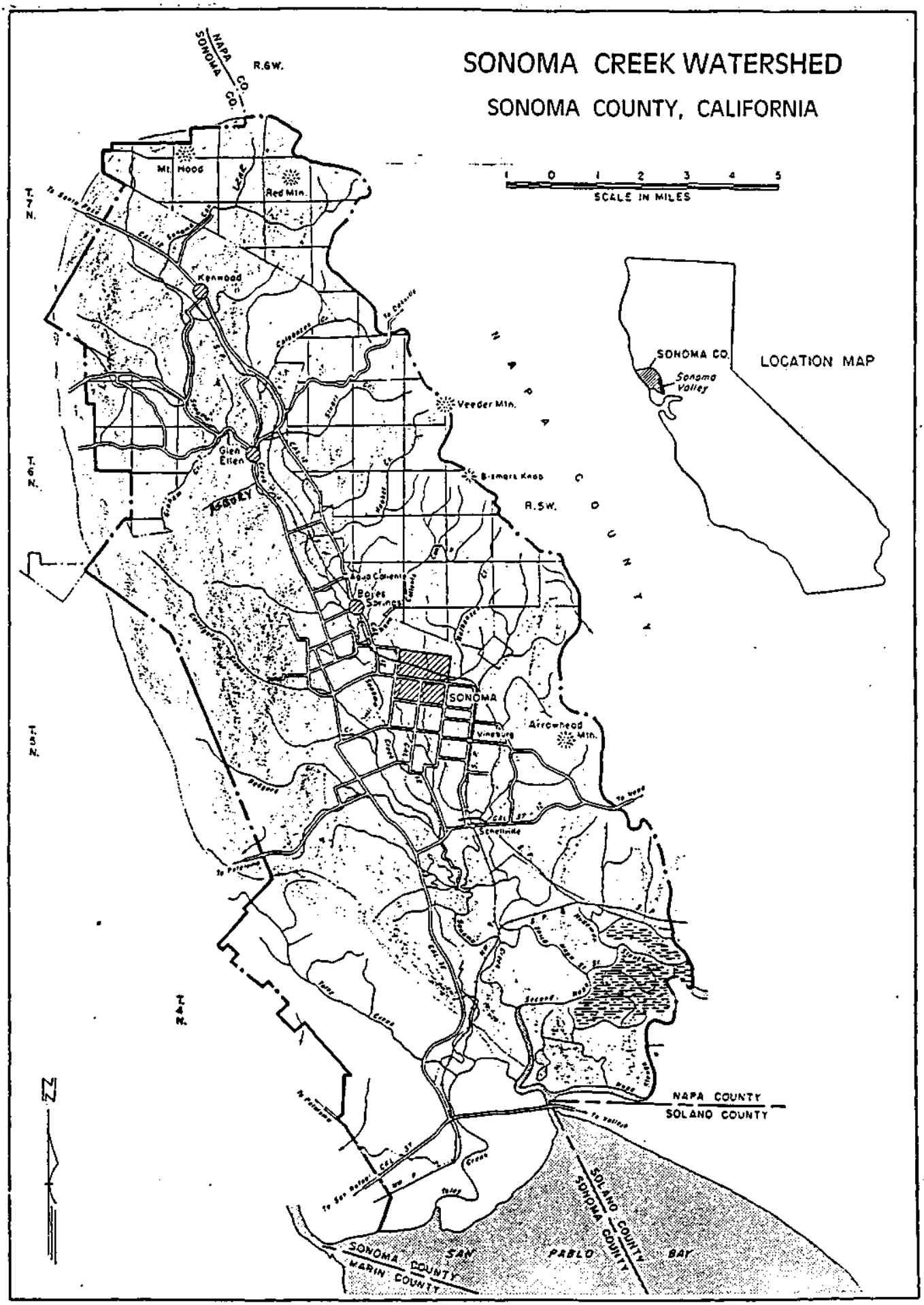
SONOMA CREEK WATERSHED
SONOMA COUNTY, CALIFORNIA
SCALE IN MILES
LOCATION MAP
SONOMA CO.
Sonoma Valley
NAPA COUNTY
SOLANO COUNTY
SONOMA COUNTY
MARIN COUNTY
SAN PABLO BAY
SONOMA
Kenwood
Glen Ellen
Boyes Springs
Agua Caliente
Mt. Hood
Red Mtn.
Veeder Mtn.
Bismark Knob
Schellville
Vineburg
Arrowhead Mtn.
R.6W.
R.5W.
T.7N.
T.6N.
T.5N.
T.4N.

Table of Contents

Acknowledgements

Southern Sonoma County Resource Conservation District would like to acknowledge the landowners and agencies that made this collaborative effort possible. Hundreds of Landowners in the Sonoma Creek watershed allowed access to their private property during the survey. Bob Coey and Bill Cox of California Department of Fish and Game provided training, report template, and technical review of the report. Ken Bunzell (CDFG) crunched numbers, developed tables and graphs. Natural Resources Conservation Service provided office space, and project support during the survey. Northwest Emergency Assistance Program (NEAP) personnel Bill Irons and Jim McIlhiney for their exhaustive field work and documentation.

November 25, 1996

STREAM INVENTORY REPORT
UPPER SONOMA CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 1996 on Sonoma Creek {above Madrone Road). The inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the amount and condition of available habitat to fish, and other aquatic species with an emphasis on anadromous salmonids in Sonoma Creek. The objective of the biological inventory was to document the salmonid and other aquatic species present and their distribution.

The objective of this report is to document the current habitat conditions, and recommend options for the potential enhancement of habitat for chinook salmon, coho salmon and Steelhead trout. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Sonoma Creek is tributary to San Pablo Bay, located in Sonoma County, California (See map of Sonoma Creek watershed). The legal description at the confluence with San Pablo Bay is T04N R05W S28. Its location is 38 09'33" N. latitude and 122 24' 25" W. longitude.

Sonoma Creek and its tributaries drain a basin of approximately 170 square miles. Sonoma Creek is a third order stream and has approximately 31.5 miles of blue line stream, according to the USGS Sonoma, Glen Ellen, Kenwood, and Rutherford 7.5 minute quadrangles. Major tributaries to the upper reaches include Calabazas, Stuart, Graham, Asbury, and Bear, and each are described in separate stream reports. Summer flow was measured as approximately 8 cfs at Madrone Ave. on 7/1/96 and as 7.5 cfs on 9/9/96 at the same general location. Elevations range from about 8 feet at the mouth of the creek to 2700 feet in the headwater areas. Redwood and bay trees dominate the upper reaches, and willow, alder, oak, maple, and bay dominate the lower reaches. State landholdings include Jack London and Sugarloaf Ridge State Parks, and Sonoma Developmental Center. The land is managed for residential, recreational, and agricultural uses. Agriculturally, grazing lands are being converted to vineyards as demand for grapes grows. Residential growth is presently slow.

METHODS

The habitat inventory conducted in Sonoma Creek follows the methodology presented in the California Salmonid Stream Habitat Restoration Manual (Flosi and Reynolds, 1994). The NEAP Surveyors that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). This inventory was conducted by a two person team supervised by Paul Sheffer (SSCRCD), with technical oversight provided by Bob Coey, Basin Planner (DFG), Bill Cox, Fisheries Biologist (DFG), and Ken Bunzell (DFG).

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 Sonoma Creek to record measurements and observations. There are nine components to the inventory form: flow, channel type, temperatures, habitat type, embeddedness, shelter rating, substrate composition, canopy, and bank composition.

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 were also measured or estimated at major tributary confluences.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1985 rev. 1994). This methodology is described in the California Salmonid Stream Habitat Restoration Manual. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity.

3. Temperatures:

Water and air temperatures, and time, are measured by crew members with hand held thermometers and recorded at each tenth unit typed. Temperatures are measured 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 and others (1988). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled "DRY". Sonoma Creek 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. All unit lengths were measured, additionally, the first occurrence of each unit type and a randomly selected 10% subset of all units were completely sampled (length, mean width, mean depth, maximum depth and pool tail crest depth). All measurements were in feet to the nearest tenth.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out reaches is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Sonoma Creek, embeddedness was visually 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). Additionally, a rating of "not suitable" (NS) was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate particle size, having a bedrock tail-out, or other considerations.

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. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All shelter is then classified according to a list of nine shelter types. In Sonoma Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the shelter. The shelter rating is calculated for each habitat unit by multiplying shelter value and percent covered. 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 fully measured habitat units, dominant and sub-dominant substrate elements were visually estimated.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the California Salmonid Stream Habitat Restoration Manual, 1994. Canopy density relates to the amount of stream shaded from the sun. In Sonoma Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every fourth unit in addition to every fully-described unit, giving an approximate 40% sub-sample. In addition, the area of canopy was estimated visually into percentages of evergreen or deciduous trees.

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 Sonoma Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully measured unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation was estimated and recorded.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. Biological inventory is conducted using one or more of three basic methods: 1) stream bank observation, 2) underwater observation, 3) electrofishing. These sampling techniques are discussed in the California Salmonid Stream Habitat Restoration Manual

DATA ANALYSIS

Data from the habitat inventory form are entered into a dBase IV data entry program developed by Tim Curtis, Inland Fisheries Division, California Department of Fish and Game. This program processes and summarizes the data, and produces the following tables and appendices:

- Riffle, flatwater, and pool habitat types
- Habitat types and measured parameters
- Pool types
- Maximum pool depths by habitat types
- Shelter by habitat types
- Dominant substrates by habitat types
- Vegetative cover and dominant bank composition
- Fish habitat elements by stream reach

Graphics are produced from the tables using Lotus 1,2,3. Graphics developed for Sonoma Creek include:

- Level II Habitat Types by % Occurrence and % Total Length
- Level IV Habitat Types by % Occurrence
- Pool Habitat Types by % Occurrence
- Maximum Depth in Pools
- Percent Pool Shelter by Shelter Type
- Substrate Composition in Low Gradient Riffles
- Percent Embeddedness by Reach
- Mean Percent Canopy
- Mean Percent Canopy by Reach
- Percent Bank Composition and Bank Vegetation

Historical Stream Surveys:

A stream survey was conducted on 2/4/57 by R.F. Elwell for (CDFG). This was a visual inspection by auto with frequent stops for closer inspection on foot. The general description of the watershed includes comments about large numbers of diversions, flashboard dams and summer dams. No permanent barriers were observed. Estimated Temperatures were similar to those measured during the 1996 habitat inventory. Pollution was suspected to be occurring due to 'heavily populated areas, wineries and dairies. Nursery areas above Boyes Springs were reported as successful for steelhead, containing 'quite common numbers of steelhead fingerlings averaging 2-3 in. in length.' No other vertebrates were observed that day. Heavy fishing intensity was seen in some sections of the stream. A 7-acre impoundment area was known to be stocked with catchable trout.

HABITAT INVENTORY RESULTS

* ALL TABLES AND GRAPHS ARE LOCATED AT THE END OF THE REPORT *

The habitat inventory of July 1 - September 26, 1996 was conducted by Bill Irons and Jim McElhiney (NEAP). The survey began at Madrone Road and extended up Sonoma Creek to the end of anadromous fish passage at a 35 foot high waterfall. The total length of the stream surveyed was 64,895 feet, with an additional 775 feet of side channel.

Flow was estimated to be 8 cfs near the Madrone Road bridge on 7/1/96 and 7.5 cfs on 9/9/96.

This section of Sonoma Creek has 4 channel types: from Madrone Road up 2 miles to Glen Ellen an F4 (reach 1); next 7.6 miles to

an area adjacent to Adobe Canyon Road a B4 (reach 2); next .7 mile a B3 (reach 3) and the upper 1.6 miles a B2 (reach 4).

F4 channel types are entrenched meandering riffle/pool channels on low gradients (<2%) with a high width/depth ratio and a predominantly gravel substrate.

B4 channel types are moderately entrenched, moderate gradient (2-4%), riffle dominated channels, with infrequently spaced pools, a very stable plan and profile, stable banks and have a predominantly gravel substrate.

B3 and B2 channel types are similar to B4 types but have cobble and boulder substrates, respectively.

Water temperatures ranged from 54 F. to 74 F. Air temperatures ranged from 50 F to 93 F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 45% flatwater units, 32% pool units, 22% riffle units, and 1% dry streambed units. Based on total length there were 55% flatwater units, 19% pool units, 17% riffle units, and 9% dry streambed units (Graph 1).

Four hundred, thirty-nine habitat units were measured and 14% were completely sampled. Twenty-four Level IV habitat types were identified. The data is summarized in Table 2. The most frequent habitat types by percent occurrence were glides at 22%, low gradient riffles 18%, mid-channel pools 16% and runs 14% (Graph 2). By percent total length, glides made up 23%, step runs 18%, low gradient riffles 14%, and runs 13%.

One hundred, forty-two pools were identified (Table 3). Main Channel pools were most often encountered at 56%, and comprised 62% of the total length of pools (Graph 3).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Eighty-two of the 142 pools (58%) had a depth of three feet or greater (Graph 4). These deeper pools comprised 13% of the total length of stream habitat.

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 types had the highest shelter rating at 43. Flatwater had the lowest rating with 22 and riffles rated 32 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 45, scour pools rated 42, and backwater pools 39 (Table 3).

Table 5 summarizes fish shelter by habitat type. Bedrock ledges and undercut banks were the two most common shelter types for pools and comprised 29% and 21% of the pool shelter, respectively. Boulders and root mass were the next most common pool shelter types and comprised 16% and 11% of the pool shelter. Large woody debris and small woody debris only comprised 7% and 4% of the pool shelter. Graph 5 describes the pool shelter in Sonoma Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 4 of the 9 low gradient riffles (44%) measured for substrate. Small cobble was the next most frequently observed dominant substrate, and occurred in 22% of the low gradient riffles (Graph 6).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 138 pool tail-outs measured, 13 (9%) had a value of 1; 55 (40%) had a value of 2; 39 (28%) had a value of 3; and 31 (22%) had a value of 4. On this scale, a value of one is best for fisheries. Graph 7 describes percent embeddedness by reach.

The mean percent canopy density for the entire survey was 79%. The mean percentages of deciduous and evergreen trees were 79% and 21%, respectively. Canopy increases in an upstream direction with Reach 1 having the least canopy and Reach 4 having the most. Graph 8 describes the canopy for the entire survey and graph 9 describes the canopy by reach.

For the stream reach surveyed, the mean percent right bank vegetated was 63% and the mean percent left bank vegetated was 62%. For the habitat units measured, the dominant vegetation types for the stream banks were: 65% deciduous trees, 19% brush, 9% evergreen trees, 4% bare soil and 3% grass. The dominant substrate for the stream banks were: 47% silt/clay/sand, 28% bedrock, 22% cobble/gravel and 4% boulder (Graph 10).

BIOLOGICAL INVENTORY

Upper Sonoma Creek Fishery Survey

In September of 1995 and 1996 fishery surveys were done at several sites on upper Sonoma Creek and its tributaries. The surveys were done by Bill Cox, Department of Fish and Game District Fishery Biologist with assistance from members of the Sonoma Ecology Center and/or the Southern Sonoma County Resource Conservation District stream survey crew. Fish were collected with a Smith-Root Type XI electrofisher. These surveys were only intended to provide a snapshot of the species present and the relative abundance. No effort was made to collect quantitative data which could be used to determine actual numbers of fish present in the stream.

In the following paragraphs reference is made to age 0+, age 1+, and age 2+ steelhead trout (Oncorhynchus mykiss): this means fish in their first year of life, fish in their second year of life, and fish older than 2 years, respectively. Age 0+ fish are also called young-of-the-year. Generally age 0+ steelhead would be from 1.5 to 4 inches long, age 1+ fish would be from 4 to about 7 inches, and age 2+ fish are about 8 inches or a little more.

Since it is not possible to distinguish juvenile steelhead trout from resident rainbow trout (they are the same species), any rainbow trout are considered to be steelhead if they are in an area accessible to adult steelhead as they migrate in from the ocean, although some are probably resident. In areas above impassible barriers, like the area above the falls in Sugerloaf Ridge State Park, the trout are considered to be resident. The young of resident rainbow trout may contribute to the steelhead population. Some young of sea-run steelhead may remain in the stream as resident fish.

Sonoma Creek

A 100 foot reach behind the Amadeo restaurant downstream from Glen Ellen. About half of this reach is shaded, but half is exposed to the sun with no shade. The bottom is sand and boulder heavily embedded in sand. No count was kept while fish were collected for a demonstration, but hundreds of western roach, a few sculpin, and one western sucker were observed. No juvenile steelhead could be found in this area. A few California freshwater shrimp (Syncaris Californica) were found, but there was very little suitable habitat.

Just upstream of the Arnold Drive bridge at Glen Ellen. This is a wide low gradient riffle and run site with a boulder and cobble bottom heavily embedded in sand with very little structure in the form of large woody debris, overhanging vegetation, or undercut banks. There is a high tree canopy, but closure is not complete and there is sun on most of the water surface. Fish found included 6 steelhead trout, 114 western roach (Hesperoleucus symmetricus), 11 sculpin (Cottus sp.), 5 western suckers (Catostomus occidentalis), and 2 California freshwater shrimp. Only a very small percentage of the roach present at the site were captured, but a relatively high percentage of the steelhead and suckers were probably captured. Freshwater shrimp habitat was very poor.

A 200 foot reach upstream from the confluence of Graham Creek near Sonoma Mountain Road. This stream section has very little shade. The bottom is mostly sand or boulder/cobble heavily embedded in sand. The gradient of the stream is very low resulting in very little current. Fish found included 11 juvenile Steelhead trout (4 age 0+, and 7 age 1+), 8 sculpin, 3 western suckers, and hundreds of western roach. All the steelhead were found in the pool formed at the confluence of Graham Creek. One California freshwater shrimp was also found.

About a mile upstream of the intersection of Warm Springs Road and Bennett Valley Road at 2445 Warm Springs Road. The canopy is high, but nearly closed. Much of the stream bed at this site is hard clay. Fish found included 10 steelhead trout, 108 western roach, and 3 sculpin. Only a very small percentage of the roach present at the site were captured, but a relatively high percentage of the Steelhead were probably captured. No California freshwater shrimp or potential shrimp habitat were found.

About ¼ mile upstream of the Lawndale Avenue bridge. The bottom is gravel and cobble heavily embedded in sand. The canopy is low and nearly complete and the stream is well shaded. The gradient is greater with more diverse riffle and pool habitat than any of the areas further downstream. There is significantly more cover for fish habitat in the form of down logs and branches, root balls, undercut banks, and overhanging vegetation than seen is any of the downstream sites. Fish found included 26 steelhead trout (22 age 0+, 2 age 1+, and 2 age 2+), 39 western roach, 35 sculpin, 1 pacific lamprey (Lampetra tridentata), and 1 crayfish (Pacifasticus leniusculus).

A 300 foot reach upstream from the confluence of Bear Creek near the entrance to Sugerloaf Ridge State Park. This stream section is well shaded with a good canopy of mature riparian trees. The bottom is boulder/cobble. Fish found included 76 juvenile steelhead trout (71 age 0+, 4 age 1+, and 1 age 2+), and 14 sculpin. Three crayfish were also seen.

Summary

Sonoma Creek downstream of the intersection of Bennett Valley Road and Warm Springs Road is clearly within the "roach zone" as described by Peter Moyle in Inland Fishes of California. This is generally a warm, low gradient, poorly shaded area with a sandy/silty bottom and a fish population dominated by roach, suckers, and other warm water species. Sonoma Creek at the entrance to Sugerloaf Ridge State Park is in the "trout zone" as described by Moyle. The "trout zone" is generally cool to cold water, moderate to high gradient, and well shaded with gravel/cobble/boulder bottom with little silt or sand and a fish population dominated by steelhead/rainbow trout and sculpin. The area along Warm Springs Road upstream of Bennett Valley Road may be considered a transition between the "roach zone" and the "trout zone".

DISCUSSION

Sonoma Creek north of Madrone Road has 4 channel types:

12,720 feet of F4 channel type in Reach 1.
40,262 feet of B4 channel type in Reach 2.
3,595 feet of B3 channel type in Reach 3.
8,318 feet of B2 channel type in Reach 4.

The water temperatures recorded on the survey days July 1 - September 26, 1996 ranged from 54 F. to 74 F. Temperatures were undesirably warm in reaches 1 and 2 and satisfactory elsewhere. Air temperatures ranged from 50 F. to 93 F. Water temperatures above 65 F., if sustained, are stressful for salmonids. To make any further conclusions, temperatures need to be monitored for a longer period of time through the critical summer months, and more extensive biological sampling conducted.

Pools comprised 19% of the total length of this survey. *In* third and fourth order streams a primary pool is defined to have a maximum depth of at least three feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. The pools are relatively deep with 82 of the 142 pools having a maximum depth of at least 3 feet (58%). However, these pools comprised only 13% of the total length of stream habitat. In coastal coho and steelhead streams, it is generally desirable to have primary pools comprise approximately 50% of total habitat.

The mean shelter rating for pools was 43. However, a pool shelter rating of approximately 100 is desirable. The relatively small amount of pool shelter that now exists is being provided primarily by bedrock ledges, undercut banks and boulders. Log and root wad cover structures in the pool and flatwater habitats are needed to improve both summer and winter salmonid habitat. Log cover structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition. The bedrock ledges and large boulders are suitable anchor points for placed log structures.

67% of the low gradient riffles measured had either gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

However, 51% of the pool tail-outs measured had embeddedness ratings of either 3 or 4. Only (9%) had a rating of 1. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered best for the needs of salmon and steelhead. Embeddedness levels increase in an upstream direction with Reach 1 having the best conditions and Reach 4 having the poorest. This is usually an indication that the introduction of fine sediments into the system was fairly recent. The higher the percent of fine sediment, the lower the probability that eggs

will survive to hatch. This is due to the reduced quantity of oxygenated water able to percolate through the gravel, or because of fine sediment capping the redd and preventing fry emergence. In Sonoma Creek, sediment sources should be mapped and rated according to their potential sediment yields, and control measures taken.

The mean percent canopy for the entire survey was 79%. This is a good percentage of canopy, since 80 percent is generally considered desirable. However, canopy in Reach 1 was only 63% and water temperatures were highest in this reach. Elevated water temperatures could be reduced by increasing stream canopy. Cooler water temperatures are desirable for Reaches 1 and 2 of Sonoma Creek. The large trees required for adequate stream canopy would also eventually provide stream bank stability and a long term source of large woody debris needed for instream structure.

SUMMARY

Biological surveys were conducted to document fish distribution and are not representative of population information. During the 1996 habitat survey, poor canopy, high water temperatures, low shelter ratings, and a higher number of predatory fish exist in reach 1, but conditions improve upstream. Nursery habitat appears to be in fair condition where temperatures are acceptable. Spawning gravel exists, but there is a high rate of fine sediment deposition, which decreases egg survival.

RECOMMENDATIONS

1) Sonoma Creek should be managed as an anadromous, natural production stream.

2) Conduct outreach to targeted landowners who draw water from, dam or otherwise manipulate the natural flow of the creek (39 were observed) to provide up to date information about responsible water usage. Also, landowners should be educated about the natural and positive role woody debris plays in the system, and encouraged not to remove woody debris from the stream, except under extreme circumstances and only under guidance by a fishery professional.

3) Increase the canopy on Sonoma Creek by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels (portions of Reaches 1 and 2). The non-anadromous reach above the survey section should be assessed for planting and treated as well, since water temperatures throughout are effected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

4) Map sources of upslope and in-channel erosion, and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream. Near-stream riparian planting along any portion of the stream should be encouraged to provide bank stability and a buffering against agricultural and urban runoff.

5) In Sonoma Creek, active and potential sediment sources related to the road system need to be mapped, and treated according to their potential for sediment yield to the stream and its tributaries.

6) Where feasible, increase woody cover in the pool and flatwater habitat units along the entire stream. Adding high quality complexity with larger woody cover is desirable. In some areas the material is at hand.

7) Where feasible, design and engineer pool enhancement structures to increase the number of pools in the upper reaches. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion

8) If riparian areas are not improved in Reaches 1 and 2, temperatures in these upper sections of Sonoma Creek should be monitored to determine if they are having a deleterious effect upon juvenile salmonids. To achieve this, more biological sampling is required.

Appendix D

Water Diversions

Southern Sonoma County Resource Conservation District

Water Diversions

In order to get an idea of the number of water diversions affecting the Sonoma Creek watershed, the following table was compiled using data State Water Resources Control Board (SWRCB) - Division of Water Rights, Stream Surveys from California Department of Fish & Game and Stream Inventories from the Sonoma Creek Habitat Inventory.

Creek	(1)Registered	(2) Observed
Asbury	0	2(11/96)
Agua Caliente	5	0(8/65)
Arroyo Seco	7	2(6/76)
Bear	0	0(7/76), 0(9/96)
Calabazas	11	6(9/96), 4(9/75), 0(1/61)
Carriger	1	1(3/76)
Felder	3	
Graham	1	10(12/59), 9(9/96)
Hooker	0	1(4/77)
Nathanson/Schell	8	0(9/74)
Rodgers	3	
Sonoma	51	32(9/96)*
Stuart	1	0(9/96), 0(10/75)
Yulupa	6	1(7/76)

1) Water rights registered with SWRCB as of June 14, 1996.

2) Diversions observed and noted in CA . Fish & Game Stream Surveys or Sonoma Creek Habitat Inventory. (Mo/Yr).

* Upstream of Madrone Road