Fish Habitat Survey

Napa River, Rutherford Region

March, 2003

Prepared For

The Rutherford Dust Society

By

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INTRODUCTION

A habitat survey was conducted during the week of November 18 – 22, 2002 along the main-stem Napa River to document the amount and condition of available habitat to fish and other aquatic organisms. Observations of fish and other pertinent flora and fauna were documented. This report is intended to provide a preliminary overview of current habitat conditions along this 4.2 mile stretch of the Napa River and suggest options for the potential enhancement of aquatic and riparian environments. Specific sites have been identified for potential restoration or improvement efforts. Recommendations for habitat improvement activities are based upon target habitat conditions suitable for native fish species of the Napa River.

Much work has been done in the Napa River basin to identify key factors limiting fish populations including the *Total Maximum Daily Load* (TMDL) study in 2002 and other studies by CDFG, USFWS, Stillwater Sciences, and other groups. Much of this research has focused on salmonids including steelhead (*Oncorhynchus mykiss irideus*), and Chinook salmon (*Oncorhynchus tshawytscha*), which have experienced drastic population declines over the past several decades. Both species are anadromous, which means they spend their adult lives in the ocean and return to freshwater to reproduce. The Napa River plays a vital role in the life histories of both species as a migration route between the ocean and spawning grounds and also as potential rearing habitat for juvenile fish.

This survey focused primarily on the life history requirements of salmonids within the Napa River basin. Chinook salmon and steelhead serve as indicators of general habitat needs of native cold-water fish species and other aquatic organisms in the mainstem Napa River and lower-gradient reaches of some tributaries.

FISH HABITAT REQUIREMENTS

Escape or hiding cover, provided by undercut banks, fallen trees, boulders and overhanging vegetation, is an important part of year round rearing habitat for juvenile salmonids, especially for larger yearling fish. Most artificial bank protection including concrete walls, sackrete (stacked bags of concrete), and gabions (wire baskets filled with rocks), provides no protective hiding places for fish. Large riprap boulders (2 foot + diameter) can provide a limited amount of cover when placed in the streambed. However, smaller riprap, with small crevices between rocks, provides little hiding cover and often fills in with fine sediment and sand.

The amount of shade provided by trees and other vegetation along the stream affects aquatic habitat in many ways. Shade from a dense riparian canopy benefits salmonids by blocking sunlight and keeping water temperatures cool during hot summer periods. However, too much shade prevents photosynthesis from occurring within the stream, thus reducing primary production at the base of the aquatic food web. A balance of approximately 75% to 90% canopy cover is desirable for salmonid streams.

Riparian trees provide a valuable source of complex habitat structure as large woody debris (LWD). When limbs are lost or whole trees fall into the stream it creates cover for fish and can promote formation of pools via scouring. The tree leaves that drop into the stream also provide a significant source of nutrients for aquatic macroinvertebrates.

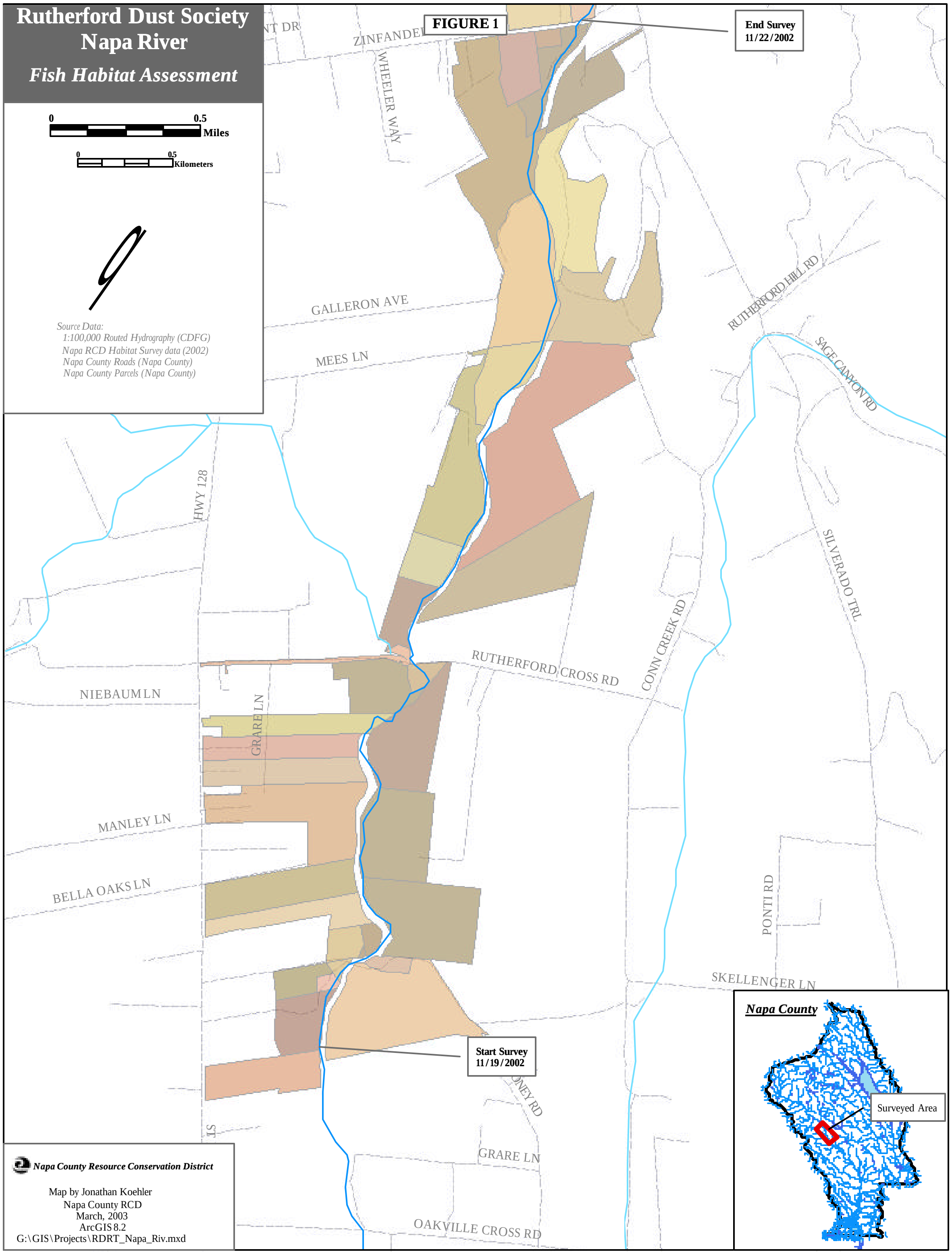


Figure 1 – Napa River habitat survey location within the Rutherford region.

Deposition of fine sediment onto the streambed reduces the amount of aquatic macroinvertebrate habitat, and it can smother algae and aquatic plants. As a consequence reductions in macroinvertebrate populations, especially aquatic insects, have direct effects on the availability of food to young salmonids and other fish. Fine sediment from roads, erosion, and upland sources can smother incubating fish eggs within the spawning nest by blocking water and oxygen flow through the gravel. Silt and sand in the streambed provide unstable habitats and fill crevices in the gravel and cobble, further reducing aquatic macroinvertebrate abundance.

Over-wintering habitat that provides refuge from winter storm flows is critical to young salmonids and many other fish species. This habitat is often in the form of deep pools with complexity from undercut banks, large woody debris, backwaters, calm eddies, and other refuges. These refugia allow fish to escape high storm flows that would otherwise wash them downstream.

Water quality is a key factor affecting fish and other aquatic organisms within a stream ecosystem. Salmonids have relatively narrow requirements for a variety of water quality parameters. In general salmonids require clean cold water with high levels of dissolved oxygen (D.O.). Temperature has an inverse effect on how much D.O. water can hold. In effect the amount of D.O. typically decreases as water temperature increases and vice versa. When water holds all the D.O. it can hold at a given temperature, it is 100% saturated. Salmonids and many other cold-water fish require high levels of D.O. saturation in order to thrive. Streams with D.O. levels above 90% saturation are considered best for supporting salmonids.

Natural and manmade barriers to fish migration are important factors in salmonid distribution and abundance. Barriers that prevent fish passage can be natural or manmade structures. They may prevent passage during all flow conditions or only during periods of low flow. Waterfalls, dry reaches, log jams, and other natural barriers exist to some degree in all streams. These represent naturally occurring stream features and are not generally considered for removal or improvement unless directly related to poor land use or other anthropogenic cause. However, many structures that have been built by humans within streams have a severe impact on migration and reduce the number of salmonids able to reach suitable upstream habitat

METHODS

The habitat survey conducted in the Rutherford region of the Napa River follows a modified methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et. al, 1994). The two-person field crew that conducted the field survey was trained in standardized habitat inventory methods.

The method samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and their lengths are measured. Habitat unit types encountered for the first time are further measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement.

Habitat typing uses 24 habitat classification types defined by their function (Table 1). 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". All 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).

Instream shelter is composed of those elements within a stream channel that provide fish 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. A standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) is 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.

Stream canopy density was measured using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. A measurement of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated visually into percentages of evergreen or deciduous trees.

Bank composition elements range from bedrock to bare soil. Stream banks are usually covered with grass, brush, or trees that influence their ability to withstand winter flows. 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.

In-stream observations throughout the survey were used to document what fish species were present and their general distribution in the river. Observations of other aquatic and riparian animals were also noted. Problems such as migration barriers, bank erosion, poor water quality or temperatures were noted and mapped. Habitat units that exhibited a favorable combination of cover and structure were also recorded for reference and analysis

RIFFLE	**FLATWATER**	**POOLS**
Low Gradient Riffle	Pocket Water	Trench Pool
High Gradient Riffle	Glide	Mid-Channel Pool
Cascade	Run	Channel Confluence Pool
Bedrock Sheet	Step Run	Step Pool
		Corner Pool
		Lateral Scour Pool
		Plunge Pool
		Secondary Channel Pool
		Backwater Pool

Table 1 - Habitat type groupings by functional category.

RESULTS

The habitat survey of the Napa River was conducted by Jonathan Koehler and Michael Champion of the Napa County RCD. A total of 21,817 feet (4.14 miles, 2.57 km) was surveyed beginning at the confluence of a small unnamed tributary and extending upstream to Zinfandel Lane (Figure 1). The survey reach was defined by landowner participation in the Rutherford Dust Society. Within the surveyed reach, a total of 259 habitat units were identified. Of this total 72 were riffles, 81 were flatwater, 105 were pools, and 1 was dry (Figure 2). By percent length riffles accounted for 19%, flatwater for 33%, pools for 47%, and dry for less than 1% of the total survey (Appendix Table 1).

A summary of habitat elements in the survey reach is in Table 2. Average canopy density was 53%, with 92% of that from deciduous trees. In general, fish habitat improves with higher canopy values.

Canopy Density:	53%
Channel Length:	21,773 ft.
Riffle/flatwater Mean Width:	15.6 ft.
Total Pool Mean Depth:	1.9 ft.
Base Flow:	Low
Temperature:	Water: 10 - 15 °C Air: 11 - 21 °C
Dominant Bank Vegetation:	Deciduous Trees
Vegetative Cover:	77%
Dominant Bank Substrate:	Silt/Clay/Sand
Evergreen Component:	1%
Deciduous Component:	92%
Dry Channel:	48 ft.
Pools >= 3 ft. deep:	44%
Mean Pool Shelter Rating:	70
Dominant Shelter:	Large Woody Debris
Occurrence of LWD:	20%
Pools by Stream Length:	47%

Table 2 – Summary of fish habitat elements for survey reach.

Native and introduced fish species were observed throughout this survey (Table 3). Other animals observed included river otters (*Lutra canadensis*), Belted Kingfisher (*Ceryle alcyon*), Great Horned Owl (*Bubo virginianus*) and Great Blue Heron (*Ardea herodias*).

Common Name	**Scientific Name**	**Native or Introduced**	**Association**
smallmouth bass	*Micropterus dolomieui*	Introduced	Warm – water predator
Sacramento sucker	*Catostomus occidentalis*	Native	Cold-water
Sacramento pikeminnow	*Ptychocheilus grandis*	Native	Cold/warm-water predator
threespine stickleback	*Gasterosteus aculeatus*	Native	Warm-water
California roach	*Hesperoleucus symmetricus*	Native	Warm-water

Table 3 – Fish species observed in the Napa River during habitat survey.

DISCUSSION

Pools comprised 47% of the total length of this survey with 44% of these pools having a maximum depth of three feet or more. This high number of deep pools is generally favorable for fish habitat, specifically salmonids. However, throughout much of the survey very long pools with little complexity were observed. Although, pools comprised a large percentage of the total surveyed length, these marginal pools do not represent favorable fish habitat. In general the marginal pools were more like deep glides with relatively even bottoms, little scour, and had primarily fine substrate (sand and silt). Several suitable pool habitats were observed and noted throughout the survey (Figure 4).

The best pool habitat was generally in areas where the river was not immediately confined by steep banks and levees. In sections of the survey reach where a floodplain or flood-terrace is present, the river has higher pool-riffle frequency which tends to improve habitat complexity and in turn create a broader range of aquatic habitats. In sections of the survey with highly confined banks the overall habitat tended to be more homogenous with less separation between riffles and pools. This is supported by the relatively high percentage of flatwater habitat (33%) in the survey reach (Figure 2). Flatwater represents a marginal habitat for salmonids and tends to favor warmer water predatory fish species such as smallmouth bass and Sacramento pikeminnow. In general, most flatwater habitats had very little cover and were dominated by fine substrate. Large schools (50+) of Sacramento pikeminnow and Sacramento sucker were observed most commonly in flatwater habitats.

Canopy throughout much of the survey was low or marginal. The mean canopy density for the entire survey was 53% comprised mostly of deciduous trees. Target canopy densities for salmonid streams are approximately 75% and above. The lack of stream canopy in many areas appears to be exacerbated by heavy bank erosion and bank failure. Disturbed areas were common throughout the survey, and they were typically either open or colonized by young willow and alder. Some areas of the survey, primarily those with flood terraces, were well covered and shaded with a mix of young and mature riparian trees (Figure 3).

Basic water quality (D.O., water temperature, specific conductance) was good in pools along the entire survey. Temperature and D.O. saturation were within the favorable range for salmonids and other cold-water fish species. Ideally these parameters would be monitored before the first major storm event of the year to capture late summer conditions. Year-round water quality measurements would provide a clearer picture of seasonal fluctuations and the impacts to the aquatic environment.

The surveyed reach of the Napa River does not provide much suitable summer-rearing habitat for steelhead due to elevated summer temperatures, presence of native and introduced predatory fish species, and hydrologic conditions during summer and winter. In most large river systems, steelhead typically spawn in smaller tributary streams with suitable gravel size and cool water. A small population of fall-run Chinook is currently present in the Napa River and strays from CDFG releases in the bay are also migrating up the Napa River to spawn (J. Emig, CDFG, pers. comm.). Chinook salmon would likely use the Napa River in the Rutherford region to spawn and rear if conditions were more suitable. Given the current habitat conditions in the mainstem it is doubtful that a large self-sustaining population of Chinook salmon can subsist. Efforts to improve habitat quality and quantity in the mainstem have the potential to improve the long-term prospect of a population increase, but this will likely take several years or decades.

No barriers to fish migration were found during this survey. A potential obstacle exists at the Zinfandel Lane crossing where concrete and boulders have been placed in the channel. This collection of large boulders combined with the concrete bridge abutments form a steep series of cascades that may limit fish passage during moderate to low flows. Although not a complete barrier, this obstacle may limit the success of downstream migration during late spring and possibly adults moving upstream during fall and winter.

CONCLUSIONS AND RECOMMENDATIONS

• Pool habitat was abundant throughout the survey reach; although it was lacking depth and complexity in many areas. Many pools were very long and wide with little shelter or complexity. These marginal pools commonly had fine substrate, which does not provide favorable habitat for most fish or aquatic macroinvertebrates. Marginal pool habitats and extensive flatwater habitats were typically associated with channel confinement and bank erosion. Areas of the river that had a more defined floodplain or flood terrace had tighter pool/riffle spacing and more favorable habitat complexity.

• Riparian canopy was generally low in the survey reach. In general canopy was deficient in areas with heavy bank erosion and where the channel was highly confined. Areas with a defined flood terrace had a good mix of young and mature riparian trees as well as a generally wider riparian zone. Efforts to increase the number of riparian trees through planting would improve bank stability, increase riparian habitat, and provide a long term source of LWD for in-stream shelter and forage.

• Basic water quality during the survey period was favorable for cold-water fish and aquatic organisms. More extensive year round monitoring would be necessary to form conclusions on seasonal water quality patterns and the associated impacts to the aquatic ecosystem.

• No salmonids were observed during this survey. Introduced and native warmer-water predatory fish species were common throughout much of the survey reach. Most of these fish were associated with marginal pools and flatwater habitats. These habitats favor warmer-water predatory fish due to elevated summer temperatures and a lack of hiding cover for prey. Efforts to decrease the number of long homogenous pool and flatwater habitats may give native cold-water fish the advantage.

REFERENCES

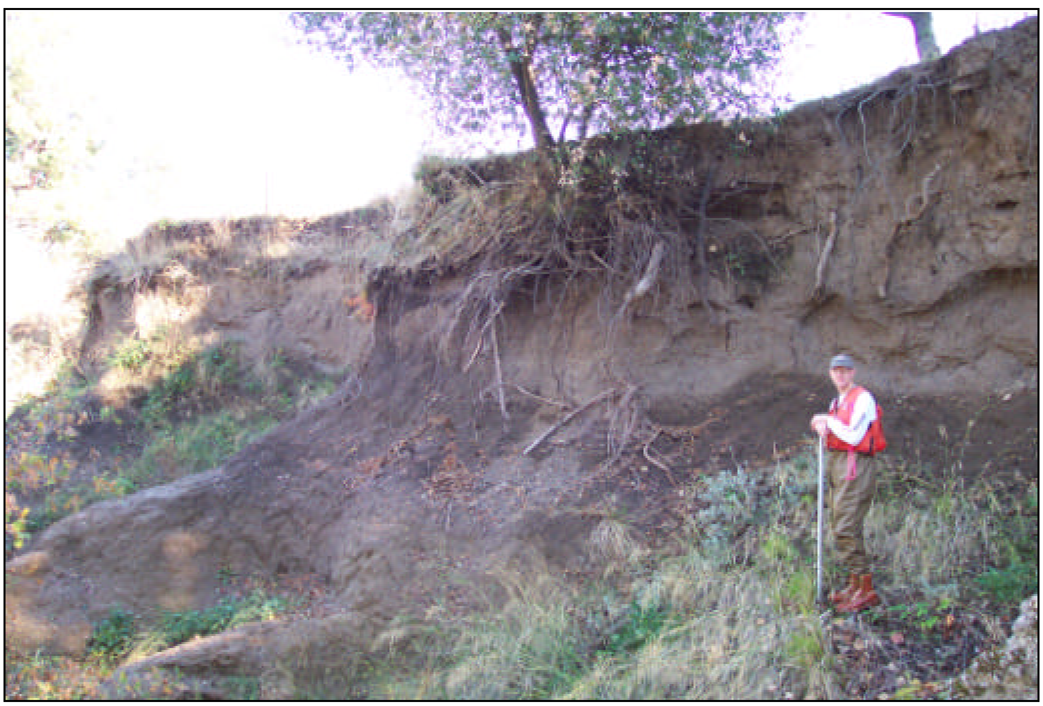
Harrington, J., M. Born. 2000. *Measuring the Health of California Sreams and Rivers, 2nd edition.* Sustainable Land Stewardship International Institute.

Moyle, P. B. 2002. *Inland Fishes of California*. University of California Press, Berkeley. 502pp

McGinnis, S. M. 1991. *Freshwater Fishes of California*. University of California Press, Berkeley. 316 pp.

Flosi, Gary, S. Downie, J. Hopelain, M. Bird, R. Coey, B. Collins. 1998. *California Salmonid Stream Habitat Restoration Manual*, 3rd ed. State of California, Resources Agency, California Department of Fish and Game.

APPENDICES



These are two examples of bank erosion sites. Note the patch of *Arundo donax* in the left hand portion of the upper photo.

This is a good pool with adequate shelter, deep scour, and clean gravel/cobble substrate. Pool/riffle spacing was much closer in this area of the surveyed reach, creating a more complex set of habitats for aquatic organisms.

This is an example of a homogenous pool habitat. This unit was approximately 500 feet long and resembled a deep glide.