A. A. RICH AND ASSOCIATES

FISHERY RESOURCES HABITAT
SURVEYS IN WALKER CREEK, MARIN COUNTY

Prepared for:

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I. INTRODUCTION

The Walker Creek Watershed is located within the Tomales Bay Watershed in Marin County, California. Walker Creek meanders northwesterly for 14 miles before emptying into the northern end of Tomales Bay (Fig. 1). The total watershed encompasses 73 square miles, 15 of which are above the Marin Municipal Water District's (MMWD) Soulajule Reservoir (Nolte, 1965). Major tributaries to Walker Creek include: Salmon Creek and Chileno Creek (Fig. 1).

Although large populations of coho salmon (Oncorhynchus kisutch) and steelhead trout (Salmo gairdneri) once inhabited Walker Creek and its tributaries (Worsely, 1972), only remnant populations exist today. Salmonid populations have declined as a result of the reduced habitat availability associated with increased sedimentation and high summer water temperatures (Bratovich, 1984; Emig, 1984; Kelley, 1976; Kelley et al., 1976). The reduction in habitat availability has been attributed to the construction of Soulajule Reservoir and years of grazing, logging, farming, and urbanization.

In an effort to restore salmonid resources in Walker Creek, MMWD entered into an agreement with the California Department of Fish and Game (CFG) in August of 1976 which was to be implemented

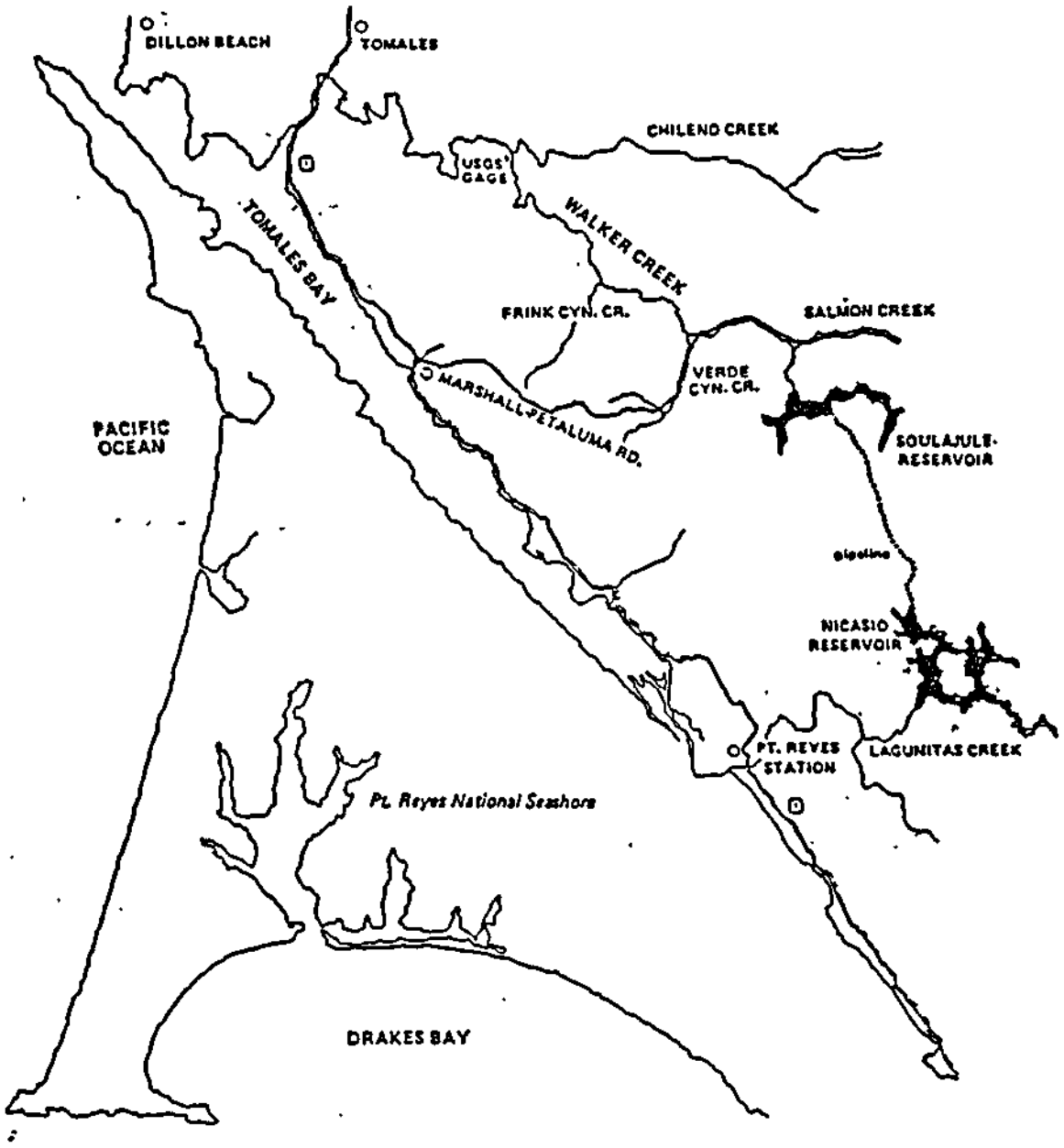

Figure 1. The Walker Creek Watershed.

after the raising of Soulajule Reservoir in 1979. The agreement provided for maintenance of winter flow of 20 cfs in normal years, 10 cfs in dry years and, in critical dry years, the flow released was to be maintained at 0.5 cfs year round. Summer flows were to be 5 cfs, 2 cfs, and 0.5 cfs in normal, dry, and critical dry years, respectively. To help re-establish coho salmon, the CFG agreed to stock 18,300 yearling coho salmon annually for three consecutive years and to maintain the population by stocking this same number of fish following critical dry years. Unfortunately, the extent to which this restoration effort has been successful is not clear.

The lack of quantitative data preclude any quantifiable conclusions regarding the results of the CFG-MMWD restoration project. Pre-project conditions had been only qualitatively addressed (CFG warden Al Giddings kept a personal diary from 1949-1974). Although there have been a number of fishery resources surveys on Walker Creek (Emig, 1984; Bratovich, 1984; Kelley, 1978, 1976; Kelley et al., 1976; Fields et al., 1975), none of these surveys has been comprehensive. After conducting

an electrofishing survey in October of 1981, Emig (1984) made the following recommendations:

(1) Annual monitoring of stream populations to provide an index of trends in fish populations;

(2) Additional stocking of coho salmon by the CFG to help restore this run; and,

(3) Erosion and sedimentation control measures should be implemented to help restore the viability of the watershed.

Despite these recommendation, there have been no quantitative fishery resources surveys on Walker Creek since 1981. However, in 1976, the MCRCD began to implement erosion control measures in the Walker Creek Watershed.

In 1986, the Marin County Resource Conservation District' (MCRCD) received $1,000,000 from the State Coastal Conservancy to do erosion control work in the Walker Creek Watershed. Feeling that this was a golden opportunity to integrate salmonid restoration work with erosion control efforts, Dr. Alice A. Rich of A. A. Rich and Associates (AAR) approached the MCRCD. Her plan was to implement the following Three-Phase Project, in conjunction with the MCRCD's Erosion Control Project:

(1) Phase I: Conduct Pre-Project Surveys to determine the status of the salmonid fishery resources in Walker Creek

Develop a Salmonid Restoration Program in conjunction with the MCRCD's Erosion Control Project

(2) Phase II: Implement the Salmonid Restoration Work determined in Phase I, in conjunction with the MCRCD's Erosion Control Project

(3) Phase III: Monitor the results of the Salmonid Restoration Project to assess the effectiveness of the restoration effort

The MCRCD has been very interested in assisting AAR with such a project. Since 1986, AAR has solicited funding from local organizations, the Coastal Conservancy through the MCRCD, and the CFG through the MCRCD.

Unfortunately, however, funding for the Three-Phase Project has been piece-meal and the comprehensive pre-project surveys (Phase I) necessary for a successful salmonid restoration project have not been forthcoming from the CFG, the agency which should be responsible for this type of project. Instead, funding from local organizations enabled AAR to begin fishery resources habitat and population surveys in 1987 and funding received from the Coastal Conservancy enabled AAR to complete juvenile salmonid habitat surveys on Walker Creek during the summer of 1989.

II. OBJECTIVES

The overall objective of the 1989 fishery resources surveys was to assess current fishery resource habitat conditions in Walker Creek, Marin County, during the summer of 1989. More specifically, we were interested in the following:

(1) The thermal conditions of the Creek during the summer when temperatures would be at their highest;

(2) The availability of riparian cover;

(3) Sedimentation problem areas;

(4) Areas of potential spawning; and,

(5) Other features of Walker Creek of importance to juvenile salmonid rearing.

The results of the 1989 habitat survey will be briefly summarized in this report. A more detailed analysis of these field surveys, together with the 1987 surveys, is anticipated at some later date, if more funding becomes available.

III. METHODOLOGY

During August and September of 1989, fisheries biologists from AAR conducted fishery resources habitat surveys on Walker Creek. Two types of surveys were conducted: detailed surveys and general surveys. The detailed surveys were conducted from the mouth of Walker Creek up to the Marshall-Petaluma Road just below Salmon Creek (Fig. 1). The poor rearing habitat conditions in the upper reaches of the drainage (due, primarily, to high silt levels in the water), precluded the usefulness of a detailed survey from the Marshall-Petaluma Road up to Soulajule Reservoir.

The more detailed surveys consisted of recording the type and amount of physical habitat present during the survey, using the Habitat Typing Methodology of Bisson et al. (1982). More specifically, the field biologists recorded the following information, as they walked up Walker Creek (Appendix A):

(1) Type of habitat;

(2) Dimensions (length, mean width, mean depth) of habitat;

(3) Air and water temperatures (surface and bottom);

(4) Type of cover available to juvenile salmonids; and,

(5) Percentage of spawning gravel within each habitat.

In addition to the above, each habitat was photographed, detailed sketches were made of the more complex habitat areas, and pertinent general information (e.g., site specific problem areas) was recorded.

IV. RESULTS AND DISCUSSION

A. Salmonid Requirements

Habitat needs of anadromous salmonids (salmonids which spawn in freshwater) (Fig. 2) in fluvial systems vary with the season and the life stage of the species in question. Generally, however, a favorable habitat for salmonids will have an adequate supply of unpolluted water, a favorable range of water temperatures, resting areas (pools), an adequate food supply with sufficient oxygen (riffles), clean spawning gravel, and a balanced ecosystem with few competitors. As the summer habitat survey focused on juvenile rearing habitat and availability of spawning areas, only these life stages will be discussed.

Young coho salmon and steelhead trout prefer habitats which are characterized by cool water (steelhead: 12.8-15.6 degrees C; coho salmon: 9-14 degrees C), food producing areas (riffles), abundance of cover, space, and clear unpolluted water.

In order for salmonids to spawn successfully, several requirements must be met: adequate streamflows, silt-free spawning gravel (although they will spawn in embedded substrate,

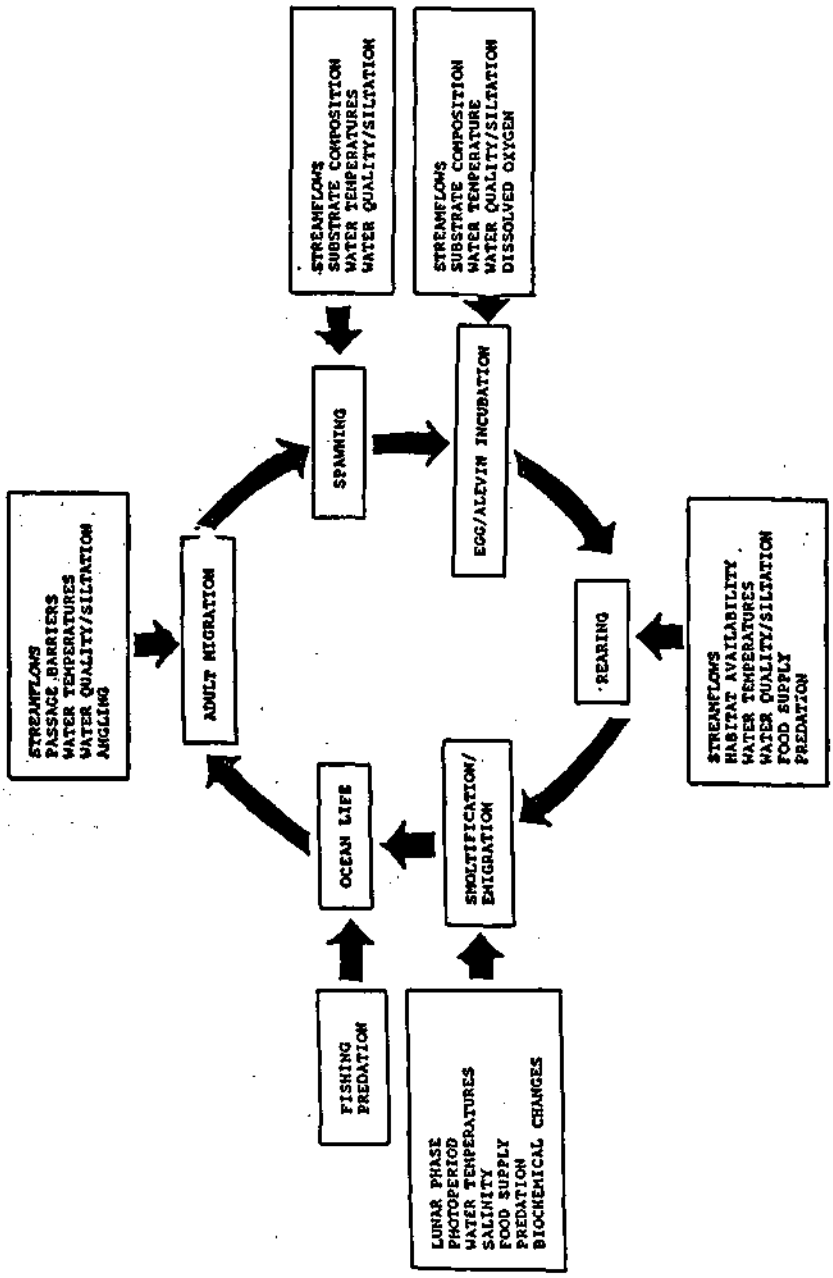

Figure 2. Life History Stages and Factors which Affect Steelhead Trout and Coho Salmon

if nothing else is available), non-stressful water temperatures, and unpolluted water. Of these factors, only potential spawning gravel was identified in surveys this summer. Steelhead trout and coho salmon normally chose gravel-based areas, generally at the head of riffles or tail of glides or pools.

B. GENERAL SALMONID HABITAT CONDITIONS IN WALKER CREEK *

1. Stream Reach 1: Mouth of Creek to the Highway 1 Bridge

The Reach from the mouth of Walker Creek to the Highway 1 bridge was characterized by a long brackish water channel. This Reach serves primarily as a migratory passageway for emigrating juveniles and immigrating adults (Fig. 3) .

2. Stream Reach 2; Highway 1 Bridge Upstream Approximately 1600 Meters (5200 feet)

Stream Reach 2 was composed of a long glide (mean width 22.4 M, mean depth 0.55 M) which was choked with aquatic vegetation (Fig. 3). Water flowed slowly and water temperatures were high (21-28 degrees C). The substrate was composed of sand and there was virtually no overhanging riparian cover. This area appeared to be inhabited by sculpin and stickleback, but was obviously too hot for salmonids. Similar to Stream Reach 1, Stream Reach 2

* See Appendix B for detailed inventory.

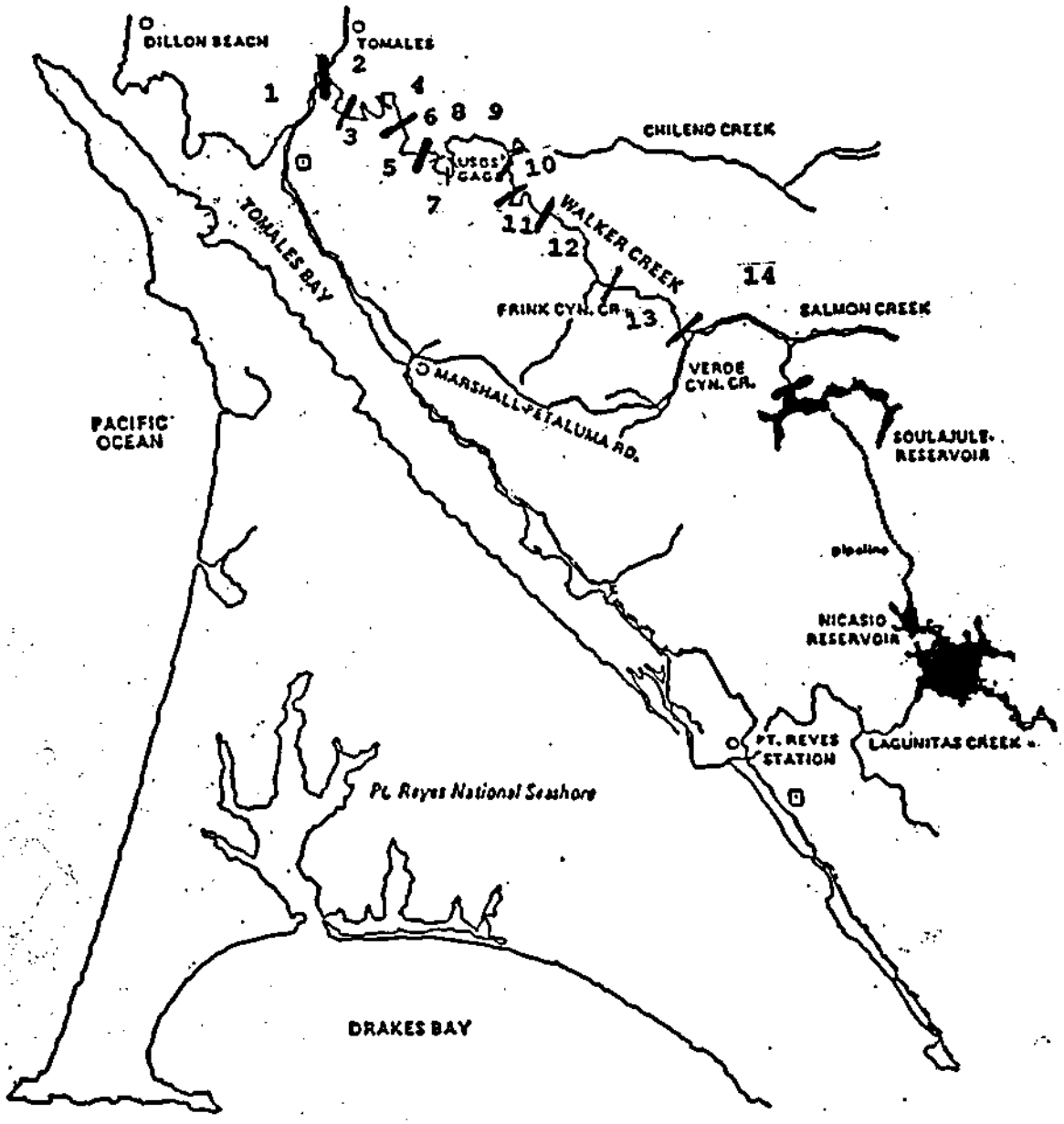

Figure 3. General Stream Reach Areas in Walker Creek.

most probably serves as a passageway for emigrating juvenile and immigrating adult salmonids.

3. Stream Reach 3; SRU 12-35

This Reach (length: 1400 M = 4550 Ft), was characterized by pools (type: lateral scour) with some glides (Fig. 3). Aquatic vegetation was still abundant, although not as prevalent as in Stream Reach 2. The substrate was primarily silt, and overhanging vegetation appeared on both banks. Again, this part of the Creek serves primarily as a passageway for salmonids.

4. Stream Reach 4; SRU 36-135

In Stream Reach 4 (1546 M = 5024.5 Ft), Walker Creek narrows, and pool and glide areas alternated with low gradient riffles (food producing areas) (Fig. 3). Although the substrate was still composed of silt, some gravel was evident, particularly in the low gradient riffle areas. The gravel, however, became embedded with silt at the upper end of the Reach. This was probably due to the heavily disturbed (cattle) area just upstream of Stream Reach 4. Although temperatures were high (> 20 degrees C), the stream banks afforded some shade for rearing salmonids.

5. Stream Reach 5; SRU 136-206

Beginning at the barbed wire fence which crossed Walker Creek and proceeding upstream (length of reach: 1629 M = 5294 Ft), the area was highly disturbed (Fig. 3) . Cattle and four-wheel drive tracks were abundant and a bulldozer had "dozed" through the Creek recently. In addition, the banks afforded no shade, water temperatures were high (> 20 degrees C), gravel was embedded with silt, and signs of eutrophication (algae in the Creek) were prevalent. Although there were some low gradient riffles, these were probably of little use as potential food-producing areas, as the riffles were highly embedded.

6. Stream Reach 6; SRU 207-231

Upstream of the previous heavily-impacted area, Walker Creek became a good salmonid stream for approximately 816 M (2652 Ft) (Fig. 3). This Reach was shaded, woody debris and rootwads provided salmonid rearing habitat, low gradient riffles alternated with either pools or glides, and stream temperatures were acceptable.

At the end of the reach was a lateral scour pool associated with a bank cut. At this point, the bank was falling into the stream.

7. Stream Reach 7; SRU 232-481

The salmonid habitat improved still further in this Reach (length: 943 M = 3045 Ft) (Fig. 3) . Low gradient riffles alternated with pools, and small and medium gravel replaced sand and silt. Although the area was open pastureland, the banks were well-vegetated, thus providing shade for rearing salmonids during the hot summer months.

8. Stream Reach 8; SRU 482-489

Long pools (lateral scour), undercut banks, and abundant overhanging vegetation, and relatively cool temperatures characterized Stream Reach 8 (length: 272 M = 884 Ft) (Fig. 3) . Most probably, this area was inhabited by such fishes as roach and stickleback.

9. Stream Reach 9; SRU 490-542

Good spawning gravels and excellent rearing areas characterized Stream Reach 9 (length: 886 M = 2880 Ft) (Fig. 3). Spawning substrate included predominantly gravel and cobble; numerous salmonid redds were sighted within this Reach. With acceptable water temperatures, abundant cover, and pool-riffle sequences, this area provided good salmonid habitat.

10. Stream Reach 10; SRU 543-594

This Reach (length: 551 M = 1791 Ft) was characterized by rocks and boulders, some high gradient riffles, and cascades, abundant overhanging riparian vegetation, and acceptable water temperatures (Fig. 3). Although the rock and boulder substrate and overhanging vegetation provided shade and protective cover for juvenile salmonids, the area was almost completely devoid of spawning areas.

11. Stream Reach 11; SRU 595-721

Although this Reach (length: 2800 M = 9100 Ft) was surrounded by open pastureland and cattle were observed in the creek, some of the best spawning habitat occurred in this Reach; numerous salmonid redds were observed during the survey. In addition, overhanging riparian vegetation, acceptable water temperatures, and woody debris within the Creek provided good rearing habitat.

12. Stream Reach 12; SRU 722-794

There was more overhanging riparian vegetation in this Reach (length 1419 M = 4611 Ft) than in the previous one (Fig. 3). In addition, there was no ready access to the Creek from shore. Some spawning gravels were sighted, as were many pool-riffle

sequences which would provide food and shelter for juvenile salmonids. However, at the upper end of this Reach, gravels were replaced with sand and existing gravel was embedded with silt. Roach and stickleback probably inhabited most of the pools, although a few juvenile salmonids were sighted.

13. Stream Reach 13: SRU 795-1016 (Marshall-Petaluma Road)

The area within Stream Reach 13 (length: 4649 M =15109 Ft) was highly disturbed (cattle, road through Creek, etc.) (Fig. 3). Although many spawning gravels characterized this Reach, the gravels were highly embedded with silt. And, although there was overhanging riparian vegetation in some areas, the Reach, as a whole, provided little salmonid rearing habitat. The stream banks were steep and eroded and many cattle were in the Creek. It should be noted, however, that there was a great deal of instream construction (roads, dams, bulldozers, etc.) work occurring on the Walker Creek Ranch this summer. It will be of interest to reassess salmonid conditions in this Reach without the human disturbances.

14. Stream Reach 14: Marshall-Petaluma Road to Soulajule

The area from the Marshall-Petaluma Road to Soulajule Reservoir is in great need of repair (Fig. 3). Although spawning

gravels were found in this reach, they were highly embedded with silt. Until the excessive bank erosion problems and high silt load within the Creek throughout this area are reduced, the entire Reach is unsuitable for salmonid rearing or spawning.

V. CONCLUSIONS

Walker Creek has great potential as a viable salmonid stream, particularly from the old U.S.G.S. Gauge upstream to just below the Walker Creek Ranch. From a salmonid habitat perspective, the main problems appeared to be embedded gravels and unsuitably high water temperatures. These unsuitable conditions were presumably due to eroding banks, cattle-related erosion problems, and the high silt load in the water flowing out of Soulajule Reservoir.

VI. RECOMMENDATIONS

Although there have been numerous salmonid restoration projects (see Review by Duff and Wydowski, 1982), there is an increasing awareness amongst fisheries biologists that more site specific data are necessary to determine how to rehabilitate/ restore streams from a fisheries perspective (Platts and Rhinne, 1985). The need for more site-specific long-term studies, rather than the old short-term "cookbook" approach to stream restoration stemmed from incomplete and, often, ambiguous results. For example, although exclusionary fencing often improves the riparian habitat, it does not always result in increased fish populations. Thus, it is imperative that fisheries restoration projects, such as the one proposed for the Walker Creek Watershed, be integrated with the land use practices and erosion control efforts currently being undertaken by the MCRCD.

It is highly recommended that the Three-Phase Project, originally proposed by Dr. Alice A. Rich be implemented in the Walker Creek Watershed. While the salmonid habitat survey conducted this past summer is valuable, we need data on existing salmonid populations and habitat data for the other salmonid life stages, as well. In addition, before any restoration effort

should be implemented, several years of fisheries data should be collected, as variability exists from year to year. Integrating habitat data with data on existing populations will enable us to assess the relative impacts of specific land uses at different times of the year. These impacts will, thus, enable us to assess how best to restore/rehabilitate Walker Creek from both biological and land use perspectives.

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PAGE NUMBER _____

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WALKER CREEK FISHERIES STREAM HABITAT ASSESSMENT

STREAM: _____ DATE: _____ CREW _____

WEATHER: _____ PAGE _____ OF _____

SRU: _____ HABITAT: _____ TIME: _____

LENGTH (M): _____ _____ _____ _____ _____ LENGTH TOTAL (M): _____

WIDTH (M): _____ _____ _____ _____ _____ WIDTH, MEAN (M): _____

DEPTH (M): _____ _____ _____ _____ _____ _____ DEPTH, MEAN (M): _____

COVER TYPE: (0-NONE; 1=LITTLE; 2=MODERATE; 3=ABUNDANT)

ROCK: _____ ROOTWAD: _____ BEDROCK: _____ WOODY DEBRIS _____ DEPTH (>0.5M): _____

AQUATIC VEG: _____ TURBULENCE: _____ OVERHANG. VEG: _____ UNDERCUT BANKS: _____

OVERHANG. VEG: _____ UNDERCUT BANKS: _____ OTHER _____

SUBSTRATE , TYPE (DOM . }: _____

GRADIENT (DEG): _____ TEMP, AIR (C): _____ TEMP,H20-B (C) _____ TEMP,H20-S (C) _____

SPAWNING GRAVEL: _____ SQ FT

PHOTOS: ROLL-FRAME DESCRIPTION

_____ - _____ _____

_____ - _____ _____

_____ - _____ _____

_____ - _____ _____

COMMENTS: _____