Three Year Evaluation of Predation in the Stanislaus River

Project Information

1. **Proposal Title:**

   Three Year Evaluation of Predation in the Stanislaus River

2. **Proposal applicants:**

   Steve Felte, Tri-Dam Project

3. **Corresponding Contact Person:**

   Jason Reed
   Tri-Dam Project
   P.O. Box 1158 Pinecrest, CA 95364
   209 965-3996
   jason@tridamproject.com

4. **Project Keywords:**

   Anadromous salmonids
   At-risk species, fish
   Fish mortality/fish predation

5. **Type of project:**

   Research

6. **Does the project involve land acquisition, either in fee or through a conservation easement?**

   No

7. **Topic Area**:

   At-Risk Species Assessments

8. **Type of applicant:**

   Local Agency

9. **Location - GIS coordinates:**

   Latitude: 37.739

   Longitude: -121.076

   Datum:

   Describe project location using information such as water bodies, river miles, road intersections, landmarks, and size in acres.

The proposed project will be conducted in the Stanislaus River between Knight's Ferry at river mile 54.6 and the confluence with the San Joaquin River, in the mainstem San Joaquin River immediately downstream of the confluence, and in the deepwater ship channel near Stockton.

10. **Location - Ecozone:**

    12.1 Vernalis to Merced River, 13.1 Stanislaus River, 1.2 East Delta, 11.2 Mokelumne River, 11.3 Calaveras River

11. **Location - County:**

    San Joaquin, Stanislaus

12. **Location - City:**

    Does your project fall within a city jurisdiction?

    No

13. **Location - Tribal Lands:**

    Does your project fall on or adjacent to tribal lands?

    No

14. **Location - Congressional District:**

    18

15. **Location:**

    California State Senate District Number: 5, 12

    California Assembly District Number: 25, 17

16. **How many years of funding are you requesting?**

    3

17. **Requested Funds:**
    a) Are your overhead rates different depending on whether funds are state or federal?

       No

       If no, list single overhead rate and total requested funds:

       Single Overhead Rate: 0

       Total Requested Funds: $671,000

    b) Do you have cost share partners already identified?

Yes

If yes, list partners and amount contributed by each:

Tri-Dam Project $20,000 in-kind services

c) Do you have potential cost share partners?

No

d) Are you specifically seeking non-federal cost share funds through this solicitation?

No

If the total non-federal cost share funds requested above does not match the total state funds requested in 17a, please explain the difference:

18. **Is this proposal for next-phase funding of an ongoing project funded by CALFED?**

No

Have you previously received funding from CALFED for other projects not listed above?

No

19. **Is this proposal for next-phase funding of an ongoing project funded by CVPIA?**

No

Have you previously received funding from CVPIA for other projects not listed above?

Yes

If yes, identify project number(s), title(s) and CVPIA program.

11332-9-j010	**Evaluate the use of radio-tagged juvenile chinook salmon to identify cause and location of mortality**	**AFRP**

20. **Is this proposal for next-phase funding of an ongoing project funded by an entity other than CALFED or CVPIA?**

No

Please list suggested reviewers for your proposal. (optional)

21. **Comments:**

Environmental Compliance Checklist

Three Year Evaluation of Predation in the Stanislaus River

1. **CEQA or NEPA Compliance**
   a) Will this project require compliance with CEQA?

      No
   b) Will this project require compliance with NEPA?

      No
   c) If neither CEQA or NEPA compliance is required, please explain why compliance is not required for the actions in this proposal.

      The proposed project is research only and does not constitute an action that will require NEPA/CEQA compliance.

2. **If the project will require CEQA and/or NEPA compliance, identify the lead agency(ies).** *If not applicable, put "None".*

   CEQA Lead Agency: none
   NEPA Lead Agency (or co-lead:) none
   NEPA Co-Lead Agency (if applicable): none

3. **Please check which type of CEQA/NEPA documentation is anticipated.**

   CEQA
   -Categorical Exemption
   -Negative Declaration or Mitigated Negative Declaration
   -EIR
   Xnone

   NEPA
   -Categorical Exclusion
   -Environmental Assessment/FONSI
   -EIS
   Xnone

   If you anticipate relying on either the Categorical Exemption or Categorical Exclusion for this project, please specifically identify the exemption and/or exclusion that you believe covers this project.

4. **CEQA/NEPA Process**
   a) Is the CEQA/NEPA process complete?

      Not Applicable

   b) If the CEQA/NEPA document has been completed, please list document name(s):

5. **Environmental Permitting and Approvals** (*If a permit is not required, leave both Required? and Obtained? check boxes blank.*)

LOCAL PERMITS AND APPROVALS

Conditional use permit

Variance

Subdivision Map Act

Grading Permit

General Plan Amendment

Specific Plan Approval

Rezone

Williamson Act Contract Cancellation

Other

STATE PERMITS AND APPROVALS

Scientific Collecting Permit Required, Obtained

CESA Compliance: 2081

CESA Compliance: NCCP

1601/03

CWA 401 certification

Coastal Development Permit

Reclamation Board Approval

Notification of DPC or BCDC

Other

FEDERAL PERMITS AND APPROVALS

ESA Compliance Section 7 Consultation

ESA Compliance Section 10 Permit Required

Rivers and Harbors Act

CWA 404

Other

PERMISSION TO ACCESS PROPERTY

Permission to access city, county or other local agency land.
Agency Name:

Permission to access state land.
Agency Name:

Permission to access federal land.
Agency Name:

Permission to access private land.
Landowner Name:

6. **Comments.**

Land Use Checklist

Three Year Evaluation of Predation in the Stanislaus River

1. **Does the project involve land acquisition, either in fee or through a conservation easement?**

   No

2. **Will the applicant require access across public or private property that the applicant does not own to accomplish the activities in the proposal?**

   Yes

3. **Do the actions in the proposal involve physical changes in the land use?**

   No

   If you answered no to #3, explain what type of actions are involved in the proposal (i.e., research only, planning only).

   The proposed project is research only.

4. **Comments.**

Conflict of Interest Checklist

Three Year Evaluation of Predation in the Stanislaus River

Please list below the full names and organizations of all individuals in the following categories:

- Applicants listed in the proposal who wrote the proposal, will be performing the tasks listed in the proposal or who will benefit financially if the proposal is funded.
- Subcontractors listed in the proposal who will perform some tasks listed in the proposal and will benefit financially if the proposal is funded.
- Individuals not listed in the proposal who helped with proposal development, for example by reviewing drafts, or by providing critical suggestions or ideas contained within the proposal.

The information provided on this form will be used to select appropriate and unbiased reviewers for your proposal.

Applicant(s):

Steve Felte, Tri-Dam Project

Subcontractor(s):

Are specific subcontractors identified in this proposal? Yes

If yes, please list the name(s) and organization(s):

Carl Mesick	Carl Mesick Consultants
Trevor Kennedy	California Fish Foundation
Tim Smith and Steve Walser	Smith and Walser Enterprises
	CDFG
	USFWS

Helped with proposal development:

Are there persons who helped with proposal development?

Yes

If yes, please list the name(s) and organization(s):

Steve Cramer, Ray Beamesderfer and Doug Demko	**S.P. Cramer & Associates**
Tim Heyne	**CDFG**

Glenda Marsh **DWR**

Craig Fleming **USFWS**

Andrea Phillips **S.P. Cramer & Associates**

Comments:

Budget Summary

Three Year Evaluation of Predation in the Stanislaus River

Please provide a detailed budget for each year of requested funds, indicating on the form whether the indirect costs are based on the Federal overhead rate, State overhead rate, or are independent of fund source.

Independent of Fund Source

Year 1												
Task No.	**Task Description**	**Direct Labor Hours**	**Salary *(per year)***	**Benefits *(per year)***	**Travel**	**Supplies & Expendables**	**Services or Consultants**	**Equipment**	**Other Direct Costs**	**Total Direct Costs**	**Indirect Costs**	**Total Cost**
1	Electrofishing surveys	0	0	0	750	5000	40600	0	4800	51150.0	0	51150.00
2	Hook and line surveys	0	0	0	250	500	45900	0	0	46650.0	0	46650.00
3	Snorkeling surveys	0	0	0	250	500	35900	0	0	36650.0	0	36650.00
4	Sample processing and data management	0	0	0	0	1000	43400	0	0	44400.0	0	44400.00
5	Project management, analyses and reporting	0	0	0	0	1000	47900	0	00	48900.0	0	48900.00
		0	0.00	0.00	1250.00	8000.00	213700.00	0.00	4800.00	227750.00	0.00	227750.00

Year 2												
Task No.	**Task Description**	**Direct Labor Hours**	**Salary *(per year)***	**Benefits *(per year)***	**Travel**	**Supplies & Expendables**	**Services or Consultants**	**Equipment**	**Other Direct Costs**	**Total Direct Costs**	**Indirect Costs**	**Total Cost**
1	Electrofishing surveys	0	0	0	750	3500	40600	0	4800	49650.0	0	49650.00
2	Hook and line surveys	0	0	0	250	500	45900	0	0	46650.0	0	46650.00
3	Snorkeling surveys	0	0	0	250	500	35900	0	0	36650.0	0	36650.00
4	Sample processing and data management	0	0	0	0	500	43400	0	0	43900.0	0	43900.00
5	Project management, analyses and reporting	0	0	0	0	500	40400	0	0	40900.0	0	40900.00
		0	0.00	0.00	1250.00	5500.00	206200.00	0.00	4800.00	217750.00	0.00	217750.00

Year 3												
Task No.	**Task Description**	**Direct Labor Hours**	**Salary *(per year)***	**Benefits *(per year)***	**Travel**	**Supplies & Expendables**	**Services or Consultants**	**Equipment**	**Other Direct Costs**	**Total Direct Costs**	**Indirect Costs**	**Total Cost**
1	Electrofishing surveys	0	0	0	750	3500	40600	0	4800	49650.0	0	49650.00
2	Hook and line surveys	0	0	0	250	500	45900	0	0	46650.0	0	46650.00
3	Snorkeling surveys	0	0	0	250	500	35900	0	0	36650.0	0	36650.00
4	Sample processing and data management	0	0	0	0	500	43400	0	0	43900.0	0	43900.00
5	Project management, analyses and reporting	0	0	0	0	750	47900	0	0	48650.0	0	48650.00
		0	0.00	0.00	1250.00	5750.00	213700.00	0.00	4800.00	225500.00	0.00	225500.00

Grand Total=671000.00

Comments.

As the applicant, Tri-Dam Project will provide in-kind services for contract management and administration. The project consists of various partnerships, however, Tri-Dam is identified as the applicant and all others are viewed as sub-contractors.

Budget Justification

Three Year Evaluation of Predation in the Stanislaus River

Direct Labor Hours. Provide estimated hours proposed for each individual.

There are no direct labor hours budgeted for the applicant. All labor by the applicant will be as in-kind services for managing the contract and administering the funds. The partners and applicant will assume a contractor - sub-contractor relationship and the work is described below.

Salary. Provide estimated rate of compensation proposed for each individual.

The applicant, Tri-Dam, will provide in-kind servies to administer the contract funds and oversee the project.

Benefits. Provide the overall benefit rate applicable to each category of employee proposed in the project.

No benefit compensation are requested by the applicant.

Travel. Provide purpose and estimate costs for all non-local travel.

Costs for travel consists of transportation to sampling sites and all sites are local.

Supplies & Expendables. Indicate separately the amounts proposed for office, laboratory, computing, and field supplies.

Supply costs include costs for sample containers and lab supplies for stomach analyses, as well as miscellaneous supplies. An allowance for boat maintenance is factored into the cost in case of damage during sampling.

Services or Consultants. Identify the specific tasks for which these services would be used. Estimate amount of time required and the hourly or daily rate.

Task 1: Electrofishing surveys Electrofishing surveys will be coordinated and conducted by SPCA and will require a crew of 4; 2 technicians and one biologist will be from SPCA. The fourth crew member will be the CDFG PI, and if the SPCA biologist or the CDFG PI is unable to attend a survey, time has been budgeted for a USFWS as a backup. Additional time will be required for coordination, scheduling and prepararion for the surveys. SPCA is budgeted for $21,600 per year at 16 surveys per year. CDFG is budgeted for $15,000 for each year and USFWS is budgeted for $4,000 per year. Task 2: Hook and line surveys Smith & Walser will be the primary contractor for the hook and line surveys and will conduct surveys year round for $35,000. SPCA will meet with Smith & Walser periodically on-site for quality control purposes for $1900/year. CDFG and USFWS are budgeted to assist with the surveys as need for $4,000 and $5,000 per year, respectively. Task 3: Snorkeling surveys Trevor Kennedy from the Fish Foundation will be the primary contractor for the snorkeling surveys for a cost of $25,000/year. Again, CDFG and USFWS will assist in the surveys as needed and budgeted for $5,000 and $4,000 per year, respectively. SPCA will coordinate and assist with the surveys periodically and budgeted for $1,900/year. Task 4: Sample processing and data management SPCA will handle all of the data management tasks and CDFG will analyze the stomach contents. $14,400 has been budgeted for SPCA to enter and obtain all data from each of the groups involved. $25,000 per year has been budgeted for CDFG and a scientific aid from CDFG to analyze the stomach contents. An additional $4,000 has been budgeted for USFWS to assist in the analyses. Task 5: Project management, analyses

and reporting SPCA and CMS will be responsible for writing the report and analyses of the data. CMS is budgeted for $15,000 per year and SPCA is budgeted for $25,400 per year. In addition, SPCA will coordinate all sampling surveys between groups involved. A statistician will be used in year 1 and 3, and is budgeted for $7,500/year. The statistician has not been identified, but will most likely be one the USFWS has used in the past.

Equipment. Identify non-expendable personal property having a useful life of more than one (1) year and an acquisition cost of more than $5,000 per unit. If fabrication of equipment is proposed, list parts and materials required for each, and show costs separately from the other items.

No equipment will be purchased for the project.

Project Management. Describe the specific costs associated with insuring accomplishment of a specific project, such as inspection of work in progress, validation of costs, report preparation, giving presentatons, reponse to project specific questions and necessary costs directly associated with specific project oversight.

Project management related to the sampling surveys and data reports will be conducted by SPCA under task 5. All other project management issues related to costs and administration will be conducted by Tri-Dam Project as in-kind services.

Other Direct Costs. Provide any other direct costs not already covered.

Other direct costs include rental costs for the electrofishing boat at $300/day for 16 surveys per year.

Indirect Costs. Explain what is encompassed in the overhead rate (indirect costs). Overhead should include costs associated with general office requirements such as rent, phones, furniture, general office staff, etc., generally distributed by a predetermined percentage (or surcharge) of specific costs.

Overhead will not be charged by the applicant for this project and will be contibuted as a cost-share to the project.

Executive Summary

Three Year Evaluation of Predation in the Stanislaus River

This proposed project is a three year joint effort by the California Department of Fish & Game, US Fish & Wildlife Service, S.P. Cramer & Associates, Inc., Carl Mesick Consultants, the Fishery Foundation of California, and Smith & Walser Enterprises. The research project will evaluate predation in the lower Stanislaus River and isolated sections of the San Joaquin River and Stockton Shipping Channel, to evaluate predator composition, abundance, habitat use, and predation rates over the course of the study. Several sampling methods will be used, including angling, electrofishing, and snorkeling to account for different biases between methodologies, and to enable us to sample different species in different habitats. The proposed methodologies will also enable us to sample predators in the upper Stanislaus River when salmon and steelhead are present, since angling methods can be directed at non-salmonids, as well as sample in the river between Knights Ferry and Oakdale, where boat access is problematic and electroshocking cannot occur during times of year when salmon are present.

Proposal

Tri-Dam Project

Three Year Evaluation of Predation in the Stanislaus River

Steve Felte, Tri-Dam Project

Three Year Evaluation of Predation in the Stanislaus River

A. Project Description: Project Goals and Scope of Work

Funding is requested for research to help resolve uncertainty regarding the impact of different predators on the survival of juvenile salmonids in dredged channels and to describe the habitats used by the different predators in the Stanislaus River. The proposed research project will be conducted in the Stanislaus River between Knights Ferry and the confluence with the San Joaquin River, in the mainstem San Joaquin River immediately downstream of the confluence, and in the deepwater ship channel near Stockton.

This project will help direct and prioritize future Stanislaus River restoration efforts, including the Department of Water Resources (DWR) Fish Passage Involvement Program, which is currently investigating the possibility of restoring the Oakdale Recreation Area gravel pits. This project will include sample sites within the Oakdale Recreation Area, and by comparing predator distribution and abundance there with other gravel pits and natural areas elsewhere in the river, we will be able to determine the relative value of restoring the Oakdale Recreation Area gravel pits.

The concept for this project was developed by the Stanislaus Fish Group, including members from DWR, the US Fish and Wildlife Service (USFWS), California Department of Fish and Game (CDFG), and various private consultants. The project will utilize administrative and scientific support, and field technician labor for snorkeling, electrofishing, and angling from the CDFG, USFWS and four consultant teams. Each of the consultant teams is currently conducting field work in the Stanislaus River basin. The collective knowledge of agency and private experts insures that this project will be well orchestrated. The fact that all parties have contributed to the development of this proposal, and have committed staff to future field activities, is evidence that the work is needed and would be beneficial to future basin planning and restoration efforts.

1. Problem

Past dredging for gravel and gold in the active channels of many Central Valley rivers and streams has degraded spawning and rearing habitat for salmon and steelhead and probably increased the populations of fish that prey on juvenile salmonids, including striped bass (Morone saxatilis), Sacramento pikeminnow (Ptychocheilus grandis), largemouth bass (Micropterus salmoides), and smallmouth bass (M. dolomieui). Professional fishing guides report that predators are typically observed in dredged areas where water velocities are low and uniform (Walser and Smith, personal communication 2001). EA Engineering, Science, and Technology (1992) reported that only one predator, a 199 mm smallmouth bass, was captured at three riffles whereas a variety of predator species were abundant in run-pools and particularly deep and/or wide dredged areas called special run-pools.

Although some of the impacts of gravel dredging on salmonids and ecosystem processes are fairly well understood, there is controversy regarding the relative impacts of predators and which types of dredged habitats should be restored. Electrofishing surveys conducted in 1989 and 1990 in the Tuolumne River by EA Engineering, Science, and Technology (1992) and in 1998 and 1999 by McBain & Trush and Stillwater Sciences

(1999, 2000) focused on largemouth and smallmouth bass as the primary predators of juvenile salmonids. However, professional fishing guides with over 15 years of experience fishing and photographing game fish in the San Joaquin tributaries believe that Sacramento pikeminnow consume many more juvenile salmon and are more abundant than the other predator species (Walser and Smith, personal communication 2001). Snorkel surveys in 1993 and 1994 indicate that substantial populations of pikeminnow may reside at least as far upstream as Knights Ferry in April and May (Cramer & Demko 1993). Angling guides have observed that largemouth bass are usually restricted to low velocity water with warm temperatures and cover provided by large woody debris. Largemouth Bass will utilize in-river gravel pits in the upstream reaches if the pits provide warm water compared to the main channel. Smallmouth bass also require warm water and are generally found in the lower river where they utilize riffle habitat in the main channel. Striped bass are believed to migrate into the Stanislaus River in April and May and utilize captured mine pits and dredged channels that are at least 10 feet deep. In contrast, adult Sacramento pikeminnow typically form large schools and utilize the mined glide habitat, 3 to 8 feet deep, throughout the river regardless of whether cover is present. The glide habitat utilized by Sacramento pikeminnow is much more abundant than the habitats utilized by the three species of bass in all three San Joaquin tributaries. Furthermore, the stomach contents of Sacramento pikeminnow indicate that they feed on juvenile salmon fry and parr from January through June; whereas most largemouth bass, smallmouth bass, and striped bass are either not present or are less active during these times. Additionally, Striped bass may feed primarily on larger prey, such as trout smolts, yearling salmon, yearling Sacramento pikeminnow, and large crayfish. Limited data collected during electroshocking surveys in1999 resulted in large prey items removed from the stomachs of striped bass, including an 18 inch Sacramento sucker (Catostomus occidentalis), which was large enough that the tail was protruding from the stripers mouth when it was captured (S.P. Cramer & Associates 2000).

The significance of these differences are two-fold. First, there are more opportunities to restore habitat utilized by Sacramento pikeminnow than largemouth or smallmouth bass. The potential to implement restoration typically depends on whether landowners will grant access to the river and whether gravel and fill can be transported to the site. This is an important distinction for the Stanislaus River, where there are several cooperative landowners who can provide gravel and fill for restoration adjacent to Sacramento pikeminnow habitat. In contrast, the restoration of large mine pits requires large amounts of gravel and is opposed by many anglers and landowners that consider largemouth bass, smallmouth bass, and striped bass to be an asset.

Most of the predator studies conducted in the San Joaquin tributaries were implemented by EA Engineering, Science, and Technology (EA) in the Tuolumne River in spring 1989 and 1990 (EA 1992). EA concluded from their river-wide electrofishing surveys that largemouth and smallmouth bass are the primary predators of juvenile salmon. However, the density of bass was not compared to other species of predators and very few bass contained juvenile salmon in their stomachs except during May 1990 when 93,653 hatchery reared salmon smolts were released at Old La Grange Bridge for survival studies. During the April and May 1989 surveys when no hatchery-reared juvenile salmon had been released, only 9 percent of the smallmouth bass and 4 percent of the largemouth bass were found to have juvenile chinook salmon in their stomachs. The estimated predation rate for smallmouth bass was 0.44 juvenile salmon per predator per day and the rate for largemouth bass was 0.20 juvenile salmon per predator per day. These estimates were computed by dividing the number of juvenile salmon contained in the stomachs of bass captured at night by the estimated rate of gastric evacuation which assumes that bass feed at the same rate 24 hours a day. There were similar predation rates from January through late April in 1990 prior to the release of hatchery reared juvenile salmon that ranged between 0.05 and

0.51 juvenile salmon per predator per day. However, after hatchery-reared salmon smolts were released on April 30, 1990, predation rates increased to 1.57 juvenile salmon per largemouth bass per day and 5.31 juvenile salmon per smallmouth bass per day in the upper half of the river. It is surprising that EA (1992) reported that no striped bass were collected at any of their five study reaches and none of the 68 Sacramento pikeminnow collected primarily near the Turlock Lake State Recreation Area (rivermile 42.3) and Hickman Bridge (rivermile 31.0) in the Tuolumne River in April and May 1989 had juvenile salmonids in their stomachs. Unfortunately, EA evaluated predation rates only for largemouth and smallmouth bass during their 1990 study.

More recent predator studies conducted in 1998 and 1999 on the Tuolumne River estimated the abundance of potential predators in large gravel pits called "special run pools" and two reference sites described as having relatively natural riverine conditions. However, stomach contents were not investigated for any of the species of predators collected (McBain & Trush and Stillwater Sciences 1999, 2000). Although the density of largemouth and smallmouth bass combined were greater than those of Sacramento pikeminnow at all study sites including the "natural" reference sites, the habitat at the reference sites was not described and it is possible that the preferred habitat for Sacramento pikeminnow was not sampled in this study.

The impact of predation on salmon and steelhead juveniles has not been studied adequately on the Stanislaus River to assess whether predation is a limiting factor. Screw trapping studies in the Stanislaus River suggest that the survival of juvenile fall-run chinook salmon can be quite poor, especially during years of low flow (Demko et al. 1998, S.P. Cramer & Associates 2001). However, the survival estimates were derived by comparing the relatively low number of juveniles estimated to be migrating past a downstream screw trap at Caswell Park with the high estimates of juvenile migrants at the upstream screw trap at Oakdale. Unfortunately, the confidence intervals for these estimates are too great to detect whether the differences are real. The California Department of Fish and Game (undated memorandum) conducted a single-pass electrofishing survey at a large instream mine pit adjacent to the Oakdale Recreational Area in the late 1980's and stomach content sampling suggests that centrarchids were preying on juvenile salmonids. A radio tracking study in the Stanislaus River during May through July 1998 suggested that 30 of 43 (70%) tagged fish were presumably eaten by predators (Demko et al. 1998). Seven of the tagged fish stopped their migration at the pit at the Oakdale Recreational Area. Subsequent electrofishing surveys at this pit indicated that several of the tagged fish had been consumed by largemouth bass and stripers. However, these studies did not evaluate the impacts of predators in the overall river nor did they evaluate the fry emergence period when Sacramento pikeminnow are the most active predator. Furthermore, the results of the radio tagging study are questionable because implanting radio tags may have affected the susceptibility of the tagged fish to predation.

Studies conducted outside of the San Joaquin Basin suggest that predation of juvenile salmonids primarily occurs with hatchery-reared salmonids and with naturally produced juveniles in reservoirs or below low-head dams where flows are altered and predators are abnormally abundant. Brown and Moyle (1981), who reviewed the literature on pikeminnow predation on juvenile salmonids, reported that under natural riverine conditions salmonids are not major prey items of pikeminnow, but that pikeminnow preyed heavily on newly released hatchery salmon after passing over the irrigation diversion dam at Red Bluff, California. Ward and others (1991) similarly reported that northern pikeminnow consumption of juvenile salmonids was highest in tailraces downstream from dams. However, other studies suggest that habitat conditions can affect whether predators feed on juvenile salmonids. Zimmerman (1999) reported that juvenile salmonid predation was much greater for

northern pikeminnow than for smallmouth bass and walleyes through the lower unimpounded Columbia River, but not in the John Day Reservoir. Curet (1993) estimated that smallmouth bass predation on wild, subyearling chinook salmon from April through June exceeded that of northern pikeminnow in Lower Granite Reservoir on the Snake River. Tabor and others (1993) reported that juvenile salmonids were the primary prey item of smallmouth bass >200 mm FL whereas crayfish was the dominant prey item for pikeminnow in a 6-km stretch of river located at the upstream end of McNary Reservoir on the Columbia River. Pickard et al. (1982) reported that juvenile salmon predation was high for both Sacramento pikeminnow and striped bass in the Sacramento-San Joaquin Delta between 1976 and 1978.

Overall, the existing information is insufficient to determine whether juvenile salmonids are primary prey for Sacramento pikeminnow, striped bass, largemouth bass, smallmouth bass or American Shad in the Stanislaus River, or whether predation is a substantial limiting factor for salmonid populations. Further, although there is some evidence to suggest that mined-out gravel pits in the river channel are locations where significant mortality may be occurring, it has not been conclusively determined, and we do not have enough data to prioritize future restoration sites. This project would address these issues.

2. Justification including Conceptual Model, Hypotheses and Project Type

Conceptual Model

Escapement of fall-run chinook salmon to the Stanislaus River has fluctuated between 50 and 35,000 fish since 1946. The fluctuations in escapement are well correlated with streamflow during smolt migration and the number of adult fish that return to spawn (Mesick 2001). Smolt survival studies with hatchery reared fish suggest that mortality is abnormally high in the deepwater ship channel between Stockton and the confluence with the Mokelumne River, and that survival can be improved by either flood flows or a barrier at the head of the Old River which shunts water into the ship channel (Mesick 2001). One possible explanation for the high mortality rates of hatchery-reared smolts during their 5-10 day migration through the deepwater ship channel in mid April when water temperatures were generally suitable is that striped bass and other predators congregate in the dredged channels and hatchery reared juvenile salmon are particularly susceptible to predation. Another possible explanation for why escapement increases two years after a flood event is that the survival of fry rearing in the San Joaquin mainstem and Delta may be substantially increased during high flows that presumably reduce the impacts of predation, unscreened diversions, contamination, and other stressors. However, presently there are insufficient data to assess the survival of juvenile salmonids rearing in the Delta.

A stock-recruitment analysis for the Stanislaus River salmon population from 1946 to 1998 suggests that recruitment initially increases as stock increases but then remains constant after stock exceeds about 2,500 three-year-old fish (Mesick 2001). The number of spawners returning to the Stanislaus River was fewer than 1,500 fish, which was probably low enough to substantially limit recruitment during 46% of the years from 1958 to 1998. It is likely that the low abundance of spawners was a result of the combined effects of poor smolt survival when springtime flows were low and ocean harvest rates of adult salmon were high.

The stock-recruitment analysis also suggests that the habitat in the Stanislaus River can support the

progeny of only about 1,250 adult female salmon. It is likely that instream gravel mining, which peaked during the early 1940s prior to the escapement surveys, degraded the quantity and quality of both spawning and rearing habitat in the Stanislaus River. The upstream dams that blocked the coarse sediment supply worsened the problem as the remaining riffles became armored and smaller as they eroded away. The limited amount of riffle habitat in the Stanislaus River results in high rates of redd superimposition during which the late arriving females either excavate and kill the incubating eggs or deposit the fine sediment from their redd on top of the superimposed redd, thereby entombing the alevins. Dr. Carl Mesick observed numerous dead alevins in superimposed redds but few in nonsuperimposed redds in the Stanislaus River in February and March 2001. Fine sediment intrusion also tends to reduce the downwelling of surface flow into the redds which increases the influence of oxygen-poor groundwater in the egg pocket. Low dissolved oxygen concentrations either kill the embryos or stunt their growth, which reduces their chances for survival (Chapman 1988). Fry with large heads and small bodies are frequently observed in the screw traps in the San Joaquin tributaries and stunted fry are probably quite vulnerable to water temperatures above 65EF, predation, low food availability, contamination, unscreened diversion and other stressors.

It is also likely that loss of riffle habitat from in-river gravel mining also reduced rearing habitat and increased predation of juvenile salmonids. Numerous chinook salmon and steelhead/rainbow trout juveniles were observed using the recently restored riffles, whereas in mined areas, the juveniles are typically restricted to the densely vegetated river margins to avoid predators (Fishery Foundation of CA, unpublished data, T. Cannon, personal communication 2001). Large schools of Sacramento pikeminnow occur at the Frymire Ranch Project sites and numerous salmonid fry have been observed in their stomachs (Walser and Smith, personal communication 2001).

Restoration of the mined channels in the primary spawning and rearing reaches of the Stanislaus River should increase the abundance and condition of the emerging fry. Presumably, healthy fry should be able to tolerate warm temperatures, low food availability, and low levels of contamination and avoid predation, unscreened diversion and other stressors better than the fry produced in the highly silted, natural riffles in the Stanislaus River. Restoration of the mined channels should also decrease the abundance of predators. Although it will be impossible to eliminate predators throughout the system, particularly in the Delta, an increase in the production in healthy smolts should result in increased recruitment to the adult population.

Hypotheses Being Tested

Hypothesis 1 Sacramento pikeminnow consume a greater number of small (<120 mm) juvenile salmon and trout in the Stanislaus River than do largemouth bass, smallmouth bass, striped bass, or American Shad. Sacramento pikeminnow appear to be the most abundant predator in the Stanislaus River and they begin feeding in January when salmon fry begin to emerge, whereas the other predators do not begin to feed until April or May.

Hypothesis 2 Striped bass consume a greater number of large (120-300 mm) juvenile salmon and trout in the Stanislaus River than do Sacramento pikeminnow, largemouth bass, smallmouth bass, or American Shad. This hypothesis is based on limited electroshocking data and observations of professional fishing guides that are highly experienced with the Stanislaus River.

Hypothesis 3 Predation of juvenile salmonids in the Stanislaus River accounts for at least 50% of the mortality of juveniles produced in the river. The screw trap studies by S.P. Cramer and Associates suggest that mortality rates of juvenile salmon migrating in the lower Stanislaus River exceeds 50%.

Hypothesis 4 Mortality of juvenile salmonids in the Stanislaus River due to predation is similar to the predation-related mortality rates in the mainstem San Joaquin River and Delta. This project would be the first study to collect data to test this hypothesis.

Hypothesis 5 Sacramento pikeminnow primary utilize mined glide habitat, striped bass primary utilize deep mine pits at least 10 feet deep, largemouth bass primarily utilize shallow mined pits where overhead cover is available and water temperatures are elevated, and smallmouth bass primarily utilize the lower river. This hypothesis is based on limited electrofishing data and observations of professional fishing guides that are highly experienced with the Stanislaus River, whereas no quantitative data are available.

Hypothesis 6 Restoration of riffle habitat in mined areas reduces predator abundance and predation. Predators are rarely observed at riffles and unmined reaches in the Stanislaus River.

Hypothesis 7 Predation rates decline as streamflow increases and water temperatures decrease. Observations indicate that largemouth and smallmouth bass migrate upstream into the juvenile salmonid rearing areas during low flows, presumably in response to increased water temperatures, whereas high flows tend to force the predators into the lower river. Coded-wire tag studies suggest that chinook salmon smolt survival increases as streamflow increases and this study will help determine whether predation is the causal mechanism.

Hypothesis 8 The Oakdale Recreation Area gravel ponds are a location where significant predation on juvenile salmonids occurs. Although there is some data to indicate that predation is a problem at this location, not enough data exists to convince local bass fishermen that restoration is warranted. Answering this question would provide DWR with enough information to either move forward with public outreach and restoration, or focus restoration efforts elsewhere in the river.

Selection of Project Type

This project is proposed as a research project due to a high level of scientific uncertainty regarding the extent of predation in the Stanislaus River, the locations it is occurring, and the predators responsible. Although numerous smolt survival studies suggest that the mortality of hatchery-reared fish is high in the lower Stanislaus River, mainstem San Joaquin River, and Delta, particularly during low flows, no studies have identified the cause of the mortality or that mortality of naturally produced fish is high. Furthermore, electrofishing studies conducted by EA Engineering, Science, and Technology in the Tuolumne River, suggest that predation of naturally produced juvenile chinook salmon was low in 1989 and 1990 (EA 1992).

The restoration of large mine pits is very expensive and will take many years to accomplish. This project will help determine whether predation is a limiting factor in the Stanislaus River, whether restoration of mine pits to reduce predation is justified, and if so, which mine pits should receive restoration priority. Further, this study

will be used by DWR and other agencies as justification for future restoration projects, including during public outreach proceedings as justification of need.

3. Approach

The goal of this project is to determine whether predation is a significant limiting factor for juvenile salmonids in the Stanislaus River and, if so, to identify the important predator species and their habitats. There are five study objectives including (1) estimation of predator densities in natural habitats, restored habitats, and mine pits, (2) estimation of total abundance of predators and juvenile salmonids in the different habitats, (3) estimation of predation rates by different predators in different habitats, (4) estimation of net predation in the river, and (5) estimation of the amount of different habitat types used by predators.

Predator densities and habitat use will be determined by three methods: (1) downstream from Oakdale three-pass removal or mark-recapture methods using electrofishing where appropriate, (2) direct counts using snorkeling, and (3) hook-and-line. Surveys will be conducted in specific habitat types at one-month intervals year-round except for electrofishing, which will be conducted from mid January through August to avoid impacts to adult salmon. All three methods are needed because although electrofishing will provide the most accurate estimates for most predator species, it may not be effective for striped bass or deep water, and it will not be used in natural riverine habitats upstream from Oakdale to minimize impacts to spawning and rearing salmonids. Conversely, snorkeling is not effective in the lower river and Delta where visibility is poor. The hook-and-line data should be effective for all predator species in all habitat types, whereas it may be difficult to determine the accuracy of catch-per-unit-effort data.

Sampling will occur from Knights Ferry downstream to the Delta. Four different habitat types will be sampled between Knights Ferry and Oakdale including deep mine pits, shallow mine pits, dredged glides, and natural and restored riffle sites. Several habitat types will be sampled in the Stanislaus River downstream from Oakdale, the San Joaquin River near the confluence with the Stanislaus River, and in the deepwater ship channel near Stockton, and will be chosen such that all available habitat types are represented. Four replicates of each habitat type will be surveyed. Overall, a total of 28 sites will be sampled monthly. To estimate the total number of predators, each of the study habitat types will be mapped in the Stanislaus River, San Joaquin River below the confluence with the Stanislaus River, and the deepwater ship channel between Stockton and the confluence with the Mokelumne River, to estimate the total length of each habitat type. Predator abundance will be estimated with confidence intervals for each survey conducted by multiplying the density of predators in a particular habitat by the total length of that habitat.

Predation rates will be determined at one-month intervals by collecting predators using both electrofishing and hook-and-line methods. Electrofishing will be conducted from January through August, whereas hook and line sampling will be conducted from January through early October above Oakdale and year-round below Oakdale. Both methods are needed because electrofishing may not be effective for species that utilize deep water and hook-and-line methods may not collect fish that are targeting non-salmonid prey. Electrofishing will be accomplished below Oakdale where few salmonids spawn or rear, and where we would be unlikely to catch rainbow trout (which we want to minimize for ESA permitting purposes). Angling will target non-salmonids and

will occur downstream from Knights Ferry.

Sampling will occur in low light periods when predation rates are highest and prey items will not be evacuated from predator stomachs. Pikeminnow and smallmouth bass feed most heavily from dusk to midnight and at dawn, but full stomachs are often found throughout the day and night (Steigenberger and Larkin 1974; Vigg et al 1991). Up to 100 stomach samples will be collected each month from each species of predator collected using lavage methods, except for pikeminnow for which stomachs will be surgically removed. All samples of stomach contents will be preserved in alcohol and later analyzed by CDFG staff in the La Grange field office. A reference collection of vertebra, otoliths and scales will be created for identifying highly digested prey. Effort will not be made to identify or quantify invertebrates, however the samples will be stored long-term by the CDFG should this information be desired at a later date.

The total number of juvenile salmonids consumed per day would be separately estimated for fry, parr, and smolts of salmon and trout as the mean number observed in the stomach samples divided by the fraction of a day required for a juvenile salmonid to pass through the predator's stomach based on known evacuation rates for each species of predator.

The total proportion of the fry, parr, and smolt salmon emigrants consumed by predators would be estimated by dividing the total number of juveniles consumed in a year by the estimated total number of juveniles migrating past the Oakdale screw trap adjusted for predation losses upstream of the trap.

These studies will be conducted for three years from January 2003 to December 2005.

Data Analysis

Hypothesis 1 Sacramento pikeminnow consume a greater number of salmon fry in the Stanislaus River than do largemouth bass, smallmouth bass, striped bass, or American Shad. This project will estimate the total number of salmon fry consumed by each species of predator during monthly surveys. Statistical tests will compare the total number consumed by each predator species in all habitats each year.

Hypothesis 2 Striped bass consume a greater number of salmon smolts and juvenile trout in the Stanislaus River than do Sacramento pikeminnow, largemouth bass, smallmouth bass, striped bass, or American Shad. This project will estimate the total number of salmon parr and smolts and juvenile trout consumed by each species of predator during monthly surveys. Statistical tests will compare the total number consumed by each predator species in all habitats each year.

Hypothesis 3 Predation of juvenile salmonids in the Stanislaus River accounts for at least 50% of the mortality of juveniles produced in the river. This project will estimate both predation rates and predator abundance and together with estimates of juvenile abundance based on screw trapping studies, it will be possible to estimate the total mortality of juvenile salmonids in the Stanislaus River due to predation.

Hypothesis 4 Mortality of juvenile salmonids in the Stanislaus River due to predation is similar to the

predation-related mortality rates in the mainstem San Joaquin River and Delta. The quantitative estimates of predation provided by the electrofishing and predation indices provided by hook-and-line data will be used to compare predation in the Stanislaus River versus predation in the mainstem San Joaquin River and Delta. Analyses with the predation indices generated with the hook-and-line data will help verify that the quantitative estimates generated with different methods used among the habitat types are comparable.

Hypothesis 5 Sacramento pikeminnow primary utilize mined glide habitat, striped bass primary utilize deep mine pits at least 10 feet deep, largemouth bass primarily utilize shallow, mined pits where overhead cover is available and water temperatures are elevated, and smallmouth bass primarily utilize the lower river. Predator abundance will be estimated in each of these habitat types as a direct test of this hypothesis.

Hypothesis 6 Restoration of riffle habitat in mined areas reduces predator abundance and predation. Study sites will be selected in areas where mined glide habitat was restored for the Knights Ferry Gravel Replenishment Project and in areas where mined glide habitat will be restored for the CMC restoration project titled "Spawning Habitat and Floodplain Restoration in the Stanislaus River at Lovers Leap" that is scheduled to begin restoration in fall 2003. Other potential restoration sites, including the Oakdale Recreation Pond and Willms Pond, will be studied as well.

Hypothesis 7 Predation rates decline as streamflow increases and water temperatures decrease. This project will study predation rates over three years and presumably flow, water temperature, and predation rates will vary during the project.

Hypothesis 8 The Oakdale Recreation Area gravel ponds are a location where significant predation on juvenile salmonids occurs. This study will sample different types of habitat throughout the river, including the Oakdale Recreation Area gravel ponds. Comparison of predator densities and predation rates in the Oakdale ponds with ponds and other habitats elsewhere in the river will allow us to determine if predation at the Oakdale ponds is a problem, and allow us to prioritize future restoration sites, including the Oakdale Recreation Area.

4. Feasibility

The proposed approach for implementation of this project is both feasible and appropriate. The project will be completed within the requested three-year period by agencies and consultants that are currently working in the basin and have intimate knowledge of river. The pooled resources of basin experts ensures that we will have the necessary equipment and staff to perform all aspects of the project. For instance, CDFG, USFWS and SPCA all have electrofishing boats that will be available for the three year study. Other field equipment is also in abundant supply.

Since a CDFG or USFWS employee will be present during all of the field sampling, sampling activities will occur within the bounds of their exiting Section 10 ESA permit for Central valley steelhead, and no other ESA authorization will be necessary. All members of the sampling teams will be required to have CDFG scientific collecting permits. All SPCA employees carry valid permits. As required by these permits, a letter of authorization will be obtained from the CDFG for each sampling activity each year. Any additional reporting requirements

specified by the CDFG in the letter of authorization will be fulfilled.

5. Performance Measures

At two critical times during this study we will seek independent statistical review from a Ph.D level Biometrician. The first review will occur after the completion of our detailed field sampling plan. The Biometrician will ensure that the proposed methodologies will result in answering the desired hypotheses, with appropriate statistical precision. At the completion of the project, after the draft report is done, the Biometrician will review our findings to ensure that appropriate statistical methods were employed in the analysis of the data. At this point we have not identified the Biometrician we will use, but it will most likely be someone the USFWS Stockton office has used before, preferably someone familiar with the Stanislaus River and predation studies.

The performance measures used to assess the project's success in relation to its objectives include development of a detailed sampling plan prior to the initiation of field work, data reports, publications, and presentations. An organized steering committee (i.e. Stanislaus Fish Group) will oversee all aspects of the study, such that there will be ongoing evaluation of the procedures and any necessary changes can be during the course of the study.

Upon initiation of fieldwork, we will distribute, via e-mail, monthly progress reports detailing all field activities. We will also provide updates to various Central Valley salmonid work groups via presentations and our presence at meetings. Furthermore, we will maintain a website with all work products.

6. Data Handling and Storage

All data will be entered onto standardized forms that specify all data to be collected for each task. Field supervisors will confirm that all data have been accurately recorded before leaving the study sites by initialing each form. All data analysis will be conducted using standard software programs, such as Quattro Pro or Excel. Copies of map files and final spreadsheet files will be submitted to CALFED or the CVPIA if requested. Copies of all data sheets will be provided to CDFG Region 4 for historical preservation, as well as to Tri-Dam Project. Copies will also be provided to CalFed upon request. Data summaries and graphs will be posted on the internet as they are created.

7. Expected Products/Outcomes

The following is a list of products and outcomes that will result from successful implementation of the Stanislaus River predation study:

1. Increased understanding of habitat use by different predators.
2. Increased understanding of the impact of predation upon emigrating salmonid populations.
3. Increased understanding of which predatory species have the greatest impact on fry, parr and smolt emigrants.
4. Guidance to prioritize restoration actions in the Stanislaus River and other Central Valley water

sheds.

8. Work Schedule

Assuming that the project is recommended for funding, a contract could be executed by September 2002. The project would begin in January 2003 and continue through December of 2005. Table 1 presents the timetable for each activity.

Deliverables:

Quarterly:	Reports to CalFed ERP
November 31, 2005	Draft Report & Database
December 31, 2005	Final Report

Table 1. Project timetable for Stanislaus River Predation study.

Year	Activity	Start Date	End Date
1	Electrofishing surveys	January 2003	August 2003
2	Electrofishing surveys	January 2004	August 2004
3	Electrofishing surveys	January 2005	August 2005
1-3	Snorkeling surveys	January 2003	October 2005
1-3	Hook and line surveys	January 2003	October 2005
1-3	Project management	January 2003	December 2005

B. Applicability to CALFED ERP and Science Program Goals and Implementation Plan and CVPIA Priorities.

1. ERP, Science Program and CVPIA Priorities

ERP Strategic Goals

The proposed study will provide new information necessary for many of the CALFED ERP strategic goals to be reached. First, considerable uncertainty exists about why at-risk species are in decline, and how to best facilitate the recovery of these species. The strategic goals state that "ERP actions must address the immediate needs of at-risk species as well as gain additional information about how they respond to modifications to

ecosystem functions and processes." Studies have been conducted to evaluate how smolts respond to modifications to ecosystem functions and processes, namely flow, exports and temperature; however, little attention has been devoted to obtaining a better understanding of the impact predation may have on emigrants in relation to habitat type. The strategic goals recognize that we must maximize opportunities that improve our understanding of the best methods for restoring at-risk species and their habitat to achieve recovery of at-risk native species. With complementary studies on-going in the Stanislaus River, and a wealth of juvenile data collected over the last decade, this is a prime opportunity to take the next step in answering many questions which have arisen since sampling began in 1993. Few systems in the Sacramento-San Joaquin basin have such a solid foundation of outmigrant data or ongoing sampling efforts to work from.

As a harvestable species, maintaining and enhancing the chinook salmon population for sustainable harvest is of great importance. By investigating predation rates by species in relation to habitat, restoration projects can be tailored to provide conditions most beneficial to salmonid survival. Measures to increase survival are necessary for the population to recover to sustainable levels sufficient for harvest.

CALFED Science Program Goals in relation to the ERP

A basic premise of the CalFed Program is that five interconnected applications of science must progress together. These are 1) adaptive management, 2) monitoring, 3) interdisciplinary knowledge of critical unknowns, 4) improving the scientific basis of water management and 5) broad communication of science knowledge and scientific activities. The proposed project will help these applications progress in unison by providing information key to the adaptive management of fall-run chinook salmon and allowing us to make better use of existing data by seeking answers to questions that have arisen from analyses of this data.

One of the priorities of the CALFED Science Program is to conduct adaptive management experiments. This project will test eight hypotheses regarding whether specific types of habitat degraded by past gravel mining should be restored to reduce predation on juvenile steelhead trout and fall-run chinook salmon.

Implementation Plan Priorities

The proposed project addresses three implementation plan priorities, one of multi-regional scale and two specific to the San Joaquin Region. Priority MR6 is to ensure recovery of at-risk species by developing conceptual understanding and models that cross multiple regions. Although the study is proposed for the Stanislaus and San Joaquin rivers, the same habitats and species exist throughout the Central Valley. Thus, greater understanding predation in the Stanislaus and San Joaquin rivers will likely be applicable throughout the Sacramento-San Joaquin drainage.

Priority SJ4 is to implement actions to improve the understanding of at-risk species in the region. The proposed study is designed to evaluate the impact of predation on salmonid emigrants by predator species and to identify how the rate of predation is affected by habitat type.

CVPIA and AFRP Goals consistent with the ERP

Section 3402 states the purpose and goals of the CVPIA. Two of these goals relate directly to the ERP and to the proposed project. The first is to protect, restore and enhance fish, wildlife and associated habitat in the Central Valley and Trinity basins. In order to reach this goal we must first develop an understanding of how to protect and restore populations and their habitat. In the case of the chinook salmon, this requires an understanding of how habitat availability and predation affect their survival during emigration.

The second goal of the CVPIA is to evaluate the effects of the CVP on fish and wildlife. New findings may support changes in operations to benefit chinook emigrants. Stanislaus River flow is affected by the CVP and thus operations may influence the survival of juvenile emigrants directly or indirectly.

Under section 3406(b)(1) the CVPIA authorizes the Anadromous Fisheries Restoration Program (AFRP) to develop within 3 years of enactment and implement a program which makes all reasonable efforts to ensure that, by 2002, natural production of anadromous fish in Central Valley rivers and streams will be sustainable, on a long-term basis, at levels not less than twice the average levels attained during the period of 1967-1991. Some of the objectives identified by the program to meet this goal are directly addressed by the proposed project.

The AFRP seeks to improve habitat for all lifestages of anadromous fish by providing flows of suitable quality, quantity and timing and improved physical habitat. In order for this to occur we must start by determining the effects of these variables on juvenile emigrants by lifestage. This requires that a second goal, to collect fish and habitat data, be addressed to provide the information needed to determine what actions should be taken to ensure optimum survival of the population.

2. Relationship to Other Ecosystem Restoration Projects.

The proposed study will provide necessary information to direct future restoration efforts in the Stanislaus River and other watersheds within the Central Valley. By identifying relative predator densities, habitat preferences and predation rates, the expected benefits of projects to reduce predator habitat will be evaluated. Because these predatory species and their respective habitats exist throughout the Central Valley, the project will also provide insight for prioritizing restoration activities elsewhere.

In the Stanislaus River, the complete analysis will allow comparison of the relative rates of predation in locations suspected to be problematic with those that are not. For example the Oakdale Recreation Area, approximately 2 miles of the Stanislaus River (RM 38-RM 40) dotted by in-channel and captured mine pits, has been suspected as an area of high mortality to juvenile chinook by way of predation. Radio tracking studies, electrofishing surveys, and differences between rotary screw trap outmigration estimates at Oakdale (RM 40.1)and Caswell (8.6) are the primary sources of data upon which this hypothesis has been built. Planning has begun for restoration of the area, however more data is needed to ensure the project will provide sufficient benefit for the cost. The project will also provide an evaluation of potential benefits of restoring Willm's Pond (RM 51.6), an in-channel mining pit within the spawning reach.

Carl Mesick Consultants, with assistance from McBain and Trush, Smith and Walser Enterprises, and other subcontractors, will implement a large-scale restoration project on the Stanislaus River in 2002 to investigate

the importance of restoring functional floodplain habitat adjacent to restored riffle habitat. The Anadromous Fish Restoration Program will fund work at Two-Mile Bar where both the floodplain and riffle habitat will be restored. The Four-Pumps Mitigation Agreement will fund work at Lovers Leap where riffle habitat will be restored but the floodplain will remain heavily encroached with riparian vegetation and constricted by dikes. CMC and Smith and Walser Enterprises will design the riffles to benefit both fall-run chinook salmon and steelhead trout. They will also conduct studies to evaluate the hypothesis that steelhead trout require cover and feeding stations adjacent to their spawning habitat. McBain and Trush will conduct fluvial geomorphic studies to evaluate the effect of a functional floodplain on sediment transport at the restored riffles.

The Frymire Ranch Project would increase the number of restoration sites, which would strengthen the environmental studies by increasing the number of replicates and increasing the likelihood of detecting a population response in terms of increased smolt production and increased escapement. This proposed predation study has been designed to study the effects of CMC's riffle restoration project on predation rates.

3. Requests for Next-Phase Funding

This is not a proposal that is requesting next-phase funding.

4. Previous Recipients of CALFED Program or CVPIA funding.

Tri-Dam and S.P. Cramer received funding from the AFRP in 1999 for an evaluation of the use of radio-tagged juvenile chinook salmon to identify cause and location of mortality.

S.P. Cramer and Associates received CVPIA funding (AFRP and B2) for juvenile salmon outmigrant sampling on the Stanislaus River at Caswell State Park from 1997 through 2001 and from B2 in 1999 for an evaluation of smolt survival in the Stanislaus River.

CMC received funding for the Knights Ferry Gravel Replenishment Project, #97-N21, which added 13,000 tons of clean gravel to 18 sites on the Stanislaus River from Two-Mile Bar to the city of Oakdale in August 1999.

CMC is in the process of contracting with the AFRP for the project called "Spawning Habitat and Floodplain Restoration in the Stanislaus River at Two-Mile Bar, Phase 1. Work is expected to begin in fall 2001.

CMC is in the process of contracting with the California Department of Water Resources for Four-Pumps Mitigation Agreement funding for the project called "Spawning Habitat and Floodplain Restoration in the Stanislaus River at Lovers Leap. Work is expected to begin in summer 2002.

5. System-Wide Ecosystem Benefits

The Stanislaus River, as well as the Tuolumne, Merced and the San Joaquin Rivers, all provide habitat for fall-run chinook salmon and steelhead trout. The former is a species of concern and the latter is listed as threatened under the Federal Endangered Species Act. It is likely that predation is a primary limiting factors for chinook salmon, and steelhead, in these rivers. This project will address the importance of predation and help guide future restoration in the Stanislaus River and the San Joaquin Basin in particular, and in the Central Valley in general.

6. Additional information for proposals containing land acquisition

The proposed project does not involve land acquisition.

C. Qualifications

Tri-Dam Project (Tri-Dam) is a partnership between two public agencies: the Oakdale Irrigation District and the South San Joaquin Irrigation District. Both irrigation districts were formed in 1909 to provide reliable irrigation. Since the early 1990's, Tri-Dam has taken an active role in fisheries monitoring, protection and enhancement on the lower Stanislaus River through the funding of several fisheries monitoring programs. Tri-Dam has retained S.P. Cramer & Associates (SPCA) since 1993 to provide fisheries consulting services related to the above activities. Tri-Dam has funded annual rotary screw trap monitoring since 1993, radio tracking in 1998-99, studies involving outmigrant responses to pulse-flows and annual advisory funding for SPCA to attend meetings in order to keep them up-to-date on all fisheries issues. Tri-Dam will extend its existing contract with SPCA to conduct the proposed project activities.

Steve Felte is the general manager of Tri-Dam and will serve as contract manager and will be responsible for quality assurance and control throughout the project. As general manager of the Tri-Dam, Steve is responsible for overall operations of Tri-Dam including fiscal, personnel, power contract administration and coordination with the two irrigation districts and the elected Board. Steve holds two Bachelor of Science degrees and has completed several courses and seminars in management and personnel.

Primary Sub-contractor:

SPCA was established in 1987 to provide innovative problem solving on issues relating to salmon and trout on the Pacific Coast. We are reputed for our investigative work in determining why fish populations have or may change in response to specific actions. The core of the firm is composed of three Senior Fisheries Consultants, each with over 20 years of noteworthy experience. Our support staff includes a Biologist Project Leader, four Biologist Assistant Project Leaders, a Computer Applications Specialist, a Statistician, a Fisheries Facilities Engineer, a GIS specialist and a seasonal staff of 10 to 18 Fisheries Technicians.

SPCA has been conducting research on the Stanislaus River for private water rights holders, CAMP, and AFRP since 1993, and are therefore very familiar with basin issues, key watershed participants, and the actions necessary to conduct the proposed project. Since we have been involved in Stanislaus River issues for so long, we have had the opportunity to work with a number of different watershed interests, including agency biologists,

private researchers, and the public. SPCA has been Tri-Dam's primary fisheries consultant since 1993 and has conducted numerous fisheries investigations, monitoring and assessments of the upper and lower Stanislaus River fisheries resources. Past and on-going fisheries work include annual monitoring of juvenile chinook outmigration, adult migrant trapping, radio tracking and electrofishing.

Selected Projects:

Radio Tracking of Juvenile Chinook in the Stanislaus River. Tri-Dam Project (1998-99). SPCA radio tagged and tracked subyearling chinook (100-115 mm fork length) as they migrated through the lower Stanislaus River. Mobile tracking via jet sled and fixed station monitors were used in each year. We found specific locations in the river where predation on tagged chinook was consistently greater than elsewhere. Diel timing of migration, daily migration distances, and habitat use were also determined.

Predation on Juvenile Chinook in the Stanislaus River. U.S. Fish and Wildlife Service (1999). SPCA used a boat electrofisher and radio tracking to determine the species of fish that was preying on radio-tagged subyearling chinook. Periodic electrofishing surveys at night showed that striped bass were the most common predator in the main river channel and largemouth bass were the most common predator in backwater areas. We succeeded at tracking and electrofishing three radio-tagged juveniles that showed unusual behavior, and each was found in the gut of a striped bass. Live cage tests showed that radio tags consumed by either largemouth or striped bass remained in the predator's gut for at least one week, and the tag remained easily detected by tracking equipment.

Key personnel:

Doug Demko will manage and coordinate the proposed project activities within SPCA and between the cooperating agencies, and will supervise data analysis, interpretation and report preparation activities. Doug has worked in the Stanislaus Basin since 1993. He has led a variety of field sampling projects and has gained the respect of state and federal fisheries biologists as an expert in migrant fish sampling. His experience in the Stanislaus River is more extensive than other researchers, and includes leading research projects such as screw trapping, smolt survival studies, radio tracking, predator surveys, resident trout population estimates, habitat surveys, and limiting factors analyses. Additionally, he recently obtained a law degree which has furthered his understanding of water law and endangered species issues. Since Doug has been a key watershed participant since 1993, he has had the opportunity to build trusting relationships with key watershed participants. This trust coupled with the understanding of the issues gained by representing both stakeholders and the resource agencies, equips Doug with the skills to facilitate communication between watershed partners.

Andrea Phillips will coordinate and supervise field personnel and data collection activities and assist in data analysis and report preparation. Since 1995 she has assisted Doug in the coordination of field research activities on the Stanislaus River and other tributaries to the San Joaquin River which has required considerable networking and coordination with state, federal and local government personnel, private consultants, landowners and recreational groups. She has considerable electrofishing and snorkeling experience and is a capable boat operator.

Ray Beamesderfer has conducted original research and analyzed applied problems of fish biology for almost 20 years. He has extensive experience with salmon, steelhead, sturgeon, warmwater sportfish, and nongame species; has published numerous scientific articles on fish sampling, population dynamics, and species interactions; and has special expertise in the use of statistics and computer modeling to solve difficult fish questions. He recently joined us from the Oregon Department of Fish and Wildlife where he analyzed Columbia River fish and fishery information to forecast runs, regulate sport, commercial and Treaty Indian fisheries, and assess Endangered Species impacts and risks.

Other Sub-contractors:

Carl Mesick Consultants, which was founded in 1992, will be contracted to aid in development of the model. Dr. Carl Mesick received his Ph.D. in fisheries science from the University of Arizona in 1984. He has twenty years of experience as a fisheries scientist evaluating the effects of water diversions, hydroelectric operations, stream restoration projects, timber harvest, and mine operations on trout, salmon, non-game species of fish, and invertebrates. Dr. Mesick's expertise includes stream habitat restoration and studies of instream flow, water temperature, riparian vegetation, sedimentation, entrainment at diversion intakes, food availability, fish passage, fish habitat preference, fish population monitoring, and stream habitat classification. He has studied the spawning habitat of fall-run chinook salmon on the Stanislaus River since 1994. Dr. Mesick manages and supervises all phases of the Knights Ferry Gravel Replenishment Project funded by CALFED, including project design, environmental compliance and permitting, construction supervision, and the monitoring of salmonid spawning habitat. Dr. Mesick recently worked as a Habitat Restoration Coordinator for the U.S. Fish and Wildlife Service's Anadromous Fish Restoration Program.

Trevor Kennedy has particpated incand managed fishery restoration and research projects in the Central Valley for over five years, and currently works for the Fishery Foundation of California. Trevor has a B.S. in fisheries from Humboldt State University and has extensive experience relevant to the proposed project. He developed and implemented measures to improve fish passage on the Cosumnes River via the Cosumnes River Salmonid Passage Improvement Project and has developed methodologies to determine spatial and temporal densities and distribution of juvenile chinook salmon and steelhead within the Stanislaus River by direct observation. He has also contributed to the present understanding of how juvenile fish utilize floodplain habitats within the Cosumnes River and is currently working with the AFRP to determine habitat preferences, residence time, and the degree of stranding of juvenile chinook salmon within the Cosumnes River Preserve.

Smith and Walser Enterprises will assist with the project design, construction supervision and steelhead trout spawning surveys. Mr. Tim Smith and Mr. Steve Walser have spent between 150 and 300 days per year for the last 14 and 27 years respectively, fishing for steelhead trout and other species in the San Joaquin River and its tributaries. They have seven years of professional experience guiding anglers, producing high quality underwater videos, writing articles and books on fish habitat and angling, and making presentations to fishing groups. Mr. Smith is the California Trout Stream Keeper for the Merced River and Mr. Walser is the California Trout Stream Keeper for the Tuolumne River. They are also collecting trout specimens from the San Joaquin tributaries for the National Marine Fisheries Service and the California Department of Fish and Game.

D. Cost

Tri-Dam is requesting $671,000 for the 3 year study. The amount budgeted includes $55,000 per year for a CDFG permanent intermittent (PI) and scientific aid assistant. In addition to field surveys, the PI will be responsible for analyzing stomach samples with the assistance of the scientific aid. The budget also includes $16,000 per year for a USFWS biologist and $15,000 per year for Carl Mesick Consultants to manage the angling component of the study, perform data analyses and prepare annual reports. We included $25,000 per year for the Fishery Foundation of California to conduct the snorkel surveys, and $35,000 per year for Smith and Walser Enterprises to conduct the angling surveys. In addition, Tri-Dam will contribute in-kind services for all contract management and administration for the project.

Rotary screw trap monitoring at Oakdale will continue to be funded by the Tri-Dam Project. The abundance estimate at Oakdale is necessary to estimate the proportion of the population lost to predation annually within the Stanislaus River.

E. Local Involvement

The project will enlist the services of nearly all organizations involved in Stanislaus River fisheries research, including the California Department of Fish and Game, the US Fish and Wildlife Service, S.P. Cramer & Associates, Carl Mesick Consulants and the Fishery Foundation of California. Other parties connected with the Stanislaus Fish group and the proposed restoration of the Oakdale Recreation Area, including the California Department of Water Resources, the US Bureau of Reclamation, the US Army Corps of Engineers, and the National Marine Fisheries Service, have expressed a strong desire to see this project move forward.

F. Compliance With Standard Terms and Conditions

The proposed project has been developed in compliance with all of CalFed's standard terms and conditions presented in Attachment D of the August 2001 PSP. The applicant has reviewed and will comply with CalFed's terms and conditions. The applicant also understands that the contract terms will apply to any sub-contracts that may be entered into to complete the proposed work. There are no conflicts of interest in performing this work.

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