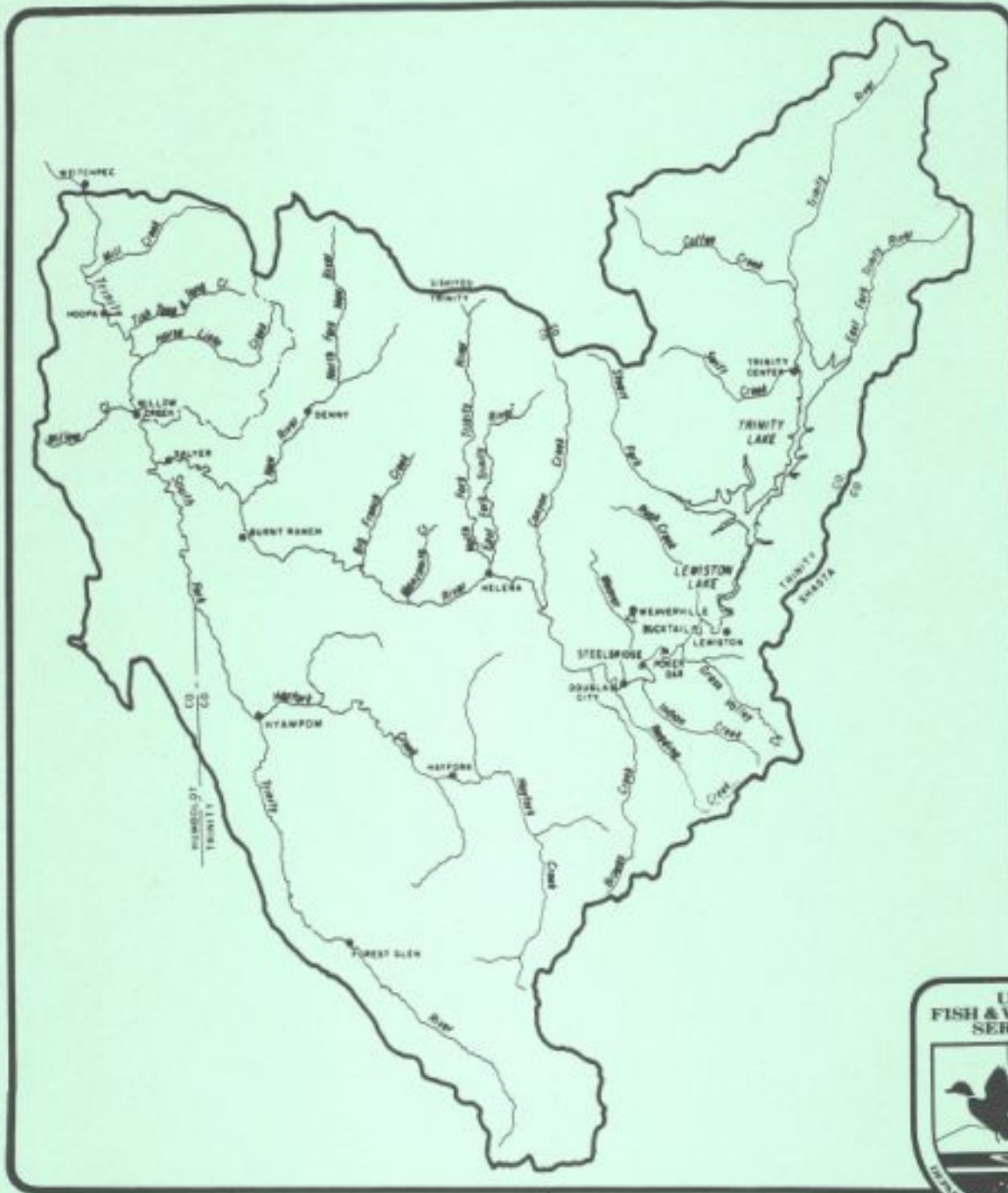


TRINITY RIVER FLOW EVALUATION STUDY ANNUAL REPORT - 1985



Fish and Wildlife Service

U.S. Department of the Interior

ANNUAL REPORT

TRINITY RIVER FLOW EVALUATION STUDY

1985

U.S. Fish and Wildlife Service
Division of Ecological Services
Sacramento Field Office
Sacramento, California

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January 1985

FORWARD

The following report is the first in a series of annual reports prepared as part of the Trinity River Flow Evaluation Study (a 12-year study). The U.S. Fish and Wildlife Service was directed to conduct the study as part of a decision by the Secretary of Interior in January 1981 to increase releases from Lewiston Dam. It is hoped that through this undertaking, we will gain a better understanding of the dynamic forces which influence and control the destiny of Trinity River salmon and steelhead. The culmination of this effort is to provide a report to the Secretary, using the knowledge we have gained through the study, recommending an appropriate course of action so that he may fulfill his responsibilities for the preservation and propagation of the Trinity River's indigenous fishery resources.

To those who are interested, comments and information regarding this study and the fishery resources of the Trinity are welcome. Written comments and/or information can be submitted to:

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ANNUAL REPORT
TRINITY RIVER FLOW EVALUATION STUDY
1985
SUMMARY

Nineteen eighty-five marked the first year of the 12-year study to evaluate the effectiveness of improved flows and other rehabilitation measures in restoring fish habitat and populations on the mainstem Trinity River below Lewiston Dam. This was directed by the Secretarial Decision of January 14, 1981.

A sub-office of the U.S. Fish and Wildlife Services, Sacramento Field Office, Division of Ecological Services, was established at the Sawmill Wildlife Site near Lewiston, California to house project staff.

Fourteen study reaches were selected between Lewiston Dam and Hoopa Valley (approximately 1 mile below Highway 96 bridge) for project evaluations. Once these reaches were established the major focus of the study was on collecting data pertinent to fish habitat preference (Task 2) and habitat availability (Task 3).

A total of 868 fish microhabitat use observations and 1170 random available habitat observations were made within these reaches. In addition depth and velocity data sets were collected at 127 transects in 12 of the 14 study reaches. These were completed at two evaluation flows (350 cfs and 450 cfs releases from Lewiston Dam).

Due to dry year conditions, as determined by Shasta Lake inflow criteria, Lewiston Dam releases were reduced from the expected "normal" year schedule. However, at the request of the Fish and Wildlife Service these releases were augmented somewhat (Figure 1).

As a result, however, we were unable to collect a third set of velocity and depth data (at 600 cfs) as scheduled for 1985. Modification of the standard IFG4 methodology recommended by the Service's Western Energy and Land Use Team, Instream Flow Group, in October 1985 combined with a revision of the plan of study for 1986 hopefully will mitigate this deficiency.

Various methods of sampling fish populations to determine relative use in a variety of habitat types were evaluated. Visual observation proved to be the best and a method of sampling transects and river margins between IFIM study sites was developed to maintain a population index and monitor habitat use.

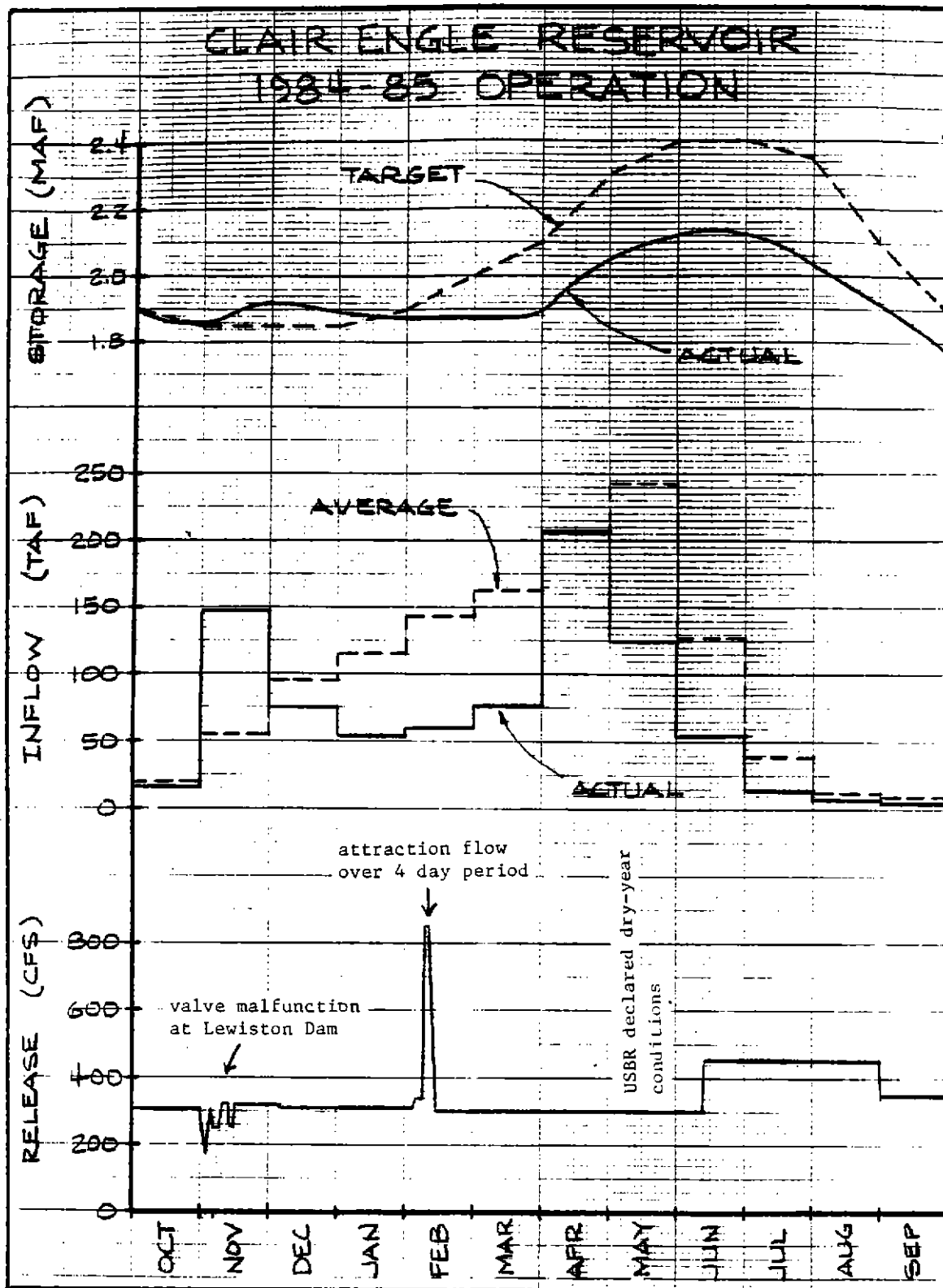


Figure 1. Lewiston Dam Operation Schedule for 1984-1985.

INTRODUCTION

The Trinity River watershed drains approximately 2,965 sq. miles in Trinity and Humboldt Counties of northwestern California (Figure 2).

A major tributary of the Klamath River, the Trinity River has, historically, been recognized as a major producer of chinook and coho salmon and steelhead trout. The Hoopa Valley Indian Reservation borders the lower 12 miles of the Trinity where the Hupa Indians, still dependent on salmon for subsistence and ceremonial uses, maintain a net fishery. In addition, the Trinity River basin supports other important natural resources, many of which sustain significant resource-based social and economic interests. Mineral, timber and water resources are examples of those developed.

The Trinity River Division of California's Central Valley Project, operated by the U.S. Bureau of Reclamation, is the only major water development project in the basin and serves to export water from the Trinity River to the Central Valley of California. The keystones to this project are Lewiston Dam at (river mile 110), and Trinity Dam just upstream. The former represents the upstream limits of anadromous salmonid migration in the basin. As mitigation for upstream losses, the Trinity River hatchery, at the base of Lewiston Dam, was constructed. In addition, downstream flows were to be provided to maintain fish resources.

Since its operation began in 1963, the project has annually exported about 75-90 percent of the runoff at Lewiston Dam. The remaining flow has been

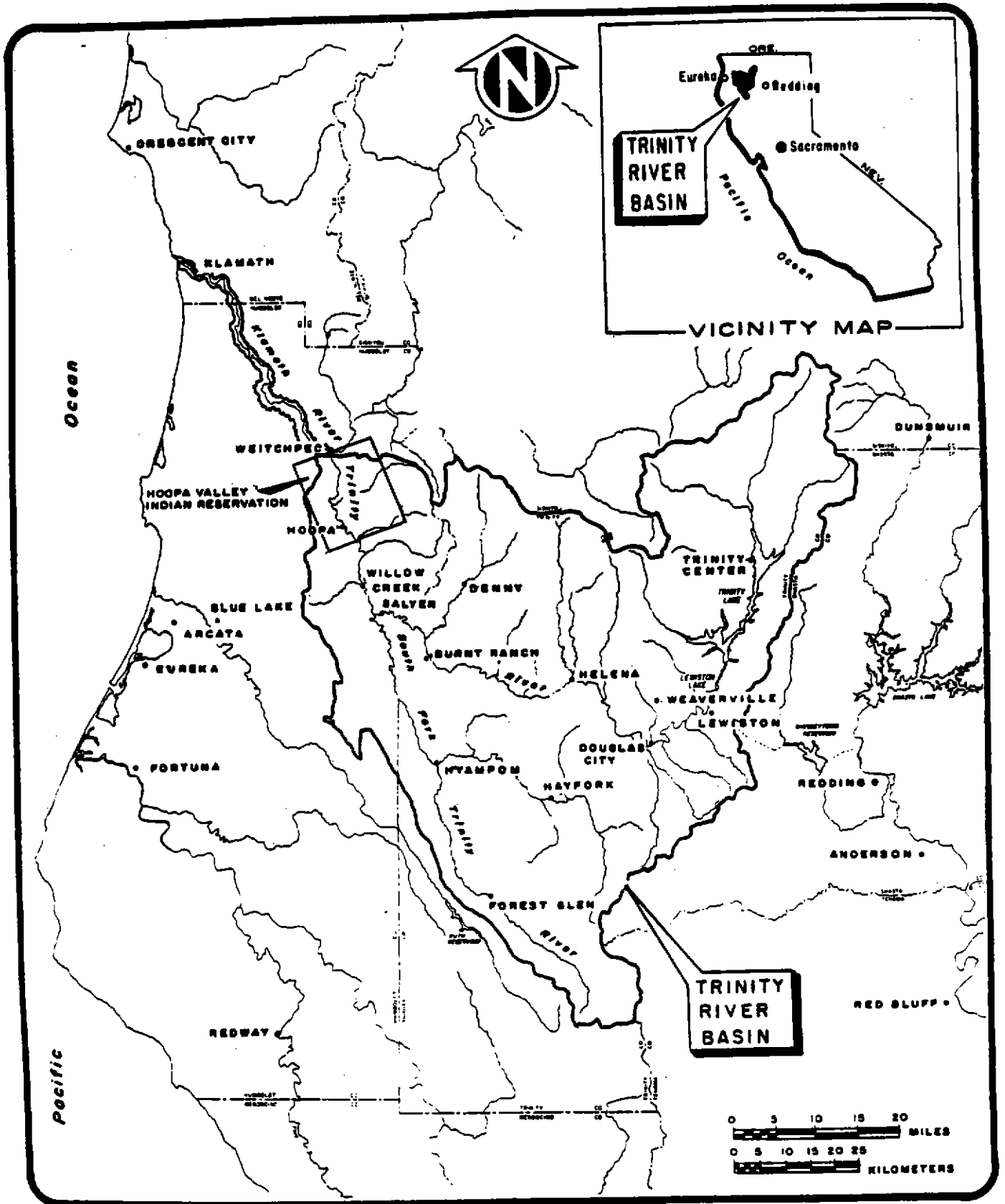


Figure 2. Trinity River Basin Location Map.

released downstream either for fisheries purposes (about 10 percent annually 1963-73 and somewhat higher in more recent years) or as flood control releases.

Coincident with construction and operation of the Trinity River Division, logging accelerated within the Trinity Basin. Higher watershed erosion rates and lowered streamflows below Lewiston Dam resulted in extensive sedimentation of fish habitat. Maintenance of minimum streamflow releases and construction and operation of the fish hatchery were not sufficient to sustain fisheries populations. Declines in some stocks have exceeded 90 percent of former levels.

In December of 1980, the Fish and Wildlife Service and the Bureau of Reclamation reached an agreement to increase releases to the Trinity River below Lewiston Dam to aid in the rehabilitation of the important and rapidly dwindling anadromous fishery resources. The agreement was approved by the Secretary of Interior in January 1981.

In addition to increasing flow releases for fishery purposes, the agreement also provides for a special study over a 12-year period during which improved releases would be maintained. The Fish and Wildlife Service is to conduct the study in consultation with the Bureau of Reclamation and the California Department of Fish and Game. At the end of the 12-year period, a report will be made to the Secretary describing the effectiveness of the improved flows and any other habitat rehabilitation measures (such as those

contained in the Trinity River Basin Fish and Wildlife Management Program) in restoring fishery populations and habitat below Lewiston Dam.

The agreement and study are necessary because the congressional authorization for construction and operation of the Trinity River Division provides for the preservation and propagation of the Trinity's indigenous fishery resources by the Secretary of Interior.

On December 8, 1983 the U.S. Fish and Wildlife Service completed a Plan of Study for the Trinity River Flow Evaluation Study. This plan was subsequently incorporated by the U.S. Bureau of Reclamation into an Interagency Agreement on November 15, 1984 and the study was formally initiated in January 1985.

The study focuses on the mainstem Trinity River from Lewiston Dam to its confluence with the Klamath River at Weitchpec. Its goal is to monitor the rehabilitation of fishery habitat in the Trinity River below Lewiston Dam. The information accumulated, together with harvest and escapement information from other ongoing studies, will be used to advise the Secretary of Interior whether the Department is operating the Trinity River Division consistent with its authorizing provisions for the protection and propagation of fishery resources. This study will meet the intent of the Secretarial decision of January 1981 pertaining to increased flow releases for anadromous fishery protection in the Trinity River downstream of Lewiston Dam.

The intent of the study is that it: 1) be conducted by utilizing current scientific methodologies; 2) be flexible to meet changing fishery resources conditions; 3) be closely coordinated with other studies and resource management agencies; and 4) be reported on, by performing timely data analyses at regular intervals and at the conclusion of the study. Under the current schedule field studies will be completed in 1995 with a final report to the Secretary of Interior in 1996.

The present study plan consists of 6 major tasks:

TASK 1. Annual Study Plan Review and Modification.

Objective: To assure that the study plan reflects current findings and data.

TASK 2. Habitat Preference Criteria Development.

Objective: To develop habitat preference criteria quantifying depths, velocities, substrates, and cover requirements for chinook and coho salmon and steelhead trout spawning, incubation, rearing, holding, and migration. Other factors such as water quality and temperature will be considered under TASK 3.

TASK 3. Determination of Habitat Availability and Needs.

- Objective: a) To determine the amount of salmon and steelhead habitat available in the Trinity River downstream of Lewiston Dam under various flow conditions and the various levels of habitat rehabilitation that may be achieved either through the Trinity River Basin Fish and Wildlife Management Program or through other resource management actions; and
- b) to determine the amount of habitat required for each freshwater life stage of salmon and steelhead to sustain those portions of the fish populations in the Trinity Basin that were historically dependent on the Trinity River downstream of Lewiston Dam.

TASK 4. Determination of Fish Population Characteristics and Life History Relationships.

- Objective: a) To determine the relative levels of successful use by fish populations of available habitat in the Trinity River downstream of Lewiston Dam, including spawning success and the subsequent survival and growth of juveniles; and
- b) To determine which habitat factors may be limiting the restoration of fish populations.

TASK 5. Study Coordination.

Objective: To develop and maintain coordination with other study and resource management agencies in the Trinity River Basin to maximize effective use of available information (and to avoid duplication of work).

TASK 6. Reports (Progress, Findings and Recommendations)

Objective: a) To report on the analysis of information developed from field investigations (TASK 2, 3, and 4) and on relevant information from other studies which have a bearing on the levels of fishery resource rehabilitation achieved in the Trinity River between Lewiston and Weitchpec; and

b) To develop recommendations to the Secretary and to other resource management agencies concerning future management options and needs.

This report summarizes project activities primarily on Tasks 2, 3 and 4 during 1985. The final section on program planning, direction and coordination describes the focus of study efforts planned for 1986.

DESCRIPTION OF STUDY REACHES

In order to complete study tasks in an organized manner, the mainstem of the Trinity River between Lewiston Dam and Weitchpec (approximately 110 river miles) was partitioned into three general segments: upper, middle, and lower. Each of these broad segments has distinctive features and is used to different degrees by salmon and steelhead. The three segments are: I) Lewiston Dam to North Fork Trinity River; II) North Fork Trinity River to South Fork Trinity River; and III) South Fork Trinity River to the confluence with the Klamath River (Weitchpec).

The upper segment (Lewiston Dam to N.F. Trinity) is probably the most important to salmonid production. The majority of the substrate within this segment is composed of sand, gravel, and cobbles with less bedrock than further downstream. Controlled river flows and encroachment of riparian vegetation are characteristic of this segment. The river itself has largely become constricted into long uniform runs with swift flows.

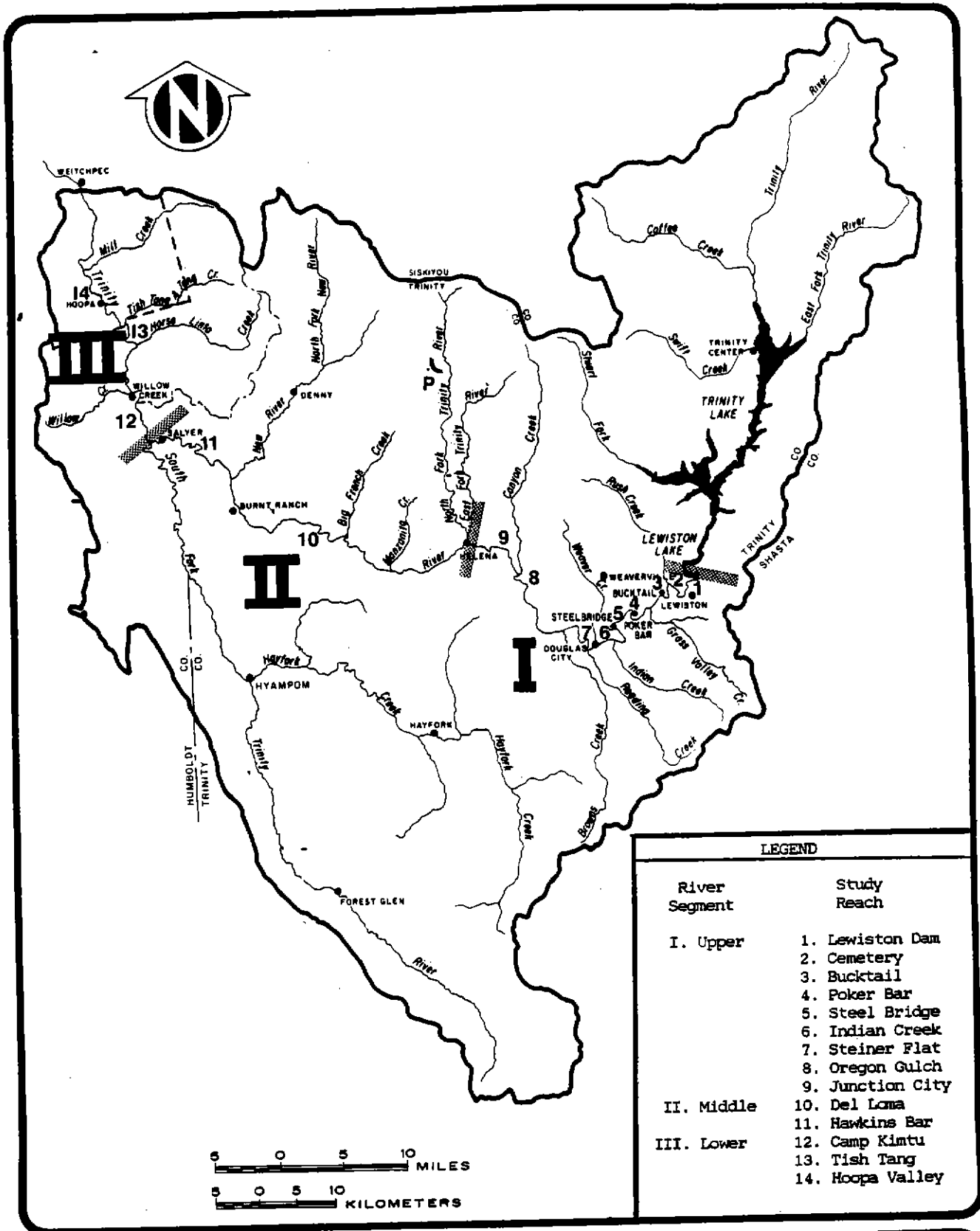
The character of the river within the middle segment (North Fork to South Fork) is quite varied. Although the overall gradient is moderate within this segment it includes the precipitous gorge between China Slide and Gray Falls, the most rugged section of the Trinity River. Here, the river is controlled primarily by a bedrock channel and is characterized by long, moderately deep pools, numerous sandy beaches, and steep wooded hillsides. The river corridor is relatively undeveloped except for a few scattered residences and small communities.

The lower segment extends 30.8 miles from the South Fork to the confluence with the Klamath River (at Weitchpec). Generally the river gradient is low as the river passes northward through a v-shaped valley, into the settled area around Willow Creek, through a short gorge above Tish-Tang, the Hoopa Valley and finally a narrow gorge before entering the Klamath River. In the valley reaches the river meanders across large gravel and cobble bars which are mostly clear of vegetation. The river flow has been greatly increased due to inflow from the South Fork, broadening and flattening the channel somewhat with numerous gravel deposits and few rapids.

Within these three generalized river segments, 14 representative study reaches were selected: nine in the upper river segment; two in the middle segment; and three in one lower segment (Table 1 and Figure 3).

Table 1. Representative Study Reaches, Trinity River Flow Evaluation Study, 1985. (See also Figure 3 for locations).

	<u>River Segment</u>	<u>Study Reach</u>	<u>Description</u>	<u>No. IFIM Transects</u>
I.	Upper	1. Lewiston Dam	Lewiston Dam to Old Fish Weir	19
		2. Cemetery	Old Fish Weir to mouth of Rush Creek	13
		3. Bucktail	Mouth of Rush Creek to mouth of Grass Valley Creek	11
		4. Poker Bar	Mouth of Grass Valley Creek to Limekiln Gulch	10
		5. Steel Bridge	Limekiln Gulch to the mouth of Indian Creek	12
		6. Indian Creek	Mouth of Indian Creek to Douglas City	0
		7. Steiner Flat	Douglas City to Dutch Creek	10
		8. Oregon Gulch	Dutch Creek to Canyon Creek	9
		9. Junction City	Canyon Creek to North Fork Trinity	9
II.	Middle	10. Del Loma	North Fork Trinity to Cedar Flat	11
		11. Hawkins Bar	Cedar Flat to South Fork Trinity	8
III.	Lower	12. Camp Kimtu	South Fork Trinity to the mouth of Horse Linto Creek	0
		13. Tish Tang	Mouth of Horse Linto to Hoopa Valley	9
		14. Hoopa Valley	Hoopa Valley	6



LEGEND

River Segment	Study Reach
I. Upper	1. Lewiston Dam
	2. Cemetery
	3. Bucktail
	4. Poker Bar
	5. Steel Bridge
	6. Indian Creek
	7. Steiner Flat
	8. Oregon Gulch
	9. Junction City
II. Middle	10. Del Loma
	11. Hawkins Bar
III. Lower	12. Camp Kintu
	13. Tish Tang
	14. Hoopa Valley

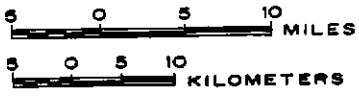


Figure 3. Map of the Trinity River Flow Evaluation Study Area.

HABITAT PREFERENCE CRITERIA DEVELOPMENT

(TASK 2)

Collection of habitat preference data began in January 1985. A total of 1470 observations have been made using snorkel techniques. An additional 4 observations were made with a seine on the lower two study sites (13 & 14) when zero visibility prevented effective snorkel methods from being used. Of the 1470 total observations, 647 were composed of random habitat observations. A summary of the number of observations taken to date by study reach for each species and life stage is presented in Table 2.

Table 2. Number of microhabitat observations by study reach, Trinity River Flow Evaluation Study.

Fish Observations

Study Reach	Chinook Salmon	Coho Salmon	Steelhead Trout	Rainbow Trout	Brown Trout	Available Habitat Observations
Lewiston Dam	35	80	27	8	4	185
Cemetery	104	43	2	34	43	113
Bucktail	27	1	22	0	24	149
Poker Bar	49	1	1	17	6	150
Steelbridge	40	5	0	18	5	150
Indian Creek	58	0	3	23	12	150
Steiner Flat	14	3	3	21	2	140
Oregon Gulch	10	0	14	0	0	50
Junction City	23	1	13	11	0	33
Del Loma	10	4	2	10	4	31
Hawkins Bar	0	0	0	0	0	0
Camp Kimtu	0	0	0	0	0	0
Tish Tang	13	2	0	16	0	19
Wagon Valley	0	0	0	0	0	0
TOTALS	383	140	87	158	100	1170

A frequency distribution of sites sampled indicates a skewed distribution, with the upper river sites being sampled more than the lower river sites. This is because of two factors: 1) river visibility decreases downstream, and 2) the proximity of the office. More effort will be directed to increased sampling of lower river sites during 1986.

At this point in time there has been no effort made to analyse the field data. A preliminary report of findings will be prepared in 1986.

DETERMINATION OF HABITAT AVAILABILITY AND NEEDS

(TASK 3)

The Instream Flow Incremental Methodology (IFIM) developed by the Fish and Wildlife Service is being utilized as the primary evaluation tool. The methodology and its uses are described in Instream Flow Information Paper No. 12 (Bovee, FWS/OBS 82/26, 1982) and other publications by the Service's Instream Flow and Aquatic Systems Group. The methodology uses hydraulic and biological data to simulate habitat conditions over a range of flows.

Generally, study sites descriptive of the representative study reaches being used for Tasks 2 and 4 of the study were chosen for the Instream Flow Incremental Methodology data collection.

From mid-April until late June, data-collection transects were chosen and marked with rebar or other monumentation at each of these sites. Survey benchmarks were established, location of transects was documented, brush was cleared, and other preparations were made to allow orderly and timely flow measurement by five to nine-person field crews.

Initially, it was planned to use three evaluation flows (based on releases at Lewiston Dam), 300 cfs, 450 cfs, and 600 cfs. However, because of dry-year conditions, water was available for only two evaluation flows, 350 and 450 cfs at Lewiston Dam. The higher flow was measured at all sites from late June to early August, with a two-week suspension of field activities in mid-July for scheduled personnel training. The 350 cfs

release was measured from September 4 to 19. In all, water depth, velocity, substrate and cover data were collected at 127 transects. Data summary and analysis has begun but is not scheduled for completion until September 1986.

DETERMINATION OF FISH POPULATION CHARACTERISTICS AND LIFE HISTORY
RELATIONSHIPS. (TASK 4)

From January through June, various methods of sampling fish populations in a range of Trinity River habitat types were evaluated.

Electrofishing with a back-pack shocker proved ineffective, although a few side-channels and river margins could be fished. The major drawbacks to back-pack shocking were that the river is generally too deep or swift to safely use the shocker, and that the small fish that are the focus of study are generally unaffected by the anode field. Boat shocking, which could be effective on the lower river, was not tried due to the unavailability of equipment.

Seining was generally of limited value because of the rarity of suitable gravel or sand bars in the upper river. Seining was effective on limited habitat types at lower-river study sites, and proved to be an effective way to catch fish for in-hand identification, size and weight measurement, and food-habitat analysis.

Visual observation proved to be the best way to sample fish densities and species distribution over a variety of habitat types, particularly in the usually-clear upper river. A method of face-plate and snorkel sampling of transects and river margins between transects in IFIM study sites was developed as the best way to maintain a population index and monitor habitat use over the period of study.

PROGRAM PLANNING, DIRECTION AND COORDINATION

Generally, planned project activities for 1986 will continue to focus on development of fish habitat preference (Task 2), and determining habitat availability and needs (Task 3). Preliminary data analysis on both tasks will be completed during 1986 and reported on in our next annual report. Efforts of determining fish population characteristics and relationships (Task 4) will be increased. More specifically, Task 4 work elements will be aimed at developing a better understanding of habitat use, fish distribution, egg and juvenile survival, juvenile growth, and invertebrate studies.

Measurement of a third evaluation flow for Task 3 (at 600 cfs) is planned for the spring or summer of 1986. Depending on scheduling and water condition, additional field measurements of transect water surface elevation and discharge is provisionally planned. The U.S. Bureau of Reclamation has planned a release of 253,000 acre-feet for 1985-1986 (Figure 4). An additional 33,000 acre-feet for migration/sediment flushing has not been scheduled.

Once the Trinity River Basin Fish and Wildlife Task Force (established by P.L. 98-541) is activated and the Trinity Field Office, as described in Action 1 of the Trinity River Basin Fish and Wildlife Management Program (March 1982), becomes operational it will be necessary to fully coordinate project activities and the scope of work. Originally, the study plan was designed to focus on streamflow releases at Lewiston Dam and their effect

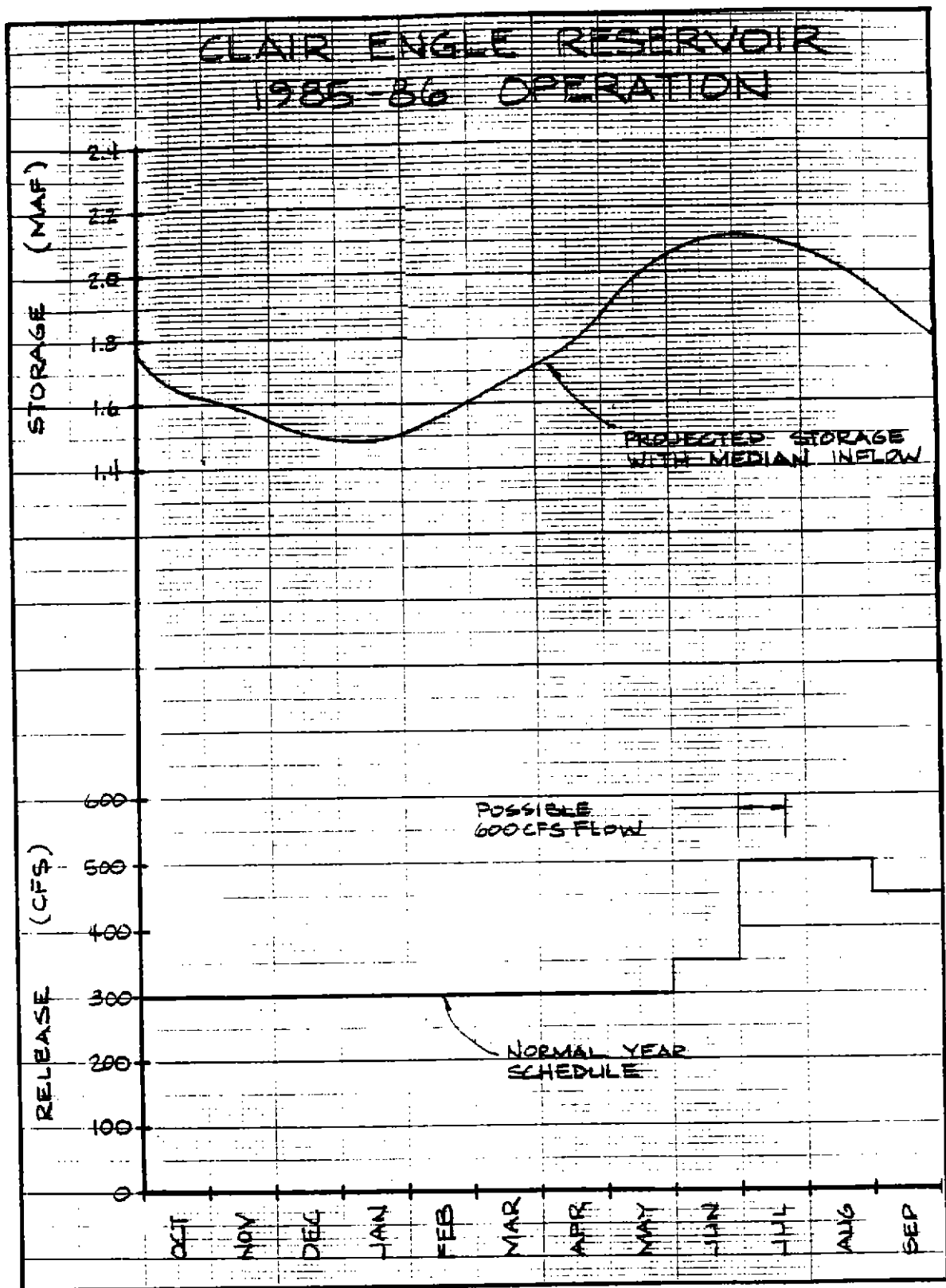
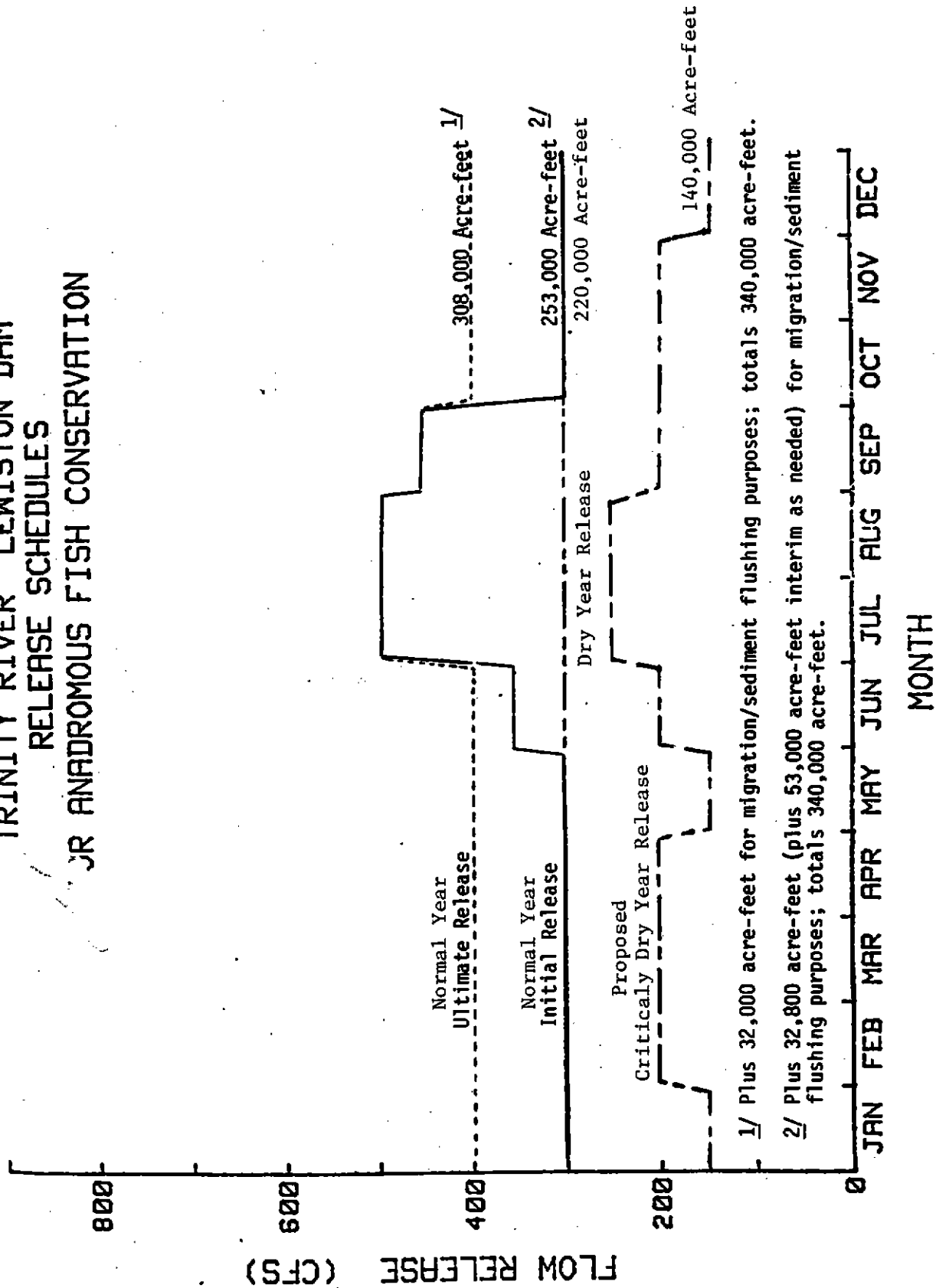


Figure 4. Scheduled Releases at Lewiston Dam for 1985-1986.

on available salmonid habitat. Although some consideration was given to monitoring the effects of actions of the Trinity River Basin Fish and Wildlife Management Program, specific to mainstem Trinity River activities, the scope of this effort can not fully be evaluated until the management program is initial. Therefore, it is expected that the majority of the project coordination effort for 1986 will be with the Trinity River Basin Task Force and the Field Office. This will be necessary to more completely coordinate the studies objectives and work tasks with implementation of the Management Program. Also, the Secretarial Decision of 1981 requires an incremental increase in releases at Lewiston Dam to 340,000 acre-feet (Figure 5). This is to be done as habitat and restoration measures are implemented. The decision directs the Fish and Wildlife Service to provide an annual "schedule of flows" (releases) to the Bureau of Reclamation in consultation with the California Department of Fish and Game. Obviously, a long term schedule of habitat improvement and incremental increases in releases at Lewiston Dam needs to be developed. It is hoped that through extensive coordination with the Task Force and Field Office such a schedule can be completed within the near future.

TRINITY RIVER LEWISTON DAM
 RELEASE SCHEDULES
 FOR ANADROMOUS FISH CONSERVATION



1/ Plus 32,000 acre-feet for migration/sediment flushing purposes; totals 340,000 acre-feet.

2/ Plus 32,800 acre-feet (plus 53,000 acre-feet interim as needed) for migration/sediment flushing purposes; totals 340,000 acre-feet.

Figure 5. Planned Release Schedules at Lewiston Dam for the Conservation of Trinity River Salmon and Steelhead.

APPENDIX

Study Goal: The goal of this study is to monitor the rehabilitation of fishery habitat in the Trinity River below Lewiston Dam in northwestern California. The information from this study together with harvest and escapement information from other ongoing studies will be used to advise the Secretary whether the Department is operating the Trinity River Division consistent with its authorizing provisions for the protection and propagation of fishery resources. This study will meet the intent of the Secretarial decision of January 1981 pertaining to increased flow releases for anadromous fishery protection in the Trinity River downstream of Lewiston Dam - a major feature of the Trinity River Division, Central Valley Project, operated by the U.S. Bureau of Reclamation.

Background and Overview: The Trinity River is a major tributary of the Klamath River in northwestern California. The natural resources of the Trinity River Basin sustain many important resource-based social and economic interests. Historically, the Trinity has been recognized as a major producer of chinook and coho salmon and steelhead trout. Indian, sport and commercial salmon fisheries have operated on these runs. Mineral, timber and water resources have also been developed in the Trinity Basin. These developments together with fisheries harvests are believed to have caused major declines in fall-run chinook and steelhead trout populations over the past two decades. Specific user groups dependent on the fisheries stocks as well as the general northern coastal economics have suffered as a result of the fisheries declines.

These losses are of high concern to this Department for two reasons: First, the Department has Indian Trust responsibilities which extend to protection of Indian fisheries rights and resources; and, second, the act authorizing the construction of the Trinity River Division of the Central Valley Project directs the Secretary to preserve and propagate anadromous fish in the basin.

The Trinity River Division which is the only major water development project in the Trinity River Basin serves to export water from the Trinity River to the Central Valley of California. Since its operation began in 1963, the project has annually exported about 75-90 percent of the runoff at Lewiston Dam. The remainder of flow has been released downstream either for fisheries purposes (about 10 percent annually 1963-73 and somewhat higher in more recent years) or as water surplus to the project's immediate needs.

Coincident with construction and operation of the Trinity River Division, logging accelerated within the Trinity Basin. Higher watershed erosion rates and lowered streamflows downstream of Lewiston Dam resulted in extensive sedimentation of fish habitat. Maintenance of minimum streamflow releases and construction and operation of a fish hatchery were not sufficient to sustain fisheries populations. Declines in some stocks have exceeded 90 percent of former levels.

In December of 1980, the Fish and Wildlife Service and the Bureau of Reclamation reached an agreement to increase releases to the Trinity

River below Lewiston Dam to aid in the rehabilitation of the important and rapidly dwindling anadromous fishery resources. The agreement was approved by the former Secretary Andrus in January 1981 and has been supported by Secretary Watt.

In addition to increasing flow releases for fishery purposes, the agreement also provides for a special study over a 12-year period during which improved releases would be maintained. The Fish and Wildlife Service is to conduct the study in consultation with the Bureau of Reclamation and the California Department of Fish and Game. At the end of the 12-year period, a report will be made to the Secretary describing the effectiveness of the improved flows and any other habitat rehabilitation measures (such as those contained in the proposed Trinity River Basin Fish and Wildlife Management Program) in restoring fishery populations and habitat below Lewiston Dam.

The fishery flow agreement and study are necessary because the congressional authorization for construction and operation of the Trinity River Division provides for the preservation and propagation of the Trinity's indigenous fishery resources by the Secretary and, as previously indicated, these resources are declining.

A number of factors, in combination, including overharvest, are thought to be responsible for fishery declines, but not all are within the jurisdiction of the Secretary of the Interior to correct. Habitat losses due to low riverflows and sediment accumulation in the main stem Trinity River can be restored in part by increasing flows, trapping sediments, and mechanically rehabilitating spawning and rearing areas, and by reducing erosion through improved watershed management in tributary streams. The Department of the Interior is focusing effort on these tasks.

The Secretary has taken the first step towards rehabilitation of fish runs by improving fishery flow releases (at the expense of other project water uses). A sediment control project (Buckhorn Mtn. Dam-Grass Valley Creek Sediment Control Project) has been authorized by Congress and Interior will likely begin work on the project during Fiscal Year 1984. The Trinity River Basin Fish and Wildlife Task Force--a 13-member group of Government specialists advisory to the Bureau of Reclamation--has developed a comprehensive plan for the rehabilitation and management of fish and wildlife resources throughout the Trinity Basin. With the cooperative assistance of the Bureau of Reclamation and Bureau of Indian Affairs, Fish and Wildlife Service is preparing an Environmental Impact Statement on the Task Force management program. Legislation to authorize and fund the program has been introduced in Congress.

The efforts described above will largely rehabilitate salmon and steelhead habitat in the Trinity River system. Restoration of the fish

populations themselves, however, will also be dependent on effective harvest management. This year (1983) the Pacific Fisheries Management Council has adopted a 20-year plan to rebuild salmon runs in the Klamath-Trinity Basin through controlled ocean harvests. Adherence to that plan or even tougher standards, as well as the effective management of Indian and sport fisheries, is vital to the successful replenishment of the anadromous runs.

Although the 12-year study plan presented here addresses habitat restoration, it is clear that consideration will have to be given to the role of harvest management in allowing run goals to be met. It is anticipated that relevant data and evaluations from other monitoring efforts (harvests and escapements) will be considered and included in developing reports and recommendations to the Secretary during this study.

Study Description: The study will span 12 years and consist of 6 major tasks:

1. Study plan review and modification
2. Habitat preference criteria development
3. Habitat availability and need
4. Fish population characteristics and life history relationships
5. Study coordination
6. Reports

The study will require a maximum of 8.8 full-time-equivalent positions depending on work in progress and will require annual funding ranging from \$116,431 to \$359,273. The study will focus on the main stem Trinity River from Lewiston Dam to its confluence with the Klamath River at Weitchpec. Each study task is described in the following section. Efforts and funding estimates for each task are presented. Effort is shown in biologist days and total staff days (A biologist-day includes biotechnicians). It is assumed that the Fish and Wildlife Service will be the lead agency. There is opportunity for (and interest in) participation by the California Department of Fish and Game and Water Resources and Hoopa Valley Business Council. Their cooperation will be solicited. Interagency participation may alter effort and funding requirements somewhat.

A matrix table showing task schedules and levels of effort throughout the study period is appended. It is intended that this study: 1) Be conducted by utilizing current scientific methodologies; 2) be flexible to meet changing fishery resource conditions; 3) be closely coordinated with other studies and resource management agencies; and 4) be reported on, by performing timely data analyses, at regular intervals and at the conclusion of the study.

Consequences of Not Performing Study: Without this study the Department of the Interior will be unable to show how it is meeting its commitments and requirements to maintain and propagate fishery resources in the Trinity River Basin. The Department will continue to be challenged by Indian and other fishery resource management and interest groups and the Trinity River Division will continue to be viewed by these elements as a classic example of the incompatibility of water resource development with fishery maintenance and of the failure of the Federal Government to be responsive to area of origin concerns.

TASK 1. Annual Study Plan Review and Modification

Objective: The objective of TASK 1 is to assure that the study plan reflects current findings and data needs.

Need: As the study progresses certain study elements may require an approach modified from that originally envisioned. Changes will be made based on experience gained from previous efforts.

Methods: Each study year the project leader will review the study efforts and findings with the principal resource management agencies in the Trinity River Basin, including the Trinity River Basin Fish and Wildlife Task Force. Based on these meetings a final study plan for the following year will be prepared.

Effort: Work required to complete TASK 1 is estimated to be:

<u>Study Year(s)</u>	<u>Biologist Days</u>	<u>Total Staff Days</u>
1-11	55 (5/yr)	110 (10/yr)
12	0	0
<u>Total</u>	<u>55 days</u>	<u>110 days</u>

Funding: Funding required to complete TASK 1 is estimated to be:

<u>Study Year(s)</u>	<u>Amount</u>
1	\$ 1,590
2-11	16,630 (\$1,663/yr)
12	0
<u>Total</u>	<u>\$18,223</u>

TASK 2. Habitat Preference Criteria Development

Objective: The objective of Task 2 is to develop habitat preference criteria quantifying depths, velocities, substrates, and cover requirements for chinook and coho salmon and steelhead trout spawning, incubation, rearing, holding, and migration. Other factors such as water quality and temperature will also be considered under TASK 3.

Need: Improved preference criteria are needed to use with stream-flow hydraulic data to determine the amount of habitat presently existing for salmon and steelhead, to determine the amount required and types required to achieve target levels of natural fish production, and to monitor increases in habitat gained from flow management and mechanical habitat rehabilitation work.

Methods: Field data will be collected using a variety of techniques. Emphasis will be on visual observations through diving and snorkeling where possible. Other techniques may include electrofishing, seining, redd sampling, and other measures as necessary. Where sufficient data are available, a bivariate analysis will be performed using procedures outlined in Instream Flow Information Paper No. 12 (Bovee, FWS/OBS 82/26, 1982) to develop habitat preference criteria for the following species and life stages:

<u>Species</u>	<u>Race</u>	<u>Life Stage</u>
Chinook salmon	Spring run	Adult holding Spawning Incubation Rearing (fry) Juvenile migration
Chinook salmon	Fall run	Adult holding Spawning Incubation Rearing (fry) Juvenile migration
Coho salmon	Fall run	Adult holding Spawning Rearing (fry) Rearing (yearling) Juvenile migration

Steelhead trout	Summer run (possible)	Adult holding Spawning Rearing (fry) Rearing (yearling) Juvenile migration
Steelhead trout	Winter run	Adult holding Spawning Incubation Rearing (fry) Rearing (yearling) Juvenile migration

Effort: Effort needed to complete TASK 2 is estimated to be:

<u>Study Year(s)</u>	<u>Biologist Days</u>	<u>Total Staff Days</u>
1	178	356
2	200	400
3	145	290
4-11	88 (11/yr)	176 (22/yr)
12	0	0
<u>Total</u>	<u>611</u>	<u>1,222</u>

Funding: Funding required to complete TASK 2 is estimated to be:

<u>Study Year(s)</u>	<u>Amount</u>
1	\$ 56,604
2	66,532
3	48,236
4-11	29,272 (\$3,659/yr)
12	0
<u>Total</u>	<u>\$200,646</u>

TASK 3. Determination of Habitat Availability and Needs.

Objectives: There are two objectives for TASK 3. The first is to determine the amount of salmon and steelhead habitat available in the Trinity River downstream of Lewiston Dam under various flow conditions and the various levels of habitat rehabilitation that may be achieved either through the Trinity River Basin Fish and Wildlife Management Program or through other resource management actions. The second objective is to determine the amount of habitat required for

each freshwater life stage of salmon and steelhead to sustain those portions of the fish populations in the Trinity Basin that were historically dependent on the Trinity River downstream of Lewiston Dam.

Need: The information from this TASK is needed to evaluate the effectiveness of riverflows and other measures in providing adequate amounts and distribution of fish habitat.

Methods: The Incremental Instream Flow Methodology developed by the Fish and Wildlife Service will be utilized as the primary evaluation tool. The methodology and its uses are described in Instream Flow Information Paper No. 12 (Bovee, FWS/OBS 82/26, 1982) and other publications by the Service's Instream Flow and Aquatic Systems Group. The methodology uses hydraulic and biological data to simulate habitat conditions over a range of potential flows. Water temperatures and other water quality data will be collected and incorporated into the habitat evaluations.

Field data will be collected 3 to 4 times over the 12-year study period from representative study reaches between Lewiston and Weitchpec. This will allow a running tally of habitat conditions and make it possible to account for habitat changes due to flows and watershed restoration, as opposed to any instream habitat rehabilitation by mechanical means.

Calculations of available habitat will be based on habitat preference criteria developed under TASK 2. Determination of habitat needs will also consider population use data to be developed under TASK 4. Minor field and laboratory research investigations may be required to test the validity of assumptions on egg and fry survival under various sediment conditions. It is anticipated that this and other specialized work may be undertaken through cooperative arrangements with research institutions.

The major subtasks of TASK 3 are:

1. Selection, establishment and maintenance (minor brush clearing, surveying, etc.) of measurement stations.
2. Hydraulic data collection over a range of flows at each station--repeated 2-3 times after initial period depending on streamflows and channel conditions (rehabilitation work).
3. Data analysis and habitat projections assuming various channel and flow conditions, and temperature and other water quality conditions.

The field schedule and effort for each subtask is detailed in the appended table.

Effort: Work required to complete TASK 3 is estimated to be:

<u>Study Year(s)</u>	<u>Biologist Days</u>	<u>Total Staff Days</u>
1	444	\$ 888
2	390	780
4, 6, 8, 10	1,200 (300/yr)	2,400 (600/yr)
3, 5, 7, 9, 11	1,000 (200/yr)	2,000 (400/yr)
12	0	0
Total	3,034	\$6,068

Funding: Funding required to complete TASK 3 is estimated to be:

<u>Study Year(s)</u>	<u>Amount</u>
1	\$ 141,192
2	129,737
4, 6, 8, 10	399,192 (\$99,798/yr)
3, 5, 7, 9, 11	332,660 (\$66,532/yr)
12	
Total	\$1,002,781

TASK 4. Determination of Fish Population Characteristics and Life History Relationships.

Objective: The objective of TASK 4 is to determine the relative levels of successful use by fish populations of available habitat in the Trinity River downstream of Lewiston Dam.

Need: Although some information is available on spawning escape-ments and spawning redd numbers in certain areas, very little is known about the total distribution of fish between Lewiston and Weitchpec or their spawning success and the subsequent survival and growth of juveniles. This type of information is needed to determine which habitat factors may be limiting the restoration of fish populations.

Methods: Selected study reaches will be surveyed periodically to develop indices of habitat use, fish distribution, and the survival and growth of juveniles. Survey field methods will include snorkeling, seining, electroshocking, emergent fry trapping, and other techniques found suitable. Survey methods will be refined and standardized based on experimentation during the first year.

Benthic aquatic organisms will also be monitored to determine the overall health and productive capabilities of the Trinity in the established field study reaches. Food habits of juvenile salmonids will be examined to determine utilization of available food supply. Methods for this study element will be patterned after those developed by researchers with the U.S. Forest Service and Brigham Young University (Biotic Condition Index: Integrated Biological, Physical and Chemical Stream Parameters for Management. Robert N. Winget and Fred A. Mangum. October 1979. Intermountain Region, Forest Service, U.S. Dept. of Agriculture) and others.

Effort: The effort required to complete TASK 4 is estimated to be:

<u>Study Year(s)</u>	<u>Biologist Days</u>	<u>Total Staff Days</u>
1	93	186
2,4,6,8,10,11	2,232 (372/yr)	4,464 (744/yr)
3,5,7,9	3,736 (684/yr)	7,472 (1,368/yr)
12	0	0
Total	6,061	12,122

Funding: Funding required to complete TASK 4 is estimated to be:

<u>Study Year(s)</u>	<u>Amount</u>
1	\$ 29,574
2,4,6,8,10,11	742,500 (\$123,750/yr)
3,5,7,9	910,158 (\$227,539/yr)
12	0
<u>Total</u>	<u>\$1,682,230</u>

TASK 5. Study Coordination

Objective: The objective of TASK 5 is to develop and maintain coordination with other study and resource management agencies in the Trinity River Basin to maximize effective use of available information (and to avoid duplication of work).

Need: Presently, the California Department of Fish and Game, Bureau of Indian Affairs, Forest Service, Bureau of Land Management, Hoopa Valley Business Council (Fisheries Department) and the Fish and Wildlife Service have fisheries studies and management programs underway. Additional study efforts will occur under this program and the comprehensive fish and wildlife management program proposed by the Trinity River Basin Fish and Wildlife Task Force. It is essential that studies be coordinated to prevent unintended interference and to make use of study results in planning future work and making management decisions.

Methods: Coordination will be maintained through both formal and informal contacts. Other study leaders and local fishery resource managers will be contacted on at least a bimonthly basis. Formal coordination meetings will be scheduled twice yearly. Quarterly work progress reports (prepared under TASK 6) and preliminary fisheries reports will be provided to interested agencies.

Effort: The effort required to complete TASK 5 is estimated to be:

<u>Study Year(s)</u>	<u>Biologist Days</u>	<u>Total Staff Days</u>
1-11	220 (20/yr)	440 (40/yr)
12	10	20
<hr/>	<hr/>	<hr/>
Total	230	460

Funding: Funding required to complete TASK 5 is estimated to be:

<u>Study Year(s)</u>	<u>Amount</u>
1	\$ 6,360
2-11	66,532 (\$6,653/yr)
12	3,327
<hr/>	<hr/>
Total	\$76,219

TASK 6. Reports (Progress, Findings and Recommendations)

Objective: The objectives of TASK 6 are: 1) To report on the analysis of information developed from field investigations (TASK 2, 3, and 4) and on relevant information from other studies which have a bearing on the levels of fishery resource rehabilitation achieved in the Trinity River between Lewiston and Weitchpec; and 2) to develop recommendations to the Secretary and to other resource management agencies concerning future management options and needs.

Need: Fishery rehabilitation efforts achieved through improved flow releases from Lewiston Dam and from mechanical aquatic habitat and watershed rehabilitation should be monitored and critically analyzed.

Methods: Three types of reports will be prepared under TASK 6. The first type will be quarterly progress and planning reports detailing study activities and accomplishments during the past quarter and describing anticipated activities during the current quarter. These will generally be prepared and distributed within 2 weeks of the close of each quarter. The second type will be preliminary findings reports containing field data and analyses for major portions of one or more study elements. As an example, this type of report would be produced following completion of the habitat preference criteria study element (TASK 2) and at the end

of each of the 3 to 4 periods of hydraulic streamflow data collection and computer analysis (TASK 3). The preliminary findings reports should be completed after data analysis and during the year following completion of field work. The final type of report will be the concluding report to the Secretary.

The concluding report will summarize the findings of each of the study elements (from various preliminary findings reports), evaluate the results of improved flows and other rehabilitation measures in an overall manner, and convey to the Secretary the Service's recommendations with respect to future management options and needs for the Trinity River downstream of Lewiston Dam.

Effort: Effort needed to complete TASK 6 is estimated to be:

<u>Study Year(s)</u>	<u>Biologist Days</u>	<u>Total Staff Days</u>
1	10	20
2	20	40
4,6,8,10	120 (30/yr)	240 (60/yr)
3,5,7,9,11	130 (26/yr)	260 (52/yr)
12	340	680
<u>Total</u>	<u>620</u>	<u>1,240</u>

Funding: Funding required to complete TASK 6 is estimated to be:

<u>Study Year(s)</u>	<u>Amount</u>
1	\$ 3,180
2	6,653
4,6,8,10	39,921 (\$9,980/yr)
3,5,7,9,11	43,246 (\$8,649/yr)
12	113,104
<u>Total</u>	<u>\$206,104</u>

Schedule of Activities and Effort (Biologist Days) for Trinity River Fishery Flow Evaluations

Piscal Year	85	86	87	88	89	90	91	92	93	94	95	96
Study year	1	2	3	4	5	6	7	8	9	10	11	12
STUDY TASK												
Study Plan Review and Modification	5	5	5	5	5	5	5	5	5	5	5	5
Habitat Preference Criteria Development	178	200	145	11	11	11	11	11	11	11	11	11
Habitat Availability and Need	444	390	200	300	200	300	200	300	200	300	200	200
Fish Population Characteristics and Relationships	93	372	684	372	684	372	684	372	684	372	372	372
Study Coordination	20	20	20	20	20	20	20	20	20	20	20	10
Reports	10	20	26	30	26	30	26	30	26	30	26	340
Total Effort^a	750	1,007	1,080	738	946	738	946	738	946	738	634	350
Funding	238,500	335,000	359,273	245,503	314,696	245,503	314,696	245,503	314,696	245,503	210,906	116,431
Grand Total Cost	\$3,186,210											

^a Effort in Biologist Days. 1 Biologist Day = 2 Staff Days