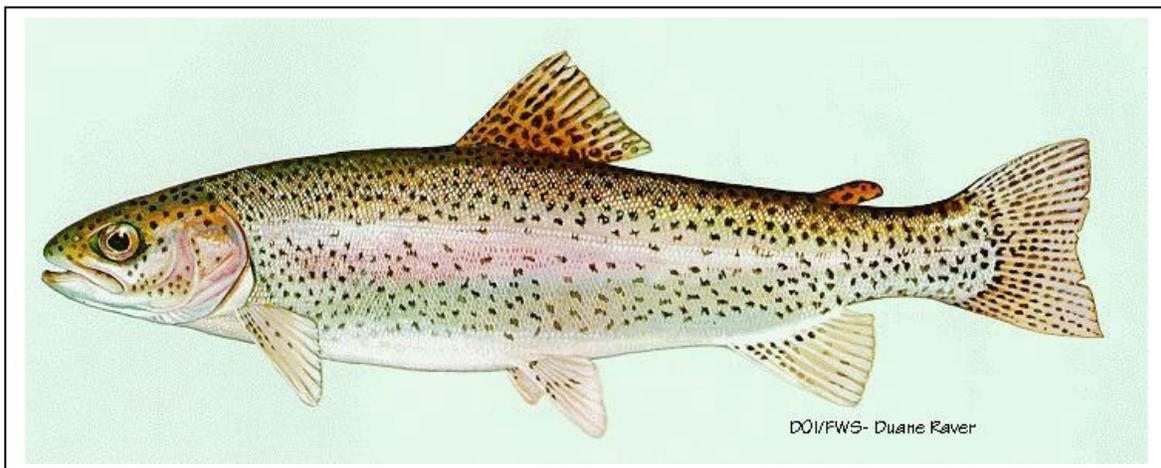


NATIONAL WILD FISH HEALTH SURVEY

**California-Nevada
Fish Health Center**

**PROGRESS REPORT
February 15, 2001**



PROGRESS REPORT

February 2001

Prepared by Kimberly True

CALIFORNIA-NEVADA FISH HEALTH CENTER STAFF

Center staff conducted the National Wild Fish Health Survey (NWFHS) in FY2000 by conducting sample collections, performing laboratory tests, and entering data in the NWFHS Database. Beth McCasland also assisted with compiling information for this report.

Kimberly True, Assistant Project Leader
Beth McCasland, Biological Science Technician
Jimmy Faulkner, Biological Science Technician

Scott Foott, Project Leader and
Kenneth Nichols, Fishery Biologist
also assisted with field collections.

OVERVIEW

Fiscal year 2001 marks the 5th year of the National Wild Fish Health Survey. The California-Nevada Fish Health Center (Ca-Nv FHC) continues to enjoy the support of many Federal, State, Tribal and private cooperators in conducting the NWFHS. This year, the Center added two commercial fishing operations as partners to assist the Center with collection of fish for pathogen screening. The Survey continues to offer much needed fish health information in a variety of other disciplines and endeavors which support both the U.S. Fish and Wildlife Services priorities in restoration and conservation management, and the needs of our partners. In reviewing the direction of the Survey in the past five years, and the projects supported this year, there appears to be 3 major categories of technical support we provide based on the requests of our partners:

Restoration
Contaminants
Pathogen Surveys

Restoration work for several State and Federal projects continues to be the highest priority for support from the NWFHS. Many geographical areas that are planning, implementing or monitoring restoration projects and need baseline data of the fish pathogens that exist in the watershed.

Long-term contaminants monitoring is the next most important area of support the Survey offers as fish health assessment is critical factor in understanding the biological effects of contaminants on immediate and long-term health of fish communities.

Lastly, there still continues to be a need for monitoring of existing and new pathogens of interest. For example, surveys to monitor endemic pathogens such as Infectious Hemorrhagic Necrosis virus (IHNV) and *Myxobolus cerebralis* to determine what effect these pathogens may be having on threatened or endangered species. In addition, there is strong interest by State partners to develop baseline data for pathogens found elsewhere in the United States and to determine if these organisms may exist in California and Nevada. Examples of pathogens that may be new to our region are Large-mouth Bass Virus (LMBV) and Viral Hemorrhagic Septicemia virus (VHSV). These have been found elsewhere, but the full geographic range of these organisms is not currently known.

In addition to surveying for specific pathogens, many National Wildlife Refuges are interesting in cataloging species abundance and distribution and want to include a fish health assessment as a component of the overall ecosystem health of their refuge system.

Obviously, several projects conducted this year overlap in one or several of these general categories and for the purpose of this report they are used simply to alert the reader to the type of support that is being requested from our partners and provided under the National Wild Fish Health Survey.

RESTORATION ACTIVITIES

Lahontan Cutthroat Trout, Nevada

Restoration of the threatened Lahontan cutthroat trout (LCT) is a high priority for the State of Nevada and the U.S. Fish and Wildlife Service. Remnant populations of this distinct genetic strain are used to implement enhancement programs that utilize the best-suited sites for re-introduction in native waters. Fish health information provides knowledge about the current health status of these populations to help ensure their success, but it also prevents the spread of disease to new locations if pathogens are detected in the existing broodstock populations. Several watersheds containing Lahontan cutthroat and other trout species were sampled for all major fish pathogens. An emphasis was placed on sampling for *Myxobolus cerebralis*, the parasite that causes Whirling Disease, because this pathogen is endemic to many waters throughout Nevada.

Eightmile Creek

In November 1999, Nevada Division of Wildlife provided wild Lahontan cutthroat trout for fish health screening. Whirling disease (*Myxobolus cerebralis*) testing was negative. This was an important finding; it suggests that this population is healthy and doing well despite the endemic history of Whirling Disease in this geographical area. Pathogen testing detected *Renibacterium salmoninarum* at moderate to low levels in this wild fish population, corroborative PCR testing was negative. Viral testing was also negative.

North Fork Humboldt River Drainage

Center staff assisted the Nevada Division of Wildlife with collection and sampling of sixty wild Lahontan Cutthroat Trout sampled from two tributaries in North Fork Humboldt River Drainage (T Creek and Pearl Creek) by means of electrofishing. These wild populations are highly valued by NDOW as a sustainable population of broodstock for LCT recovery programs. Whirling disease (*Myxobolus cerebralis*) testing was negative. Pathogen testing detected *Renibacterium salmoninarum* at low levels in this wild fish population by ELISA, however PCR tests were negative. Other bacterial and viral pathogens that were assayed provided negative results.

East Fork of the Walker River

In November 1999, Nevada Division of Wildlife provided ten rainbow trout and fifteen brown trout from the East Walker River for fish health monitoring. Respective tissues were tested for *Renibacterium salmoninarum* and *Myxobolus cerebralis*, the fish pathogens causing Bacterial Kidney Disease (BKD) and Whirling Disease. The ELISA method detected low to moderate levels of *Renibacterium salmoninarum* antigen in both the rainbow and brown trout stocks from the Walker River. However, corroborative testing with PCR was negative. This population is reported as suspect for *Renibacterium salmoninarum*.

Endangered Cui-ui - Marble Bluff Fish Facility, Nevada

Pyramid Lake is an important fishery to the Pauite Tribe as well as State and Federal managers involved with the Lahontan cutthroat trout restoration activities in Nevada. A fairly extensive survey of fish diseases was conducted in 1978-79, however the prevalence of fish pathogens in this body of water has not been reassessed during the past twenty years.

The Survey was interesting in not only updating this information, but also surveying for important pathogens with the more current and sensitive detection methodologies. Species of interest in Pyramid Lake are the threatened Lahontan cutthroat trout and the endangered cui-ui sucker. The endangered cui-ui sucker is an important species to the Pauite Tribe of Pyramid Lake. Studies on life history and reproductive rates have been conducted by the USGS for several years, and the Center wanted to supplement these findings with fish

health information. In cooperation with USGS, the Center examined 60 cui-ui for fish pathogens. Of particular interest was *Aeromonas salmonicida*, an endemic pathogen to Pyramid Lake detected in Lahontan cutthroat trout when the adults spawn. Adult Cui-ui were collected at the Marble Bluff Fish Facility during spawning migration into the upper Truckee. Other than infrequent and minor skin abrasions, the fish appeared very healthy. No abnormalities were noted internally, viral testing and bacterial cultures were negative. ELISA detected low to moderate levels of *Renibacterium salmoninarum*, but the corroborative testing by PCR was negative.

Battle Creek Restoration

Battle Creek is a healthy watershed in Northern California, that is comprised of excellent habitat and cool water from its origin, the volcanic geology of Mount Lassen. Because Battle Creek is a healthy ecosystem comprised of primarily undisturbed habitat and cool water for natural salmon production, it is the focus of a large scale restoration program for California's salmon stocks such as: the endangered Sacramento Winter-run chinook, threatened Spring chinook, threatened steelhead, as well as Sacramento Fall and Late-fall chinook (candidate species).

This watershed is also the source of water for Coleman National Fish Hatchery (CNFH), which operates a seasonal weir to collect broodstock for hatchery production and prevent some fall and late-fall chinook from migrating above the hatchery. The hatchery program produces over 14 million fish annually and is the largest federal hatchery in the United States. Due to the number of fish and complexity of this hatchery program, disease prevention of hatchery stocks and protection of this water supply are important components of recovery efforts for important stocks reared at CNFH, including Fall chinook, Late-fall chinook and steelhead.

A better understanding of the significant pathogens in this drainage, such as Infectious Hematopoietic Necrosis Virus (IHNV) and *Myxobolus cerebralis* (Whirling Disease), is an important component of a restoration plan for this watershed, and management of hatchery stocks. The relationship between disease pathogens and wild fish populations provides a biological basis for management decisions regarding restoration efforts, fish passage above CNFH, stocking of trout, and other activities in the watershed. The NWFHS provides information on the presence, distribution and prevalence of fish pathogens in both salmonid and non-salmonid populations in Battle Creek for this purpose.

Coleman National Fish Hatchery Barrier Weir

A total of 107 fish, representing three species were collected and tested for fish diseases between February and May of 2000 at the Coleman NFH weir. Species sampled were Sacramento sucker (63%), Sacramento pikeminnow (17%), hardhead (19%), and rainbow trout (1%).

Although Battle Creek has a history of Whirling Disease, no *Myxobolus cerebralis* spores were found in the fish examined from the Coleman Weir during this sampling period. An earlier study of Battle Creek conducted in FY1999-2000 detected *Myxobolus cerebralis* in rainbow trout in both the north and south fork of Battle Creek. It will be important to continue testing natural populations in Battle Creek for this parasitic disease in order to assess if this pathogen poses any risk to planned restoration of the watershed or to hatchery stocks.

Trinity – Klamath Ecosystem

Klamath River, CA

This river with its major tributaries, the Scott & Shasta Rivers, forms an important chinook salmon producing system in the Pacific Northwest. Historically, infectious disease has significantly affected the survival of out-migrating juvenile chinook salmon. Two pathogens of regional importance (PRI) have been the prime cause of mortality in the past and they continue to be of concern to resource managers. These pathogens are the bacteria *Flavobacterium columnare*, which causes Columnaris disease and the internal parasite, *Ceratomyxa shasta*, which causes debilitating inflammation and necrosis of the intestinal tract. The summer of 2000 was a relatively low water year in the Klamath River watershed, resulting in recorded water temperatures above normal. A fish kill occurred in early July and several sites in the Klamath River were sampled in response to this abrupt mortality. Juvenile chinook salmon were collected by CDFG, Yreka Office, at Dolan's Bar and sampled for bacterial pathogens and parasites. No pathogens were found in this sample set. Twenty-two juvenile chinook salmon were collected by the same crew at the mouth of Aikens Creek. Kidney and intestine samples were taken for histology which revealed 2 out of 22 fish with severe infections of *Ceratomyxa shasta*.

To investigate a fish kill effectively, a quick response to the event is critical so water quality can be performed as well as adequate tissue samples be collected. The CA/NV Fish Health Center worked with Tribal, State, and Federal agencies to provide training to these groups in identifying clinical signs that may be associated with infectious disease when a fish kill occurs. Our goal was to train fisheries crews that work on the Klamath River and supply them with the necessary materials to rapidly respond to fish kills in the future.

Scott River

The Scott River is a major tributary of the Klamath River, and an important chinook salmon producing system in northern California. In cooperation with the U.S.

Forest Service, California Department of Fish & Game, and Americorps, 91 out-migrant juvenile chinook salmon were collected from screw traps and examined from March to July 2000 for pathogens. In addition to the major pathogens of the NWFHS, fish were tested for the pathogens of regional importance that are also found in the mainstem Klamath; *Flavobacterium columnare* and *Ceratomyxa shasta*. Information gathered from this study will build a better understanding of the relationship between wild fish populations and disease processes. In addition to pathogen prevalence, the Forest Service is interested in the effect that water diversion and elevated water temperatures might have on the overall health of fish in the Scott River.

The two major fish pathogens previously found in the mainstem Klamath River were not found in the samples collected from the Scott River during the sampling period. Crews monitoring the screw traps observed no obvious signs of fish disease.

Shasta River

The Shasta River is also a major tributary of the Klamath River. In cooperation with the U.S. Forest Service, California Department of Fish & Game, and Americorps, 110 out-migrant juvenile chinook salmon were collected from screw traps and examined from March to June of 2000 for pathogens. As in the Scott River samples, these fish were tested for *Flavobacterium columnare* and *Ceratomyxa shasta*.

The two major fish pathogens in the mainstem Klamath River were not found in the samples collected from the Scott River during the sampling period. Crews monitoring the screw traps observed no obvious signs of fish disease.

San Joaquin River, CA

Declining chinook populations in California's Central Valley is prompting an intense restoration effort of this valuable resource which is a key element of the state's aquatic biodiversity. Infectious disease can influence survival due to both direct mortality and reduce physical performance during outmigration of juveniles. No comprehensive fish pathogen survey of juvenile fall-run chinook in the San Joaquin River and Estuary has been reported to date. In conjunction with the National Wild Fish Health Survey, 70 free ranging fish were examined. Sample sites were chosen to blend in with existing monitoring work by our cooperators, California Fish & Game and USFWS Sacramento-San Joaquin Estuary Fishery Resource Office. Field sample methods included beach seine, Kodak trawl, and midwater trawl.

No clinical signs of disease, viral, or obligate bacterial pathogens were detected in any of the juvenile fall-run chinook salmon examined.

CONTAMINANTS PROJECTS

Lake Mead, NV

In a continuation of a USGS contaminants study that was begun in FY 1999 which focused on endocrine disrupter effects on carp from Las Vegas Wash, blood samples were collected from 39 carp in November 1999. A 1995 study of adult carp from the Las Vegas Wash and Bay region of Lake Mead reported that these fish showed evidence of endocrine disruption. The current USGS study was designed to build on this earlier work by surveying adult carp in the Las Vegas Wash and Overton Arm region of Lake Mead for reproductive indicators and general health.

No significant bacterial or parasitic infections were detected in either population from the contaminant or the reference (control) site. No consistent trend in elevated white blood counts (neutrophil cells) or endogenous pigment depositions was observed in the May and June collections. The presence of iron granules in liver cells (hepatocytes) without associated signs of hemolytic distress may indicate a dietary or waterborne source for this iron deposition.

Other contaminant projects are underway for FY2001. We started sampling this fall at Kesterson National Wildlife Refuge, a site of concentrated selenium contamination due to agricultural run off. The Nevada Fish and Wildlife Office has also asked for our assistance in monitoring fish health in old mining sites contaminated with mercury. So we look forward to be able to provide fish health assessments in conjunction with new or on-going contaminants studies.

PATHOGEN SURVEYS FOR NEW OR ENDEMIC DISEASES

Tracy Fish Collection Facility, Tracy - California

The Bureau of Reclamation's Tracy Fish Collection Facility is located on the San Joaquin River in the Sacramento-San Joaquin delta region of the state. This facility runs a fish salvage operation to collect and truck fish around the large diversion pumps that supply agricultural water to the Central Valley of California. The location, and diversity of species collected at the Tracey Fish Collection Center (TFCC) provided an excellent opportunity to collect various specimens from these large rivers as they migrate downstream and to assess the health impacts of the fish salvage operation. Bureau of Reclamation employees collected striped bass, white catfish, American shad, and threadfin shad. The white catfish had clinical signs of bacterial infections that were identified as *Aeromonas hydrophila* in laboratory testing. A large percentage of the striped bass also tested positive for *Aeromonas hydrophila* but did not exhibit clinical signs of disease. Elevated water temperatures, handling required for the trapping and transport of fishes,

and poor water quality were all thought to contribute to the prevalence of *Aeromonas hydrophilia* in the otherwise hardy catfish species.

Upper Sacramento River, CA

Infectious Hematopoietic Necrosis Virus (IHNV) infection is common and widespread in adult Fall-run Chinook salmon in the Upper Sacramento River system and is not strictly centered in Battle Creek where hatchery production occurs at Coleman NFH. The virus appears to be quite prevalent in both hatchery and natural chinook stocks of the region. In October 1999, viral samples from 23 Fall-run Chinook adult (“fresh”) carcasses were collected in the upper Sacramento River in Redding, CA. It was surmised that some portions of the sample group were of natural origin as fish collected were not marked with an adipose fin clip used to denote hatchery stocks.

The prevalence of infection for this sample group was 96% in individual samples. Similarly, the prevalence of virus in spawned broodstock at Coleman NFH in the same month was 80% in 3-pool kidney samples (pooling of samples may mean that the prevalence was actually lower in this group). Previous viral testing of Fall-run chinook carcasses in Battle Creek showed a similar prevalence of infection. These data indicate that IHNV is found in both hatchery and natural chinook stocks in the upper Sacramento River at relatively similar prevalence levels.

Stone Lakes National Wildlife Refuge – Stone Lakes, California

Stone Lakes NWR was established in 1994 and contains some of the last remaining fresh water lakes in the Central Valley of California, providing both seasonal and permanent wetlands. Located just south of Sacramento and part of the Sacramento-San Joaquin Delta system, the refuge supports a rich variety of wildlife. The variety of fish species that are within the refuge made it an excellent sampling site for the Survey. Particular pathogens of interest at this location were Infectious Pancreatic Necrosis Virus and Largemouth Bass Virus. Two hundred seventy nine fish were sampled from South Stone Lake over two sampling periods, one in the fall of 1999 and one in the spring of 2000. Several species had samples that were positive for *Renibacterium salmoninarum* by ELISA and negative by PCR. No other reportable fish pathogens were found.

Largemouth Bass Virus Survey

Largemouth Bass Virus (LMBV) has not been detected in the state of California which supports recreational fisheries for several of the susceptible species (largemouth, small moth and striped bass). In an effort to determine the presence or absence of this virus in California waters, the Center proposed sampling several reservoirs stocked by the California Department of Fish and Game for LMBV. Because this virus is most often stress-induced in fish populations, it is often difficult to detect when clinical signs are

absent. For this reason, we also included a survey of stressed fish undergoing pumping operations to address this aspect of the disease.

Lake Shastina, California

The Center coordinated the collection of specimens with reservoir biologists in the California Department of Fish and Game Redding office. Thirty largemouth bass were assayed and found negative for the bass iridovirus. *Renibacterium salmoninarum* tested positive ELISA but not by PCR. The overall health of the bass was very good, which was attributed to a large population of pond smelt as the forage base in this lake. Due to inclement weather and scheduling conflicts no other lakes were sampled for Largemouth Bass Virus in FY2000. Next year we hope to survey several more northern California impoundments.

Pumping Studies at Red Bluff Diversion Dam, California

The Bureau of Reclamation (BOR) operates the Red Bluff Diversion Dam on the Sacramento River. Several pumping studies have been conducted over the past 5 years to evaluate the effects of irrigation water pumping operations on outmigrating salmonid smolts. This year's study at Red Bluff included striped bass collected from the Sacramento San-Joaquin delta at the Tracy Fish Collection Facility (TFCC). The striped bass had already been processed through the Tracy facility, and then trucked to Red Bluff for additional pumping experiments, making them good candidates for stress related impacts to their overall health. The Center conducted examinations on a group of 80 fish to determine if pumping operations increased the prevalence or severity of fish pathogens. These fish were also tested for Largemouth Bass Virus as this pathogen is associated with stressed fish and is difficult to detect in sub-clinical, non-stressed fish populations. The fish experienced some impacts from the pumping studies that included minor scale loss and skin abrasions. LMBV and other viral pathogens were not detected. ELISA detected low levels of *Renibacterium salmoninarum* antigen in thirteen out of eighty fish, but PCR did not confirm this finding. The bacterial pathogen *Flavobacterium columnare* causing Columnaris disease, was detected in significant numbers (twenty one of thirty spleen samples). This pathogen can also be stress induced when handling fish.

Survey for Viral Hemorrhagic Septicemia virus (VHSV) in herring.

Viral Hemorrhagic Septicemia (VHS) virus was detected in the United States in 1988 in Washington state and later found to be a unique and less virulent form of the virus found in Europe. The North American isolate has also been detected in a number of marine species, Pacific cod and herring most notably, but the full geographic range of this virus

has not been determined. The farthest southern point for this virus is Coos Bay, Oregon. In an effort to determine if VHSV is present in California stocks of herring, we worked with two commercial fisherman to sample herring during annual spawning.

Tomales Bay, California

A private fisherman collected one hundred adult Pacific herring during the winter spawning season from Tomales Bay, near San Francisco. The fish health examination and viral testing was negative for Viral Hemorrhagic Septicemia virus, as well as the other major fish pathogens tested.

San Francisco Bay, California

Pacific herring collected from San Francisco Bay were also submitted for fish health examination and viral screening. Twenty-five herring were sampled for virus and found negative. No other reportable fish pathogens were found within this sample group.

Yellow Creek, California

In October 1999, 35 fish from two salmonid species were sampled from Yellow Creek, Plumas County, California in cooperation with California Department of Fish & Game. This stream has been historically positive for the parasite *Myxobolus cerebralis* which causes Whirling Disease. Collected fish were tested for viral & bacterial pathogens as well as for *M. cerebralis*.

No viral or cultured bacterial pathogens were found in the samples. *Myxobolus cerebralis* spores were identified in 38% of the brown trout samples, but were not found in the two brook trout sampled. Brook trout are more susceptible to Whirling Disease but only comprised 6% of this sample; the majority of fish sampled were brown trout.

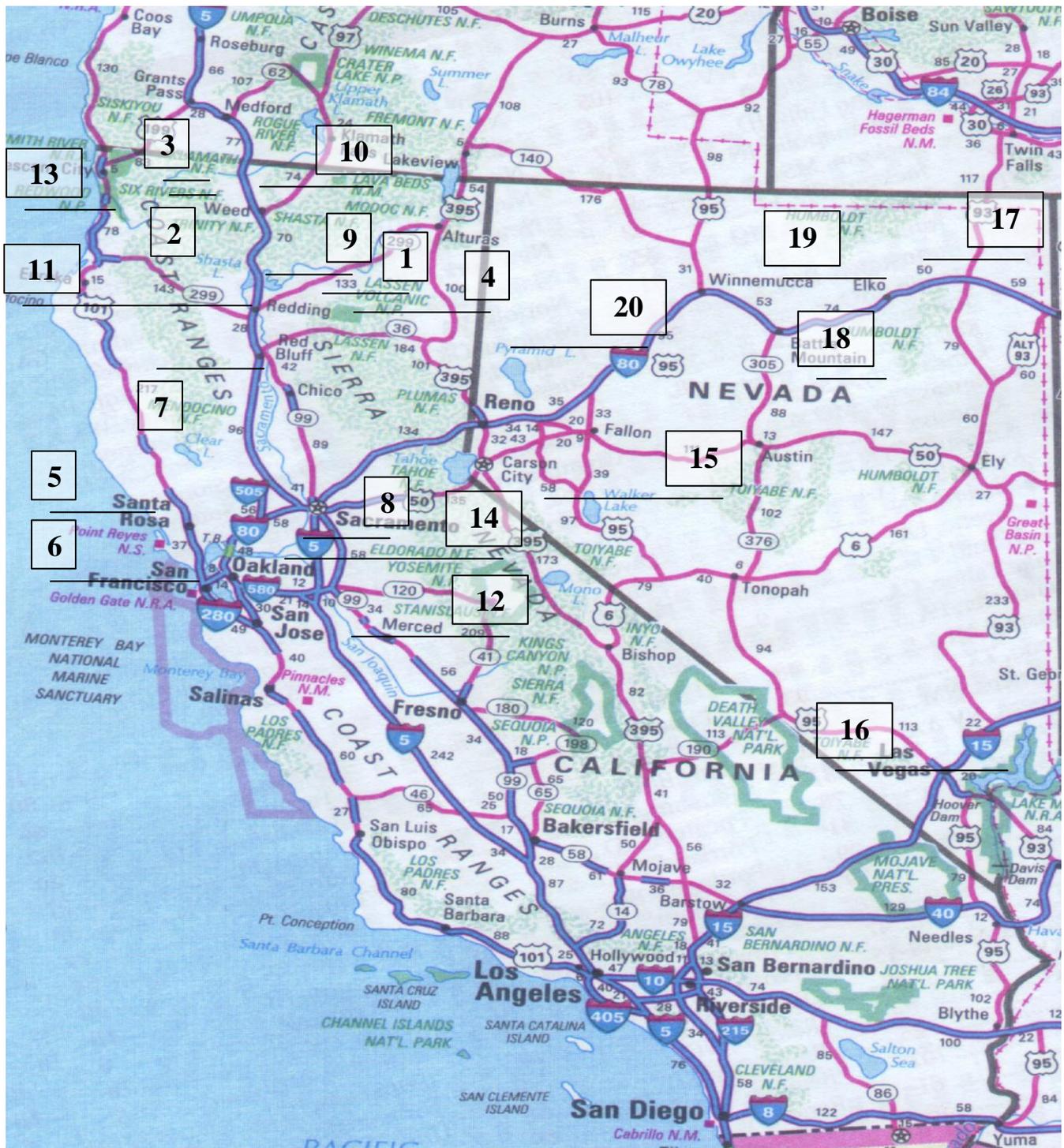
PARTNERSHIPS

List of Partners corresponding to Sample Sites on Map

	<u>Map Site</u>	<u>Partners</u>
1	Battle Creek	U.S. Fish & Wildlife Service - Northern Central Valley FWO USFWS Coleman NFH California Department of Fish & Game
2	Shasta River	CDFG Americorps
3	Scott River	U.S. Forest Service
4	Yellow Creek	CDFG
5	Tomales Bay	NGO
6	San Francisco Bay	NGO
7	Sacramento River, Red Bluff Diversion Dam	U.S. Bureau of Reclamation
8	Stone Lakes NWR	USFWS - NWR
9	Shasta Lake	CDFG
10	Lake Shastina	CDFG
11	Upper Sacramento River	CDFG
12	San Joaquin River	USFWS - Sacramento/San Joaquin Estuary FRO
13	Klamath River	CDFG
14	Tracy Fish Collection Facility	BOR
15	East Walker River	Nevada Division of Wildlife
16	Lake Mead	U.S. Geological Survey
17	Eight-Mile Creek	NDOW
18	Pearl Creek	NDOW
19	T Creek	NDOW
20	Marble Bluff Fish Facility, Pyramid Lake	USFWS Reno FWO Paiute Tribe - Pyramid Lake Fisheries

Figure 1 - Map showing collection sites of wild fish California and Nevada

(Numbers correspond to List of Partners, page 12)



COST ACCOUNTING

CAPITOL OUTLAY **\$ 2,500.00**

- Capitol equipment costs for Back-pack electrofishing gear..

DIAGNOSTIC TESTS **54,350.00**

- Supplies and Labor for laboratory work

Pathogen Testing 1144 @ \$35.00 40,040.00

Histological exam 265 @ \$54.00 14,310.00

Total = 54,350.00

TECHNICAL ASSISTANCE **730.00**

WFS conferences, meetings and stakeholder outreach.

FIELD SAMPLING COSTS **1,336.00**

- Labor and supplies outside laboratory costs.

DATA VERIFICATION / DATA ENTRY COSTS **6,033.00**

- Data checking and input into WFS database.

Data verification 2011.00

Data entry 4022.00

Total = 6033.00

TRAVEL **300.00**

- Airfare or other common carrier expenses

TOTAL = \$ 65,249.00

TABLE 1-3 on pages 15-17