Carson River Aquatic Life Status Report

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TABLE OF CONTENTS

List of Tables

Appendices

1.0 Introduction

The Carson Water Subconservancy District (CWSD) was requested by the Nevada Division of Environmental Protection (NDEP) Bureau of Water Quality Planning to conduct a literature review for the most current data and information on the aquatic life of the Carson River (fisheries and macro-invertebrate populations). This information will be used for NDEP's Carson River Report Card Project and for the Carson River Watershed Stewardship Plan.

The Carson River fisheries have been reported as extremely abundant, according to newspaper articles and other historical documents, until the late 1800's. A rapid decline of the abundance and diversity of fish species began during the Comstock Mining Era. The mills that were developed along the river to process the ore, and the massive log drives greatly impacted the water quality and habitat conditions. Competition from the introduction of exotic species also caused a decline in the number of native fish.

In more recent history, channel modifications, bank erosion and decrease in riparian vegetation are among factors that continue to challenge native and non-native fish species. The unavailability of proper habitat in many reaches makes successful propagation and population maintenance extremely difficult for fish species. Water quality and stream flow issues have significant impacts on the fisheries, particularly the coldwater fisheries. High spring flows, high water temperatures, heavy metal and acid mine runoff (in Bryant Creek), sediment pollution, and poor spawning habitat negatively impact hatchery trout survival and wild trout production. Low flow to dry conditions occurring in late spring and summer along the main stem of the Carson River greatly limit the amount and types of fish that are able to survive.

According to both the Nevada Department of Wildlife (NDOW) and the California Department of Fish and Game (CA F&G) fewer trout are present in the Carson River than other large rivers in the region. As previously stated, poor environmental conditions are suspected to be the major contributing factor to the lesser populations. In addition to high suspended solids, water temperatures can reach into the high 70's and low 80's in the main stem, lowering the dissolved oxygen, and creating conditions that are lethal to trout. Management techniques such as increasing flows during the summer may reduce the trout mortality rate by helping to lower water temperatures, however without adequate upstream storage and methods for increasing the flows, this is not a practical option at this time. Improvements to stream channel habitat that would provide shading can help to reduce water temperature and improve the fish habitat. Many of the river restoration and community river workday projects are aimed at implementing this goal. Currently the main management strategy employed by NDOW and CAF&G is to maintain a put and take fishery. A put and take fishery is describe by NDOW (2000) as the following:

"…management is directed towards providing fishing opportunity for hatchery stocked catchable sized fish and rapid harvest turnover in the fish population structure. This management concept is adopted when there is less natural opportunity for fish to reproduce or where harvest is great in a limited resource."

1.1 Purpose of Report

The purpose of this investigation is to compile and document the current status of aquatic life in the Carson River according to the most recent information. This information will be used to

better define the impacts to aquatic life due to nonpoint source pollution and hydrogeomorphic modification. Specific issues that will be investigated include:

- Fish species that do reproduce naturally;
- Population estimates of native and non-native species;
- Frequency and locations of fish surveys;
- Lahontan Cutthroat Trout (LCT) habitat requirements and current status;
- Macro-invertebrate population estimates and frequency of surveys; and,
- Amphibian survey results.

1.2 Information Sources

Information for areas located within Alpine County, California was obtained primarily from CA F&G and the U.S. Forest Service (USFS) Carson Ranger District. CA F&G recently compiled data and completed reports for the Carson River Drainage Streams in California. One report addresses the East Fork and one addresses the West Fork. These reports are the result of a statewide inventory of trout streams that began in 1983. The inventory was undertaken after passage of the "Trout and Steelhead Conservation and Management Planning Act of 1979" (California Senate Bill 192; Sections 1725 – 1728). The CA F&G was directed to conduct biological and physical surveys of all California trout streams and lakes and was required to identify and designate selected waters where the quality of wild trout fishing could be improved with catch and release angling regulations. The data compiled in these reports ranges from 1974 to 2000. The intent of the study and inventory is to look at long-term trends and to collect the population data necessary to manage and protect the resources. The primary objectives of the reports are to briefly describe the streams that were sampled in the East and West Fork Carson River drainage, report on the current distribution of the fish species present, their densities and biomass, and discuss the specific results and management implications of trout population surveys

The USFS completed stream habitat surveys for the East and West Forks of the Carson River and associated tributaries in 2006 to evaluate potential LCT introduction streams and validate existing LCT inhabited streams. The surveys are part of the action items identified for the development of ecosystem management plans aimed at developing strategies for LCT restoration and recovery.

Information for areas located within Nevada was obtained primarily from NDOW's "Draft East Carson River Fisheries Management Plan", and NDOW annual federal aid progress reports for the East and Main Carson Rivers.

Macroinvertebrate survey information was obtained from the Lahontan Regional Water Quality Control Board and the NDEP Bioassessment Program.

Amphibian survey information was obtained from the NDOW field trip report prepared to document activities conducted from July1, 2003 to July 31, 2004.

Other sources of information are also documented in the reference section of this report.

2.0 Historical Background

Native species in the Carson River system are remnants of the ancient Lake Lahontan that once covered the entire region. When the lake recessed, many of the fish species, such as Lahontan and Paiute Cutthroat Trout, were trapped in the numerous pools and streams that remained. Non-native, or exotic, species found in the system today are the result of human introduction.

Perhaps the best source of information on the history of the Carson River fisheries is a collection of newspaper articles compiled by Bob McQuivey of NDOW (NDOW 1999). This account documents and provides insight into the status of the Carson River fisheries from 1849 to 1931. The following are some of the excerpts from this compilation.

In August of 1862 an article in the San Francisco Evening Bulletin reported:

"*Gentlemen who live in Carson Valley state that there are great quantities of trout in the river returning to the sink from the mountain streams. Persons living on the stream catch great numbers of them with the seine or hook and literally feast on the luxury of fresh trout three times a day."*

Modes of fishing varied in the late 1800's with techniques ranging from the typical cane pole to the use of quicklime and clubbing to this technique described in the Virginia City Territorial Enterprise on November 7, 1869.

"….while stopping at the warm springs, near Genoa, last week, he several times went out with parties of gentlemen to blast trout out of the Carson...with two cartridges he saw over fifty pounds of fish killed, counting trout, white fish and chubs. In places after a blast the whole surface of the water would be covered with minnows, from an inch to three or four inches in length…"

Most of the accounts refer to trout and do not describe the specific species of trout. One account refers to a salmon weighting 16 pounds being caught in the river near Empire City.

By 1876 the accounts begin describing large fish kills and the decline of the Carson River fisheries. The Virginia City Territorial Enterprise on August 7, 1876 reports the following:

"The fish in the lower sink of the Carson River are dying and are floating to the shores in great numbers. ... Not only are there great quantities of tailings run into the river, but also in the aggregate a vast amount of chemicals of various kinds which doubtless serves to still further deteriorate the waters of the stream and lakes. Formerly trout were quite abundant in the river, but of late few are to be found in the lower part of its course."

Other accounts in 1877 describe the fishery below the Dayton area where the Comstock mining operations were located as virtually nonexistent.

By the 1880's both native and stocked trout were rarely caught and chubs, large minnows, catfish and carp became the predominant species in the main stem of the Carson River (NDOW 2000).

The massive wood drives on the river were clearly making an impact on the water quality and the fisheries as stated in the following account:

"From Empire to its source the crystal waters of the Carson have not yet been polluted with "mud" and probably never will until there is a change of management in the mining affairs in Alpine; and were it not for the wood-driving business, trout would be as plentiful in the river today as they were twenty years ago. The water becomes impregnated by filtering through the "jams" of fresh pine wood as it lies in the river for weeks at a time, which is quite distasteful and unhealthy to the fish as the much complained of sawdust in the Truckee and other streams…"

By 1895 the fishing appears to have picked back up after the closure of most of the mills along the river. The Lyon County Times states the following in the May 25, 1895 edition:

"Fishing in the Carson River in this vicinity is now very fair. Catfish, chubs, and succors are plentiful, and occasionally a fine trout, weighing from one to three pounds is caught. While fishing in the Carson River, above the mills, has always been good, below the mills, when running, the fish could not live on account of the water being so strongly impregnated with the chemicals which came from the mills. Of late years the fish have had a chance because nearly all the mills have been shut down and the water in the river has become moderately clear."

But by 1898 the river is described as being impregnated with cyanide to the extent that there are fish kills and the water is unfit for drinking without first boiling.

In 1907 the fishing is described as being very good throughout the system, including Churchill County. At least one account credits the Newlands Irrigation Project with improving the fishery. An account in the 1927 edition of the Gardnerville Record-Courier states the following:

"Trout are now running up the Carson River to the spawning beds and it is reported that large numbers are going over the fish ladder at the Douglas power dam. Among the trout are many of great size and it is believed that they have made their way up from Pyramid Lake through the Derby canal and Lahontan dam."

NDOW makes the following observation about the fisheries:
"It appears that the newspaper articles, if read from the earliest reports to the latest, document the reduction in reproducing fish populations over time. This may be inferred from the increase in stocking activities, the number of fish that were being stocked in the river and the imposition of ordinances to limit fishing starting in the 1920's."

Massive fish die-offs were documented in late 1986 and early 1987 in the lower Carson River in the Carson Sink (Horton 1997). Estimates of over seven million fish died from an unusual combination of high evaporation and freezing conditions that produced high concentrations of dissolved solids. Approximately 1,500 aquatic birds were also killed during this period because of an outbreak of avian cholera. In 1991 Lahontan Reservoir experienced a massive fish kill from a suspected blue green algae bloom.

3.0 Life History and Physiological Needs of Fishes

Each species of fish has certain physiological needs that must be met in order for the species to survive in its environment. Reproduction activities are particularly influenced by environmental conditions. Trout species go through great pains to choose safe spawning habitat. If the environmental conditions are not favorable to spawn, a female may reabsorb her eggs and wait until the next year. Suitable spawning sites provide protection from freezing, flooding, predation and suffocation (due to siltation or poor gravel aeration). According to NDOW (2003) the high spring flows of the Carson River along with elevated levels of suspend sediment comes at a time when rainbow trout spawn and when mountain whitefish and brown trout eggs hatch. This may reduce spawning and egg hatching success plus decrease fry survival thereby limiting wild trout populations.

All life stages of fishes require certain habitat conditions and if these conditions are not met then their survival is not likely. The main conditions for the embryonic period are temperature and oxygen supply which are responsible for embryonic mortality, the duration of the period, and size and condition of newly-hatched larvae. Fry need to remain in suitable habitat for a few days after emergence or they will starve to death, drift downstream into potentially unsuitable habitat or become food for other fish.

Hannigan (2005) describes some of the physiological needs for game trout species such as the rainbow and brown. These game fish require water temperatures of between 10-24°C to survive. Feeding will typically cease at 22°C and death will occur at 25°C. Spawning season occurs during spring months for the rainbow and fall for the brown. Successful spawning requires a habitat that contains well-oxygenated water with a gravel (pea to golf ball size) or cobble substrate. The optimum water temperature for spawning is 5.5 to 8.8°C. Fry require a gravel substrate. The diet of trout species consists of aquatic and terrestrial insects, worms, crustaceans, fish (including own species), and fish eggs. Young fish feed on plankton. The age to sexual maturity is 2 to 5 years, earlier for males than for females. The average life span is 6 to 7 years. The following table provides information on the general life history and physiological needs of native fish species found in the Carson River.

Table 3.0-1 – General Life History and Physiological Needs of Native Fish Species
(Sources: Otis Bay 2005)

	Cutthroat Trout	Mountain Whitefish	Paiute Sculpin	Speckled Dace	Lahontan Redside	Mountain Sucker	Tahoe Sucker	Tui Chub
Temperature Range	14-20°; tolerates 25°C, growth stops at 22°C	11-21°C (summer)	Typically <20°C	0-34°C inactive below 4°C	Inactive below 10°C	1-28°C, suffers at 24°C	Typically below 16°C, but may tolerate up to 25°C	15-30°C
Spawning Temperature Range	6-14°C	2-6°C, with rapid temperature drop	No info.	Near 18-19°C	13-24°C	11-19°C	12-23°C	13-17°C
Adult Habitat	Stream pools or lakes with sand or rock bottom, undercuts	Streams: pools >1m Lakes: Cold, mountain lakes, rarely in reservoirs	Stream: swift rocky riffles Lakes: deep (>60m) weed beds	Variable – lakes or streams with rocky or sandy bottoms, avoids high gradient	Variable – lakes and both lower river and mountain streams	Swift mountain streams and some lakes with rocky bottoms	Lakes (10-300m deep), pools of lower stream reaches	Weedy shallows of lakes and slow rivers, deep water in winter
Fry Habitat	Low flows shallows with abundant food <13.3°C	Stream shallows	Gravel riffles, 1-2 weeks	Gravel beds	Quiet covered shallows	Pondweed shallows	Weedy shallows of lake or tributaries	Shallow vegetated shores
Juvenile Habitat	Stream pools, may migrate to lake <21.8°C	Lake, seek deep cover of aquatic vegetation	Stream bottoms, gradual drift downstream	Warm stream or lake shallows with rocks	Quiet shallows with floating debris	Vegetated shallows	Vegetated shallows	Rocky, sandy areas
Spawning Season	Dec-Mar; Apr-early July	Oct-early Dec	May-Jun/Jul	Throughout summer, peaks in Jun-Jul	Late May-Aug, peaks in June	3 weeks in May – mid Aug	Apr-early Jun/Jul	Lat Apr – late June
Spawning Substrate	Shallow stream well-sorted gravel riffles	Loose gravel/cobble beds with current in streams and lakes >75cm	Crevices under rocks in gravel riffles	Streams: gravel riffle pools Lakes: shallow gravel beds	Streams: sand/gravel pools Lakes: shallow gravel areas	Gravel riffles	Streams: gravel/rock riffles Lakes: rock/gravel bottoms (5-18m depth)	Shallow vegetated beds with sandy bottoms

Table 3.0-1 – General Life History and Physiological Needs of Native Fish Species (continued)

	Cutthroat Trout	Mountain Whitefish	Paiute Sculpin	Speckled Dace	Lahontan Redside	Mountain Sucker	Tahoe Sucker	Tui Chub
Feed Type	Opportunistic, surface, drift, and bottom feeder	Bottom feeder, dusk to nocturnal	Nocturnal bottom ambush	Omivorous, nocturnal, bottom feeder	Opportunistic surface and drft feeder, active anytim	Adult: Algae scraper, drift feeder Juv: Omnivore	Nocturnal bottom feeder	Opportunistic nocturnal omnivore
Diet	Aquatic and terrestrial invertebrates, zooplankton, Tui chub, small fish, salmon eggs, amphibians, earthworms	Benthic invertebrates, fish eggs (including own), zooplankton, surface insects	Benthic invertebrates, algae, detritus	Benthic invertebrates, sucker and minnow eggs and larvae	Surface and benthic insects, planktonic crustaceans, sucker eggs and fry, algae	Algae, diatoms, small invertebrates, detritus	Algae, invertebrates, diatoms, detritus	Benthic invertebrates and aquatic plants, plankton
Age to Maturity	Female: 3-4; Male: 2 yr	2-4 yr	2 yr	2yr	3-4 yr	Female: 4-5 yr: Male: 2-3 yr	Stream: 2-3 yr Lake: 4-5 yr	2 yr
Average Lifespan	7-9 yr	7-8 yr, can live up to 17 yr	Up to 5 yr	4-6 yr	No info.	Female: 9 yr Male: 7 yr	5 yr, can live up to 17 yr	Female: 7 yr Male: 4 yr
Hybridizes with	Rainbow trout	-	-	Lahontan redside	Tui chub, speckled dace	Tahoe sucker	Mountain sucker	Lahontan reside
Predator/Threat	Fish-eating birds, game fish, anglers, habitat alternation	Trout, habitat alteration, anglers	Game fish, trout, habitat alternation	Trout, game fish, fish-eating birds	Trout, fish eating birds, habitat alternation	Trout, birds, habitat alternation	Trout, game fish, fish-eating birds	Trout, game fish, fish-eating birds, mammals habitat alternation
Current Status	Threatened	Common, on watch list	Abundant	Abundant	Abundant	Abundant	Abundant	Species of Special Concern
Where found	East Fork CA	Upper reaches	Upper reaches	Throughout system	Throughout system	Throughout system	Throughout system	Stillwater???

4.0 Current Status of Carson River Watershed Fisheries

Fish population surveys and studies have been conducted through the watershed over the past two decades. Roving angler surveys are also used on both forks and the main stem of the river as a tool to assess fish status. Surveys will continue to be conducted as budgets and manpower allow.

Between 1993 and 1997 the U.S. Geological Survey (USGS 2002) collected data on selected reaches of the Carson and Truckee Rivers for fish, crayfish, algae and aquatic invertebrates (USGS 2002). Sites sampled on the Carson River were: Site 1 – East Fork near Dresserville; Site 7 – Carson River at Deer Run Road near Carson City; and Site 9 – Carson River at Fort Churchill State Park. Fish species that were found are shown in Table 4.0-1.

Table 4.0-1: Fish and Crayfish Identified on Carson River during USGS 1993 to 1997 Study

East Fork near Dresserville (total amount collected)	Carson River at Deer Run Road (total amount collected)	Carson River at Fort Churchill State Park (total amount collected)
Speckled dace (351)	Crayfish (35)	Lahontan redside (617)
Crayfish (123)	Green sunfish (16)	Common carp (108)
Mountain sucker (120)	Smallmouth bass (12)	Speckled dace (97)
Tahoe sucker (39)	Largemouth bass (5)	Tahoe sucker (87)
Lahontan redside (23)	Tahoe sucker (5)	Fathead minnow (85)
Brown trout (1)	Mountain sucker (3)	Mountain sucker (44)
	Common carp (2)	Sacramento blackfish (5)
	Specked dace (1)	Green sunfish (2)
	Black bullhead (1)	White bass (1)

Source: USGS 2002

The most recent population survey estimates from CAF&G and NDOW for the upper watershed extending from the headwaters to just below Ruhenstroth Dam on the East Fork and to Woodfords on the West Fork are shown in Appendix A. Native species are listed in Table 1; non-natives in Table 2. The native fish species found to be the most abundant during the most recent surveys was the speckled dace (128,078.8 fish/mile). The species found to be the least abundant was the lahontan redside shiner (327.6 fish/mile). Brook trout was found to be the most abundant non-native species (18,226 fish/mile), compared to rainbow trout (9,008.1 fish/mile) and brown trout (3,995.1 fish/mile). Reaches containing the greatest number of native species per mile are the West Fork through Hope Valley during the 1991 survey, and the East Fork from the state line to Hangman's Bridge during the 1988 survey. Specifics from these surveys are discussed in the following subsections.

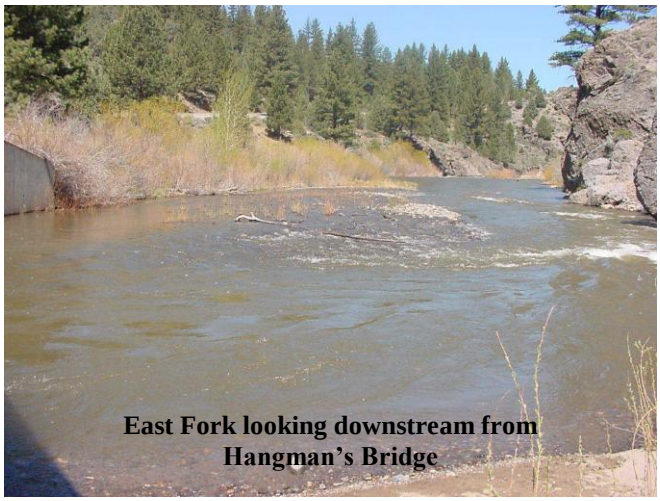
4.1 East Fork Carson River

For the purposes of this report the portions of the East Fork in California will be referred to as the upper East Fork. Those portions that are downstream in Nevada will be referred to as the lower East Fork. The following subsections provide information on where the population surveys are conducted by CAF&G and NDOW and general discussions regarding the status of the fisheries in these segments.

4.1.1 Upper East Fork Carson River

The upper East Fork is divided into four segments for management purposes by CAF&G with several sections contained within each segment. Figure 1 in Appendix B shows the specific survey sites. The numbers on the maps correspond with the section numbers referred to in the following sub-sections.

1. Stateline to Hangman's Bridge: This segment is approximately 10 miles long and extends from the California/Nevada state line upstream to the first road crossing at Hangman's Bridge. The reach was designated as a catch and release area by the California Fish and Game Commission in 1992. The segment includes the following sections: Scossa Canyon (8); below the USGS gaging station (7); at and immediately downstream of gaging station (10 & 11); between the gage and Hangman's Bridge (9). Surveys were conducted for this segment in 1987 and 1988. The 1997 flood severely impacted this segment. Banks were scoured, new channels were formed and (or) old channels were re-established. The floodwaters shifted the reach below the USGS gauging station (section 7) into a new channel and left the original channel dry.

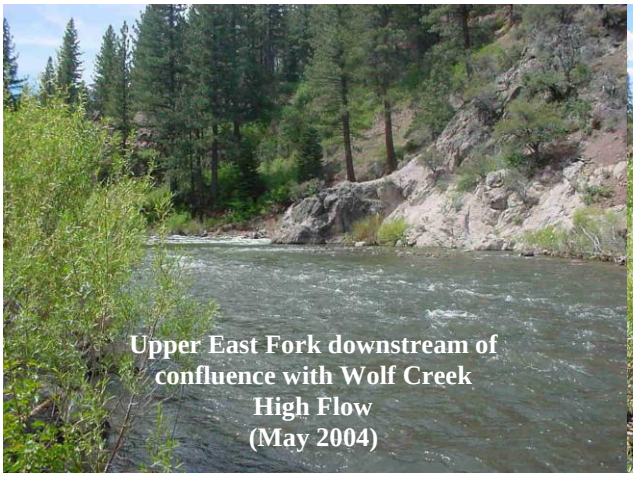


East Fork looking downstream from Hangman's Bridge

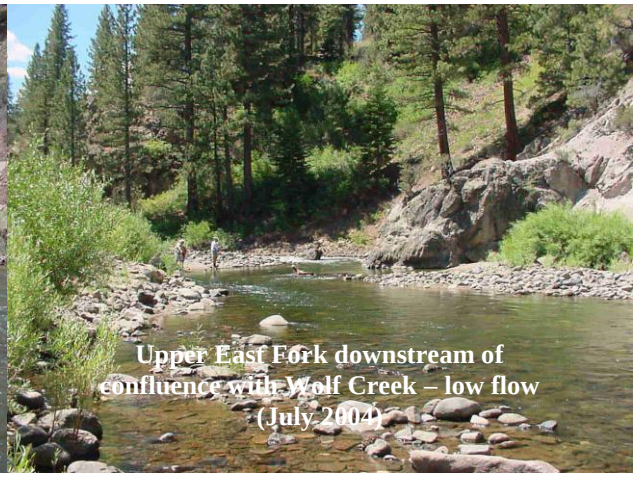
This segment was the used as part of an experimental stocking program in 1988. Approximately 10,000 brown trout fingerlings were released into two miles of stream below Hangman's Bridge. The survival of the trout was not as high as was hoped. Prior to the stocking the test sites (sections 7 and 9) averaged 400 brown trout in the >6 inch age class during the 1987 survey. The 1988 survey produced only 416 in the same class group.

Non-native trout densities between Scossa (8) and Hangman's' Bridge (9) averaged 368 fish per mile during the 1987 survey (the latest survey conducted for this section). The abundance of catchable size trout (>6 inches) was low. Catchable size trout densities were much higher in areas with pool habitat; however the densities were still relatively low as compared to other waters. Of 181 catchable trout per mile about half were >12 inches in length. The surveys, including a snorkeling survey, confirmed the suspicition that larger trout occupy several of the pools below Hangman's Bridge and were not necessarily being detected during electro-shocking surveys.

2. Hangman's Bridge to Wolf Creek: The segment is approximately nine miles long and is paralleled by Highway 89 and Highway 4. The segment spans from above Hangman's Bridge to about a mile below the confluence of the East Fork and Wolf Creek and encompasses the area by the Carson River Resort. According to CAF&G this is the most visible and heavily fished reach of the East Fork. Fisheries in the area are maintained primarily by stocking catchable-size rainbow trout. CAF&G stocks rainbow trout from CAF&G hatcheries and Alpine County supplements this stocking program with larger, robust trout purchased from private hatcheries. Fish populations were sampled at four roadside sites as follows: Sections 2 and 3 in 1983, and sections 12 and 13 in 1994.



Upper East Fork downstream of confluence with Wolf Creek
High Flow
(May 2004)



Upper East Fork downstream of confluence with Wolf Creek – low flow
(July 2004)

This segment was also impacted by the flood of 1997. CAF&G (2004a) states that during the flood the river moved across cobble bars and became established closer to the far bank. The section that flows through a narrow steep banked portion (section 12) was severely scoured and willows growing along the banks were stripped out. CAF&G also suspects that changes in the streambed materials occurred as well.

Non-native trout densities varied sharply between section 2 (above Hangman's Bridge by the Carson River Resort) and section 3 (upstream of the confluence with Monitor Creek) during the 1983 survey. Approximately 52 trout per mile were estimated in section 2 while in section 3 approximately 2,077 trout per mile were estimated. However, of the 2,077, only 1% was over 6 inches in length.

3. Wolf Creek to Carson Falls: This segment was in the original group of Wild Trout Streams designated by the California Fish and Game Commission in 1972. It is a 14 mile long roadless segment that is accessible only by trail. All four sections of this segment (4, 5, 6 and 14) are part of the management program associated with the upper East Fork Carson River Wild Trout Stream designation. Sections 4, 5, 6 were originally surveyed in 1980. Surveys were conducted on sections 4, 6 and 14 in 1996.

Section six of this segment, near the confluence with Poison Creek, had some interesting results during the two surveys. In 1980 no brook trout were collected at this site or at any of the other sampling locations on the East Fork, however during the 1996 survey brook trout were estimated at 913 trout per mile. CAF&G assumes that brook trout were washed down from Poison Creek and/or Poison Lake. Also, the Paiute sculpin population varied greatly between surveys. In 1980 only 8 fish per mile were estimated as compared to 1,056 fish per mile during the 1996 survey.

In the 1980 survey section 5 (Falls Meadow) had the highest density of catchable size rainbow and brown trout of all the surveys conducted to date for the upper East Fork. Good instream habitat is credited with the 508 catchable trout per mile. The segment by Carson Falls had the lowest total biomass for the entire upper East Fork.

4. Above Carson Falls: This segment is accessible by trail upstream from the Soda Springs Guard Station or by dropping down from the Pacific Crest Trail through Golden Canyon. This is a fairly isolated segment and is managed as a LCT refugium and is closed to angling. This population (estimated to be 202 fish per mile in 1989) is one of the few remaining composed of the original strain

of Carson River LCT. The reach above the falls is identified in the current USF&W recovery plan as having a population important for recovery (USFWS 1995).

4.1.2 Lower East Fork Carson River

NDOW conducts population surveys at the following sites on the lower East Fork from the California/Nevada state line to just below Ruhenstroth Dam. These sites are described as follows:

Border Site by CA/NV Stateline 2003

1. Border: This site is located upstream of the Bryant Creek inflow, close to the state line. The site is approximately 1,080 feet in length. The latest survey conducted at site was on September 6, 2006. Speckled dace was the most abundant (14 total recorded), followed by mountain sucker (8), whitefish (6), brown & rainbow trout (5 each), Tahoe sucker (3) and Paiute sculpin (1) (NDOW 2006). One rainbow trout was noted as being a wild fish.

The following table provides results for sportfish population surveys conducted from 1999 to 2006 at the Border site based on fish per kilometer.

Survey Year	BN	RB	WF
1999	12.7	25.4	29.7
2001	33.4	15.2	173.2
2003	7.1	205	49.5
2006	14.9	14.9	17.9

Notes:
BN – Brown Trout
RB – Rainbow Trout
WF - Whitefish

2. Apple Orchard: This site is located 2.0 river miles downstream of the state line. Trout densities are generally low at this location. NDOW stocks fingerling brown trout occasionally in this reach. Catchable size rainbow trout (>8 inches) and rainbows stocked by CA F&G upstream may migrate to this area. The latest survey conducted for this site was September 6, 2006. Mountain suckers and speckled dace were the most abundant at 11 each, followed by rainbow trout (6), brown trout (4) and whitefish (3) (NDOW 2006). One rainbow trout was noted as being a wild fish.

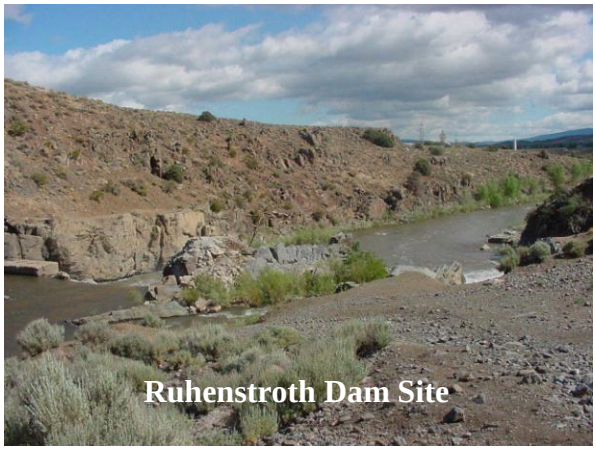
The following table provides results for sportfish population surveys conducted from 1999 to 2006 at the Apple Orchard site base on fish per kilometer.

Survey Year	BN	RB	WF
1999	45	48.4	72.7
2001	24.2	41.5	96.9
2003	83	27.7	38.1
2006	20.9	15.7	31.4

Notes:
BN – Brown Trout
RB – Rainbow Trout WF - Whitefish

3. Sheep Bridge. This site is located downstream of the Apple Orchard site 3.2 miles from the state line. Fingerling brown trout are stocked annually at this location by NDOW. The latest survey conducted for this site was in 2003. Mountain suckers were the most abundant at 88 fish, followed by speckled dace (44), whitefish (36), brown trout (11), and rainbow trout and lahontan redside shiner at 1 each (NDOW 2003).

4. Below Ruhenstroth Dam (Old Power Dam). This is the farthest downstream site that NDOW samples and is 7.7 miles below the state line. The site is located several hundred yards below the dam. According to NDOW (2000) the greatest abundance of rainbow trout, brown trout, and mountain whitefish on the lower East Fork occur here. NDOW suspects that the spawning migrations of brown trout and mountain whitefish coincide with sampling efforts. Ruhenstroth Dam (a good example of structures that impede fish passage) prohibits upstream migration. Hatchery rainbow and brown trout are stocked at the site and also contribute to the high population estimates. NDOW points out that based on the size of the fish captured here there is no indication that many trout survive for long below the dam. NDOW suspects that this is due to angling activity, and low flow/high temperature conditions during summer months.


Ruhenstroth Dam Site

According to NDOW 2001 trout captured upstream of the dam were of larger size and showed morphological characteristics of being wild (NDOW 2001). The fishery from the Dam to Highway 88 is primarily an urban fishery. The latest survey conducted for this site was in 2006. Whitefish were the most abundant at 38 fish, followed by rainbow trout (18), brown trout (12), mountain sucker (11), and speckled dace and lahontan reside shiner at 10 each (NDOW 2006). Two rainbow trout were noted as being wild fish.

4.1.2 East Fork Carson River - Tributary Information

Tributaries to the upper East Fork were sampled as part of the statewide inventory by CA F&G (CA F&G 2004a). The latest survey results are show in Appendix A, Tables 1 and 2. The following subsections provide brief descriptions of the tributaries and discuss some of the findings from the surveys.

4.1.2.1 Bryant Creek

Originating at the confluence of Mountaineer and Leviathan creek at an elevation of 6,142, Bryant Creek drops about 1,000 in elevation during its 6.5 mile run to the East Fork. An impassable fish barrier consisting of a 50-foot long box culvert with a five foot exit drop into a plunge pool is located approximately 0.2 miles from the origin of the creek. Downstream of the fish barrier the creek flows through a narrow gorge that contains numerous rock falls that may also act as fish barriers. The lower reaches of the creek on the Nevada side are located on a fluvial floodplain that is frequently grazed by cattle. There is also a water diversion that diverts the majority of the streamflow during summer and fall months.

Bryant Creek is an interstate water so typically CA F&G and NDOW team up to survey both the lower and upper reaches. The latest survey, conducted in 1998, resulted in no fish being captured in the

lower section of Bryant Creek near the Nevada Stateline. Four small rainbow and one catchable-size brook trout were captured in the upper section just below Mountaineer Creek, which equates to 64 rainbow and 16 brook trout per mile, respectively. CA F&G (2004a) attributes the absence of fish in Bryant Creek near the state line and few trout captured upstream to toxic chemical drainage from Leviathan Creek. Combined rainbow and brook trout densities in Mountaineer Creek, 0.5 miles above the confluence with Leviathan Creek, were about 20 times greater than those present in the upper Bryant Creek.

4.1.2.2 Mountaineer Creek

Mountaineer Creek originates from Big Spring northeast of Leviathan Peak near Monitor Pass at an elevation of 8,090 feet (CAF&G 2004a). The creek joins Leviathan Creek after flowing approximately 6.5 miles through a series of aspen groves and meadows. Instream habitat is good with undercut banks, aquatic vegetation, and woody debris in the reaches through the meadow areas. A total of four sections were sampled, the uppermost and middle sections were sampled in 1995 and the two lower in 1998. The creek ranked fifth in total non-native trout abundance of the California portion of Carson River drainage, and second in catchable size trout abundance, and third in biomass. The creek ranked first in catchable trout abundance for the upper East Fork drainage. No special designation or angling regulations are recommended for this area.

The rainbow trout in this reach are unusually colorful (CAF&G 2004a). It is not known if this is a genetic or environmentally produced characteristic. CAF&G recommends that precautions be taken not to expose the rainbow populations to possible hybridization. The creek has also been recognized in the 1995 LCT recovery plan as a potential candidate for LCT reintroduction.

4.1.2.3 Leviathan Creek

Upper Leviathan Creek originates from springs on the north side of Monitor Pass at 7,870 feet in elevation. It flows for 2.3 miles then enters the Leviathan Mine Superfund site. There is a 6-foot vertical drop located 1.0 miles upstream of Leviathan Mine that creates a natural barrier. LCT were planted upstream of the barrier in the late 1980's, only a small non-viable population still exists. The middle to lower sections are severely down cut due to unstable soils (CAF&G 2004a). CAF&G suspects that the inability of the LCT to become self-sustaining in the upper reaches of the stream is due to the apparent lack of winter habitat. The stream has very little depth and anchor ice formation would eliminate fish in this reach. The lower reaches of Leviathan Creek have limited cover and shallow pools. The creek joins Bryant Creek, which eventually merges with the East Fork.

In 1998 the creek was sampled upstream and downstream of Leviathan Mine. No fish were captured downstream and one LCT and 43 rainbow trout were captured in the upstream section. The one LCT was assumed to be a downstream migrant from Heenan Creek and not a part of a self-sustaining population.

CA F&G efforts on Leviathan Creek are focused on the Leviathan Mine clean-up and they hope that these efforts will result in aquatic life being restored to the creek between the mine site and Bryant Creek.

4.1.2.4 Markleeville Creek

Markleeville Creek originates at the confluence of Pleasant Valley and Hot Spring Creeks. It flows along the south side of the town of Markleeville, through a grove of cottonwoods and across a meadow area before joining the East Fork. The creek has a low gradient dropping in elevation from about 5,600 to 5,400 feet along its two-mile journey. The meadow section is shallow and lacks appropriate cover

needed to maintain an abundant population of larger trout (CA F&G 2004a). Sediment, which is suspected to be the result of grazing, is present in most of the meadow reach and accumulates in pool areas. Riparian habitat and overhead canopy is limited. Hatchery plants are used to maintain the fisheries around Markleeville with catchable size rainbow trout and fingerlings.

Two sites were surveyed by CA F&G. Section 1 is located between the campground (just outside of town) and the East Fork, and the section 2 is located in the reach that runs along the edge of town. Both sections were sampled in 1993 and a second survey was conducted on section one in 1995.

The meadow section of Markleeville Creek had the most varied and abundant native non-game fish populations found in an East Fork Carson River tributary (CA F&G 2004a). The 1995 survey estimated mountain whitefish at 25 fish per mile. No Paiute sculpin were collected during the surveys. There was a decrease in mountain sucker populations between 1993 and 1995 and appeared to involve almost every size class with the possible exception of the small number of fish in the largest size classes. One tahoe sucker was collected in the 1995 survey, none were found in the 1993 survey. In 1993 605 fish/mile of lahontan redside shiner was estimated, however, the 1995 survey resulted in no shiners collected. In 1993 the survey showed an exceptionally abundant population of speckled dace at an estimated 22,500 fish/mile. But this number decreased to 4,724 fish/mile in the 1995 survey.

CA F&G suggests that high streamflows were probably responsible for the sharp changes in native non-game fish populations. No mountain whitefish or other native non-game fish were captured at the upstream site probably due to the deeper, faster flows and limited cover.

4.1.2.5 Pleasant Valley Creek

Pleasant Valley Creek originates from several small headwater streams at about 9,000 feet. It descends about 3,000 feet through a steep walled canyon before reaching the large meadow named Pleasant Valley. This valley has a long history of cattle grazing which has increased sediment levels in the stream (CAF&G 2004a). There is a major water diversion at lower end of stream and the limited pool habitat lacks cover. Two sites were surveyed 1983. The upper sites (1 and 2) were resurveyed in 1993, and the lower sites (3 and 4) were resurveyed in 1995. Paiute sculpin populations were estimated in section 1 at 493 fish/mile in the 1983 survey and increased to 3,277 in the 1993 survey. CAF&G states a difference in sampling techniques may account for the difference in population. The estimated average for sculpin in the creek is 767 fish/mile, the second highest found in an East Fork tributary. During the surveys only one mountain whitefish and one tahoe sucker were collected.

Non-native trout populations had a larger proportion of larger trout than other East Fork waters for reasons not clear to the surveyors. The majority of the trout were 8 to 11 inches long with some greater than 12 inches. The only golden trout found throughout the East Fork drainage was captured in section 3 during the 1995 survey.

4.1.2.6 Hot Springs Creek

Stream flow for Hot Springs Creek originates from an upstream combination of outflow from Burnside Lake and inflow from Charity Valley Creek. The creek drops about 2,500 feet from Burnside Lake and then has a fairly low gradient all the way to its confluence with Pleasant Valley Creek. The flow is channeled into pools at Grover Hot Springs for public use and then is released across a lower meadow area. The upper meadow area has a high percentage of sediment (CAF&G 2004a). The lower area, that is accessible from Grover Hot Springs Road, is stocked with catchable-size and larger non-native trout.

Three sites were surveyed. Section 1, located just below the bridge crossing 1.5 miles downstream from Grover Hot Springs was surveyed in 1993. Section 2, midway along the road between Markleeville and the hot springs, and section 4, about 0.25 miles upstream from the hot springs parking area, were surveyed in 1995.

Paiute sculpin were the most abundant native fish captured averaging an estimated 909 fish per mile during the 1995 survey. This represents the highest estimated sculpin density for an East Fork tributary. In the 1993 mountain suckers were estimated at 656 fish per mile and tahoe suckers at 78 fish/mile. CAF&G conducted a follow-up survey to confirm the presence of the mountain and tahoe suckers in 1998 but none were found. Speckled dace populations ranged from 2,613 fish/mile in Section 1 in 1993 to 37 fish/mile in 1995. One mountain whitefish was captured in the lowermost sampling site in 1995.

4.1.2.7 Silver Creek

Silver Creek originates near the top of Ebbetts Pass at 8,700 feet elevation. It joins the East Fork at about 5,850 feet in elevation. The creek contains a variety of stream habitats from sub-alpine to valleys. The upper sections flow through a combination of granite and decomposed granite mountain sides. In the valley there are wide shallow stretches. As the creek approached the East Fork the stream contains boulder and cobble laden channels with deeper pools and more diverse habitats. The stream parallels Highway 4 and is one of the longest stretches of "roadside" streams in the East Fork drainage.

The creek was surveyed in 1983 and 1995. An estimated 176 fish per mile was estimated for mountain whitefish during the 1983 survey, making this one of the most abundant whitefish populations found in the East Fork tributaries. Over 85% of the fish captured were probably in the one-year class. The sculpin collected from the lower section in 1983 were among the largest specimens found in the East Fork drainage. The stream has historically been supplemented with hatchery trout, but current priorities and resources preclude the stocking of hatchery fish into Silver Creek. Results of the 1995 survey can be found in Appendix A, Table 1.

4.1.2.8 Wolf Creek

Wolf Creek originates right below the Sierra Nevada crest and descends gradually for several miles through a steeply walled canyon. Most of the upper reach is located with the Carson-Iceberg Wilderness area and has experienced little anthropogenic change. There is a documented landslide along the road that provides access to the campground area. Before the 1997 flood the stream had developed a good riffle to pool ratio with undercut banks and woody debris but the 1997 flood destroyed the stable stream channel in various locations from the lower canyon to near the headwaters. In the lower reaches water diversions have been known to dry up the entire meadow reach of the stream.

Surveys were conducted in 1983 and 1994. Sampling in three sections produced 15 mountain whitefish and no other native fish species. Rainbow and brook were present in the 1994 survey at 663 and 377 fish per mile, respectively. Stocking is not currently being conducted, although it has in the past in the meadow area.

4.1.2.9 Silver King Creek and Tributaries

The Silver King Creek basin is almost entirely within the Carson-Iceberg Wilderness of the Toiyabe National Forest. Logging was conducted in various locations within the basin during the 1850's and 1860's to supply timber for the gold and silver mines in the vicinity. Beavers introduced in the area damaged the stream channel in Four Mile Channel. The major tributaries are Snodgrass, Corral

Valley, Coyote Valley, Four Mile Canyon, Bull Canyon and Tamarack creeks. Natural barriers are numerous in the basin and block fish migration in many areas.

Silver King Creek contains the rare Paiute Cutthroat Trout (PCT), a federally listed threatened species. The Silver King Creek drainage upstream of Snodgrass Creek is considered to be the historic range of the PCT, and currently their habitat exists above Llewellyn Falls in Silver King Creek. The PCT also occupy portions of Corral Valley, Coyote Valley, Four Mile, and Fly Valley creeks. Upper Fish Valley contains the best habitat in the basin for larger adult PCT in the deep pools of the meandering meadow section.

Coyote Valley Creek is the most productive stream within the Silver King basin. This creek had the highest density (698 trout/mile) for all sections sampled containing pure PCT. Bull Canyon Creek supports one of the smallest PCT populations. Four Mile Canyon has a pure population and has been used to evaluate fish population response to cattle grazing, and monitor long term trends. Fly Valley Creek has provided an historic refugia for pure PCT trout since 1947. The area has remained isolated from subsequent unauthorized introductions of rainbow and PCT, unlike virtually all other populations. Fly Valley Creek is the ultimate source stream for restocking all other PCT populations within the basin. The PCT abundance drops sharply with increased gradient. The Lower Fish Valley reach of Silver King Creek contains a hybrid swarm of rainbow and golden trout, LCT, and PCT.

Future management actions for the Silver King Creek and tributaries focus on recovery of the PCT. Areas above Llewellyn Falls are closed to fishing, as are Corral Valley and Coyote Valley Creeks. Future PCT recovery may include extending the population downstream of Llewellyn Falls to the Silver King Gorge, which is upstream of Snodgrass Creek. Silver King Creek also provides known or potential habitat for two amphibian candidate species, the Sierra Nevada population of the mountain yellow-legged frog (*Rana muscosa*) and the Yosemite toad (*Bufo canorus*) (USFWS 2005).

4.1.2.10 Poison Flat Creek

The stream, which is not named on maps and is located within the wilderness area, is about 2.5 miles long and supports an introduced population of genetically pure LCT. Natural barriers protect the fish from other trout species.

Cattle grazing has resulted in substantial stream bank erosion and in 1998 the area was placed in a "long-term rest" status by the USFS. When surveyed in August of 1981 the sample site contained an estimated 869 LCT/mile. Of this amount an estimated 209 LCT/mile were >6 inches in length. CA F&G suspect that LCT population has declined since the 1981 survey but the report does not offer any explanation for this decline. The stream has served as a refugia from which LCT have been transplanted to other waters. Unlike other stream with pure strains of LCT, this stream remains open to angling.

4.1.2.11 Murray Canyon Creek

Murray Canyon Creek originates at about 7,500 feet flows through a largely forested canyon for about four miles before its confluence with the East Fork. The stream is well shaded, water temperatures rarely exceed 66°F. The lowermost 2.5 miles of the creek supports an introduced, but genetically pure population of LCT. The population is considerably smaller than that found in Poison Flat Creek with an estimated population of 241 trout/mile with 71 trout/mile >6 inches as determined in the 1981 survey. The biomass in this stream was the lowest among the streams covered in this report which

sustained either pure PCT or LCT. The creek is closed to angling and is part of the LCT restoration program and continues to serve as a refugium for LCT.

4.1.3 General Discussion for East Fork Fisheries

According to the inventories documented by CA F&G and NDOW twelve species of fish have been captured in the upper and lower East Fork, including eight species native to the Lahontan Basin and four introduced salmonids. These species are:

Native to the Lahontan Basin:
Lahontan cutthroat trout (*Oncorhynchus clarki henshawi)*
Paiute cutthroat trout (*Oncorhynchus clarki seleniris)*
Mountain whitefish (*Prosopium williamsoni)*
Paiute sculpin (*Cottus beldingi)*
Mountain sucker (*Catostomus platyrhynchus)*
Tahoe sucker (*Catostoomus tahoensis)*
Lahontan redside shiner (*Richardsonius egregious)*
Speckled dace (*Rhinichthys osculus)*

Non-Native Introduced Species
Rainbow trout (*Oncorhynchus mykiss)*
Golden trout (*Oncorhynchus aguabonita)*
Brown trout (*(Salmo trutta)*
Brook trout (*Salvelinus fontinalis)*

The East Fork and most of its tributaries are not exceptionally productive trout waters, especially in comparison with other east slope streams that are designated as Wild Trout and/or Catch-and-Release waters (CA F&G 2004a). Non-native trout densities in the East Fork of the Carson are 4.3 to 16.9 times less than the other Sierra Nevada streams (Truckee, East Walker, Owens). The abundance in the Carson is about half that of the Truckee River.

Frequency of occurrence for all fish species collected by CAF&G in the upper East Fork from 1974 to 2000 is shown in table 4.1.3-1.

Table 4.1.3-1: Frequency of Occurrence of Fish Species Collected in the East Fork Carson River Drainage Streams from 1974-2000

Fish Species	Percent of Sites with Species Present
Lahontan Cutthroat Trout	13.8%
Paiute Cutthroat Trout	12.5%
Rainbow Trout	65.0%
Brown Trout	35.0%
Brook Trout	17.5%
Mountain Whitefish	27.5%
Paiute Sculpin	32.5%
Mountain Sucker	13.8%
Tahoe Sucker	6.2%
Lahontan Redside	3.8%
Speckled Dace	15.0%

Source: CA F&G 2004A

NDOW (2000) states that historically the wild salmonid populations and the fishery in the approximately 21 miles of the East Fork in Nevada has been poor and has been managed mostly as a put-and-take. The areas from Stateline to Ruhenstroth Dam are managed by NDOW as put-grow-and-take fishery. They suggest that environmental conditions such as high spring run-off, high suspended sediment, high water temperature, and toxic mine runoff have impacted the health of the rainbow and brown trout, as well as other native and non-native species. NDOW states that based on the length of fish captured during surveys there is little evidence of much wild rainbow trout reproduction and recruitment within the East Fork in Nevada (NDOW 2000). Spawning success of the trout species may be inhibited since high flows on the river correspond with the spawning season of the rainbow trout and the time when brown trout and mountain whitefish fry should be emerging from the gravel (NDOW 1998). Flooding and sediment pollution may greatly influence trout populations in the East Fork, especially upstream of Ruhenstroth Dam (NDOW 1998).

NDOW (2001) reports that non-native trout densities were highest in places where stocking occurs along the lower East Fork. Based on the size of fish noted during angler and electrofishing surveys, they suggest that few fish carry-over from one year to the next and that the health of fish appear to be better going upstream as does the condition of the habitat.

A fisheries assessment was conducted on the East Fork in 1998 as part of the Leviathan Mine Natural Resources Damage Assessment (CA F&G 2000). The report dated October 2000 addressed issues within the Leviathan-Bryant Creek watershed and the East Fork Carson River. This area is part of the historical range of the LCT. The purpose of the sampling was to determine if comparable sites that do not receive discharges from the Mine have different densities, composition, and standing crops (pounds/surface acre) than those that do receive mine discharges. Results of the assessment showed that Mountaineer and Upper Leviathan Creek, which do not receive discharges from mine waste, contained significant populations of rainbow and brook trout. All age classes were represented and fish appeared healthy. There were no fish captured in Aspen or Lower Leviathan Creeks and there was a near absence of fish of all reaches of Bryant Creek. The East Fork contained all species of fish found in the Leviathan-Bryant Creek watershed, however no conclusion is offered in this report as to the status of these populations.

In October 2001, the USFWS conducted an investigation to determine the degree to which acid mine drainage (AMD) discharges from Leviathan Mine may be impacting fish communities in the East Fork Carson River (USFWS 2001). The objectives of the investigation were to:

- Describe the status of the fish community;
- Determine the health and condition of salmonids;
- Determine trace-elements concentrations in aquatic invertebrate tissues and salmonids, and
- Assess the potential adverse effects to fish from trace-element exposure.

Four sites were selected for the investigation, including a reference site. The site locations are the following:

1. EFC1: East Fork ~250 meters upstream of Ruhenstroth Dam
2. EFC2: East Fork ~1,850 meters downstream from the confluence of Bryant Creek
3. EFC3: East Fork ~520 meters upstream from the confluence with Bryant Creek. This is the reference site.
4. BRY: Bryant Creek ~170 meters upstream from the mouth (confluence with the East Fork)

Observations of presence/absence of fish species and comparison of index of biological integrity (IBI) scores were used to determine the degree to which discharges may be impacting the fish communities. Up to 50 randomly selected fish of each salmonid species were measured, weighed, and assessed for indicators of disease, parasites, and external anomalies from each sample site. The following table provides species that were collected or observed, origin, sites where they present and their pollution tolerance level.

Table 4.1.3-2: Geographic Origin and Pollution Tolerance of Fish Species Collected by USFWS, October 2001

Common Name	Origin	Tolerance Level*	Sites of Occurrence**
Mountain/Tahoe sucker	Native	T	EFC1, EFC2, EFC3, BRY
Pauite sculpin	Native	I	EFC1, EFC3
Rainbow trout	Introduced	M	EFC1, EFC2, EFC3, BRY
Mountain whitefish	Native	M	EFC1, EFC2, EFC3, BRY
Lahontan redside shiner	Native	M	EFC1, EFC3, BRY
Lahontan speckled dace	Native	M	EFC1, EFC2, EFC3, BRY
Brown trout	Introduced	T	EFC1, EFC2, EFC3, BRY

Source: USFWS 2001
*Tolerance Levels: I=intolerant; M=intermediate; T=tolerant
** - Please see above for description of sampling sites

Seven species of fish were identified, with the number of species at each site ranging from 5 to 7. Species common to all sites were brown trout, mountain/tahoe sucker, mountain whitefish, rainbow trout, and speckled dace. Total abundance ranged from 130 (BRY) to 877 (EFC1). Mountain whitefish was the most abundant salmonid at all sites except site EFC2 where brown trout were similar in abundance. Speckled dace was the most abundant for non-salmonids at sites EFC1 and BRY. Mountain/Tahoe sucker was the most abundant at EFC2 and EFC3.

The investigation indicated that the East Fork fish communities are impaired. The presence or absence of sensitive species such as the Paiute sculpin, combined with the abundance of tolerant species, such as the mountain/Tahoe sucker, immediately below the confluence of Bryant Creek with East Fork suggests an influence of AMD on water and habitat quality. The IBI scores also declined on the East Fork downstream of the confluence with Bryant Creek. The length-frequency data also show that brown trout and mountain whitefish have one or more age classes missing, and that reproduction and recruitment of rainbow trout is absent. Health conditions of brown and rainbow trout were within a healthy range, however, mountain whitefish had reduced health condition and were much below their expected relative weight. Trace-element concentrations in invertebrate populations were variable among the sites. Those found in lower Bryant Creek and immediately below its confluence with the East Fork had elevated levels of cadmium, cobalt, mercury, nickel and selenium.

In order to examine the health condition of rainbow and brown trout, and mountain whitefish a hepatic-somatic index (HSI) was performed by NDOW in 2001 (NDOW 2001). The HSI measures chronic health problems by examining fish livers. Fish livers should weigh about 2% of the total body weight. Fish livers of rainbow and brown trout, and mountain whitefish taken from the lower East Fork sampling sites were closer to 1%. This decrease in liver size could suggest that there is a depletion in energy reserves occurring, however, the HSI can vary between seasons and populations. Results of the condition factors analysis showed that the health condition of catchable size fish was highest at the stateline sampling site and lowest below the Ruhenstroth Dam site. The condition of

rainbow trout in the East Fork was lower than those found in other waters. The condition of brown trout was average when compared to fish of other waters, but showed significant differences in conditions among the sites sampled in the East Fork.

4.2 West Fork of the Carson River

The West Fork was sampled as part of the statewide inventory by CA F&G (2004b). NDOW does not sample, stock or manage the West Fork or the Brockliss Slough. All references to the West Fork in the following sections are referring to those portions of the river that are located in California.

4.2.1 West Fork Carson River Population Surveys

CA F&G divides the upper West Fork Carson River into the following segments with numerous sections within each segment. Figure 2 in Appendix B shows the specific sections. The numbers on the maps correspond with the segment numbers referred to in the following sub-sections. Appendix A, Tables 1 and 2 provide information from the latest surveys based on fish per mile.

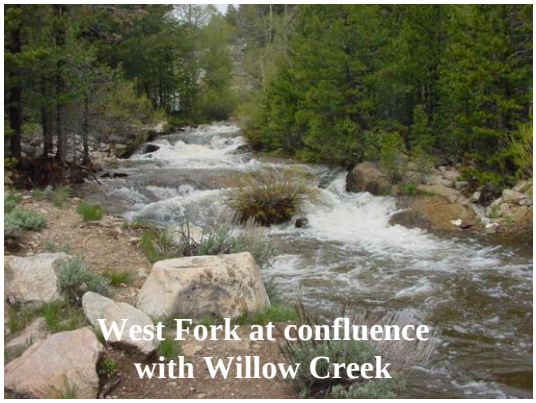
1. State Line to Woodfords

From the Nevada state line to Paynesville, approximately 4.25 miles, the river flows through privately owned lands and farmlands. From Paynesville to Woodfords, approximately 6.75 miles, the gradient increases slightly and the river flows through predominately privately owned lands. This reach of the river does not receive year round flows that are conducive to good trout production due to the water releases from upstream facilities and agricultural diversions (CAF&G 2004b).

Population surveys have been conducted at Paynesville (section 8) and below Woodfords (section 13) in 1993, 1994 and 1995. A survey conducted in 1993 at the Paynesville site contained an estimated 6,715 non-native trout per mile. Over 95% of the fish were <6 inches and may have been the result of an unmarked rainbow trout fingerlings stocking program. During the 1994 survey at the same site the estimate dropped to 708 non-native trout/mile. In 1995 the population decreased 400 fish per mile, however this survey showed a greater number of fish >6 inches than the previous year. In 1995 the section below Woodfords (section 13) had the second highest estimated number of >6 inches trout found in the West Fork drainage at 620 fish/mile. Management for this segment is recommended as a self-sustaining wild trout fishery.

2. Woodfords to Hope Valley

From Woodfords the river flows through the West Carson Canyon and is paralleled by Highways 88. The high gradient of this segment creates a fast flowing boulder strewn stream. Below Hope Valley Resort the river plunges over a cascade that may be a barrier to upstream fish migration (CAF&G 2004b). This segment is comprised of six sections that are as follows: Woodfords at 89 (section 17); Above Woodfords (2); Crystal Springs (16); Hope Valley Resort (14); Lower Sorenson's (15); and Upper Sorenson's (11).


West Fork at confluence with Willow Creek

This segment was surveyed during the timeframe of 1983 to 1996, with one survey conducted per section. Non-native trout densities for the entire segment ranged from 88 trout/mile to 1,425 trout/mile. Sections 17 and 16 contained the greatest number of non-native trout >6 inches at over 500 fish per mile. CA F&G routinely stocks the river between Woodfords and Hope Valley with catchable-size rainbow trout and Alpine County supplements with stocking with plants that include

larger size trout. Most wild trout captured in this reach are 6 to 9 inch wild rainbow and brown trout with an occasional fish in the >10 inch class.

From the Highway 89 Bridge to the Highway 88 Bridge the river meanders through the meadows of lower Hope Valley. Stream habitat is largely sandy bottom pools and deep runs with an occasional riffle. At the lower end of the valley boulders from an ancient glacial moraine are scattered throughout. These boulders are also found in the stream channel above the old Highway 89 Bridge.

3. Hope Valley

This segment is comprised of six sections that are as follows: Old Highway 89 Bridge (1); Hope Valley (3); just above Highway 89 (5); Hope Valley (6); Hope Valley (4); and Hope Valley above Highway 88 (7). The section between Highway 88 and 89 is owned by CA F&G and has been considered for the wild trout program. The stream bank habitat in this reach has been degraded by previous cattle grazing practices but appears to be improving. For the past two decades CA F&G has managed this segment by stocking catchable-sized rainbow trout. In 1989 surveys were conducted to establish baseline non-native trout population data. Non-native trout densities were low at all sites and ranged from 24 to 51 trout/mile. No rainbow trout were captured and the largest brown trout was <10 inches in length (CAF&G 2004b). In 1996 an additional 4,340 feet was sampled within Hope Valley and 362 trout/mile was estimated with 15 brown trout >14 inches. This segment contains an exceptionally high abundance of speckled dace as shown in Appendix A, Table 1. CAF&G (2004b) states that heavily fished roadside areas such as this segment may require special angling regulations, such as reduced limits combined with minimum size restrictions, in order to maintain quality fisheries.

West Fork Carson River in Hope Valley 2004

4. Hope Valley to Faith Valley

The stream bottom through upper Hope Valley is described in CAF&G (2004b) as being composed mostly of fine sands and gravel, with a few scattered large boulders. The habitat is largely pools and runs linked by shallow riffles. Beds of filamentous algae, some undercut and sloughing banks are present.

One section (9) was sampled in 1993 and contained an estimated 460 non-native trout/mile. Brook trout comprised 424 of this amount with the remaining comprised of rainbow trout. The majority of the fish in this reach were <7 inches.

5. Faith Valley

Faith Valley is a large meadow upstream of Hope Valley. The river is described by low gradient pools and runs linked by shallow riffles. The stream channel is smaller than in Hope Valley and there is more trout cover and riparian vegetation. From the upper end of the valley to the confluence of Forestdale Creek the stream is characterized by extremely high gradients.

One section (10) was sampled in 1993 and all trout captured were brook trout with the exception of one LCT. About 60% of the brook trout population was very small at 4 to 6 inches. This reach is recommended to continue to be managed as a self-sustaining brook trout fishery.

4.2.2 West Fork Carson River Tributaries

The following subsections provide brief descriptions and some results from the population surveys that were conducted on tributaries within the West Fork drainage. Appendix A, Tables 1 and 2 provides the fish per mile data for the latest surveys.

4.2.2.1 Horsethief Canyon Creek

Two sections were surveyed in this creek: lower meadow (section 2) in 1987 and lower meadow (section 1) in 1993. This creek is a small stream with moderate gradient and a narrow mountain meadow. It contains short riffles and pools with undercutting at meandering corners (CAF&G 2004b). Brook trout was the only species collected in this creek during both surveys with an abundance ranging from 737 fish per mile in 1987 to 3,489 in 1993. The largest brook trout captured was <8 inches. This creek has been identified as a candidate stream for reintroduction of LTC (USFWS 1995).

4.2.2.2 Willow Creek

Four sections are located on this creek: below the bridge (section 3), middle (section 2), above bridge (section 1) and upstream of a culvert crossing on the upper basin road (section 4). Habitat on Willow Creek ranges from a narrow stream channel with moderate gradient and high sediment loads in the upper reaches to a fast flowing run with grassy banks and a gravel substrate at the site below the road crossing. The average trout density and biomass in Willow Creek was average compared to other West Fork drainage streams. The density of >6 inches was the second lowest amount of West Fork streams. Willow Creek has been identified as a candidate for the reintroduction of LTC (USFWS 1995). The most recent survey conducted by CAF&G in 1994 was dominated by brook trout at 1,721 fish/mile.

4.2.2.3 Red Lake Creek

Four sections were sampled within this reach. The sections are as follows: Confluence of the West Fork in Hope Valley (2); Below Highway 88 (3); Below Highway 88 (4); and Above Highway 88 (1). The stream habitat contains shallow riffles and slow flowing runs with cover formed by undercut banks, pools and willows. All sections were surveyed between 1993 and 1995. Non-native trout densities were lower at all sites compared to a survey conducted in 1983. Red Lake Creek had lower population and biomass as compared to other West Fork streams but contained a larger number of native nongame fish. This creek is recommended to continue to be managed as a self-sustaining wild trout fishery with a five trout per day limit.

4.2.2.4 Forestdale Creek

Two sections were sampled in 1993 on this creek; just above the confluence with the West Fork (section 2) and the upper (section 1) located just downstream from the upper road crossing. Habitat at section 2 is of low gradient, lined with willows, and has a wider reach with riffles and shallow runs. Habitat at section 1 is in a higher gradient reach with a series of short riffles and shallow runs interspersed with small, boulder-lined pools and pocket water. Section 2 contained the second highest density of non-native trout population of the West Fork Carson drainage with 5,377 trout/mile. The majority of these trout were <7 inches. Non-native trout density and biomass at section 1 was lower than that found in the West Fork and only a few trout exceeded 8 inches. The recommended management strategy for this reach is to continue a wild trout fishery that supports “fast action” fishing.

4.2.3 General Discussion of the West Fork Fishery

Fish species collected from West Fork Carson River Drainage as part of the CA F&G inventory surveys are as follows (2004b):

West Fork Carson River Native Species:
Lahontan cutthroat trout (*Oncorhynchus clarki henshawi)*
Paiute sculpin (*Cottus beldingi)*
Mountain sucker (*Catostomus platyrhynchus)*
Tahoe sucker (*Catostoomus tahoensis)*
Speckled dace (*Rhinichthys osculus)*

West Fork Carson River Non-Native Species
Rainbow trout (*Oncorhynchus mykiss)*
Brown trout (*(Salmo trutta)*
Brook trout (*Salvelinus fontinalis)*

Non-native trout, speckled dace, and Tahoe sucker were the most commonly occurring species collected during the inventory in the West Fork drainage. Rainbow trout were present in 21 of the 33 sections, brown and brook trout were collected from 18 sections. Speckled dace and Tahoe suckers were the most common occurring native species, followed by Paiute sculpin, LTC and mountain sucker. Where present, speckled dace were usually the most abundant species collected. No mountain whitefish or Lahontan redside shiners were collected in the California portion of the West Fork. The frequency of occurrence for all fish collected in the West Fork drainage is shown in Table 4.2.3-1.

Table 4.2.3-1: Frequency of Occurrence of Fish Species Collected in the West Fork Carson River Drainage Streams from 1974-2000

Fish Species	Percent of Sites with Species Present
Lahontan Cutthroat Trout	6.1%
Rainbow Trout	63.6%
Brown Trout	54.5%
Brook Trout	54.5%
Paiute Sculpin	18.2%
Mountain Sucker	6.1%
Tahoe Sucker	48.8%
Speckled Dace	54.5%

Source: CAF&G 2004b

Estimated non-native trout density (fish per mile) on the West Fork was lower than other Wild Trout and/or Catch and Release waters but was greater than the East Fork (CAF&G 2004b). Overall non-native fish populations on the West Fork were comprised of almost equal densities of rainbow, brown and brook trout. Estimated number of non-native trout by length class was highest in the <6" class at a mean of 1,012 followed by 185 in the 6-7" class. Rainbow trout had a mean of 393 in the <6" class, followed by 104 in the 6-7" class. Brown and brook trout had a mean of 288 and 1,051, respectively, for the <6" class, followed by 54 and 150 for the 6-7" class.

4.3 Main Carson River

From the confluence of the two forks, the main Carson River flows approximately 60 miles to the Lahontan Reservoir. This section of the Carson River system is managed by NDOW as a put-and-take fishery. Rainbow and brown trout are stocked in mainstem when environmental conditions are

favorable for the relatively longest survival time and greatest angler success. There has been no evidence that the stocked trout are self-propagating and none have been noted during surveys.

Species that have been identified during surveys on the mainstem of the Carson River include the following:

- Introduced warm water sport fishes:
  - White bass
  - Largemouth bass
  - Smallmouth bass
  - Channel catfish
  - Black bullhead

- Other nonindigenous fish that occur in river:
  - Mosquito fish
  - Green sunfish
  - Carp
  - Crappie (black and white)

- Native fish
  - Mountain sucker
  - Tahoe sucker
  - Tui chub
  - Speckled dace

On September 6, 2006 NDOW conducted fish surveys at three locations on the main Carson River. The following table provides information from those surveys.

Table 4.2.3-2: Results of 2006 Fish Survey on Main Carson River (based on total number recorded)

Site	TS	MS	GS	SMB	TC	SD	BC	WC	C
MD	4	5	5	11	13	2			
MH				104					
FtC	1		5	32	8		2	1	7

Notes:
MD – Below Mexican Dam
MH – Moundhouse
FtC – Fort Churchill
TS – Tahoe Sucker
MS – Mountain Sucker
GS – Green Sunfish
SMB – Small Mouth Bass
TC – Tui Chub
SD – Speckled Dace
BC – Black Crappie
WC – White Crappie
C - Carp

It is interesting to note that although the Nevada Administrative Code (NAC445A.146) identifies coldwater species as fish of concern for the reaches from the Stateline to New Empire (below Mexican Dam) these species were not present during the most recent surveys. High water temperature, sediment pollution, poor spawning habitat and low flow conditions occurring in spring and summer

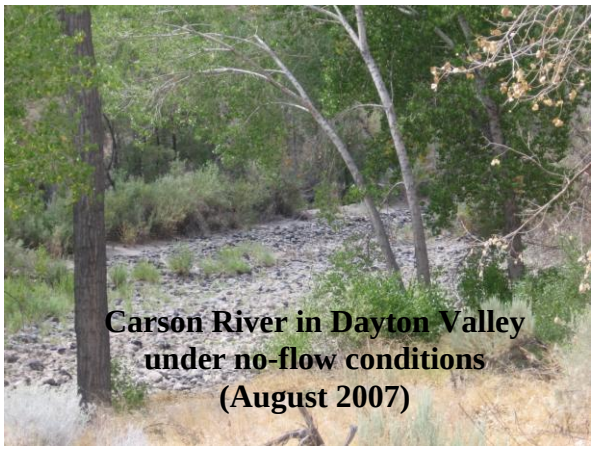
limit the amount and type of fish that are able to survive. NAC445A.146 lists the fish species of concern as the following:

Table 4.2.3-3: Fish Species of Major Concern as Listed in the Current Nevada Water Quality Standards (NAC445A.146)

Reach	Fish Species of Major Concern
West Fork Carson River at Stateline	Rainbow trout, brown trout
Bryant Creek	
East Fork Carson River at Stateline	
East Fork Carson River from Stateline to near Highway 395	
East Fork Carson River from near Highway 395 to Muller Lane	
West Fork Carson River from Stateline to confluence, East Fork Carson River from Muller Lane to confluence, Carson River from confluence to Genoa Lane	Rainbow trout, brown trout
Carson River from Genoa Lane to Cradlebaugh Bridge (Highway 395)	
Carson River from Cradlebaugh Bridge (Highway 395) to Mexican Ditch gage	Rainbow trout, brown trout
Carson River from Mexican Ditch Gage to New Empire	Rainbow trout, brown trout, smallmouth bass
Carson River from New Empire to Dayton Bridge	Walleye, channel catfish, white bass
Carson River from Dayton Bridge to Weeks	
Carson River from Weeks to Lahontan Reservoir at Lahontan Dam	

Source: NDEP 2004

NDOW (1998) states that habitat; streamflow and water quality conditions will probably inhibit wild trout populations from developing in the main stem of the Carson River. Some of the specific issues impacting the fisheries include the channelization of the river, cattle grazing along the upper river and throughout Carson Valley, chemicals such as fertilizers added for crop production migrating into the river, and the decline of riparian habitat (NDOW 2002a). Streamflow can be extremely low due to agricultural diversions. NDOW does speculate that there may be some fish survival during these adverse conditions by fish taking refuge in large irrigation canals in Carson Valley.



Carson River in Dayton Valley under no-flow conditions (August 2007)

Sections of the river from Carson City to Lahontan Reservoir are often completely dry during the months of August and September (NDOW 2001). Some large pools of water may be found during times of low to no flow and warm water fish species such as carp, largemouth bass and green sunfish may be able to survive. During a field investigation in Carson Canyon in August 2007, CWSD staff sighted large carp (>10") in areas where there were deep pools. But more often dead, dried fish, primarily carp, are found during these conditions. It is interesting to note that during drought conditions more bass occurred in angler surveys taken from 1987 to 1993 (NDOW 1998). NDOW suspects

that the spawning success and fry survival of bass and green sunfish increase during drought conditions with low flows, both during spring and summer.

According to NDOW there is no evidence of spawning or wild trout populations present in the main river. Wild trout are fish that spawn in the river and survive to reproduce. Trout species rarely hold over from one year to the next due to environmental conditions and/or complete harvesting of the stocked trout (Sollberger 2003). Bottom substrates dominated by sand and silt add to the challenges of spawning success by many species in the main stem.

General trends of rising turbidity and conductivity at downstream sites suggest increased habitat damage and anthropomorphic influences (NDOW 2002a). All of the above stated factors and conditions also appear to greatly influence benthic macroinvertebrates which the fish rely upon for food, and probably trout eggs and larvae.

Health Advisory Warnings: In the fall of 2006 the State Health Officer for Nevada, in consultation with NDOW and NDEP, determined that the health advisory for the consumption of wild fish in Nevada would be based on a 1.0 parts per million (ppm) mercury (wet weight) (NDOW 2006). Fish samples from 23 waters throughout the State, including the Carson River, were examined. Fish collected from the Carson River upstream of Carson City had mercury levels of 0.04 to 0.22 ppm. Fish collected downstream of Carson City had high levels of mercury ranging from 0.99 to 11.27 ppm. The fish with the 11.27 ppm was a 12" smallmouth bass that was collected from the Carson River along Fort Churchill State Park. The existing health advisory in place for the Lahontan Reservoir, the Carson River from Dayton downstream to Lahontan Reservoir and all the waters in the Lahontan Valley will remain. The following table provides information about the sampling locations and the average mercury weight.

Table 4.2.3-4.: 2006 Mercury Study Results for the Carson River

Water	Species and Number	Average (wet weight, ppm)
East Fork at Border Site	Rainbow trout (1)	0.13
	Brown trout (4)	0.22
	Mountain whitefish (1)	0.07
East Fork at Apple Orchard Site	Mountain whitefish (3)	0.11
	Rainbow trout (1)	0.04
	Brown trout (1)	0.13
East Fork at Ruhenstroth Dam	Mountain whitefish (6)	0.15
	Rainbow trout (2)	0.06
Carson River (Ellis)	Smallmouth bass (5)	3.24
Carson River at Fort Churchill	Smallmouth bass (5)	4.88
	Carp (5)	1.18

4.4 Lahontan Reservoir

According to the 2002 NDOW Progress Report for Lahontan Reservoir (NDOW 2002b), the prominent sport fishes are white bass, largemouth bass, wipers (a white bass and striped bass hybrid), channel catfish, crappie, yellow perch and walleye. All fishes, with the exception of trout and wipers are believed to successfully reproduce within the reservoir. Wipers and walleyes are stocked frequently while black bass and trout were stocked occasionally.

Roving angler surveys in 2001 showed the total catch reported as the following: white bass 41%, walleye 29%, carp 11%, channel catfish 7%; white catfish 3%, 2% each of largemouth bass, crappie

25.38 lb. Wiper caught at Lahontan Reservoir (Summer 2007) Photo Courtesy of Aleta Hannum/Reno Gazette Journal

and wipers, and the remaining catch at 1% each consisted of black bullhead, other bass and other fish. The 2002 roving survey showed a total reported catch of the following: carp 36%, white bass 35%, channel catfish 13%, black bass at 6%, bluegill 5%, wiper 3%, rainbow trout 2% and walleye at 1%. Beach seining is also used to examine the species present and to look at successful reproduction during a particular year. The latest survey conducted was in 2002 and the most abundant species collected was white bass, followed by carp, then crappie. Other species collected were largemouth and spotted bass, walleye, channel and white catfish, and Sacramento blackfish. According to NDOW (2002b) white bass historically dominate these surveys. Gill netting efforts resulted in carp being caught in all habitats sampled, and dominating the total catch followed by walleye and channel catfish.

Record size fish can be caught in the reservoir such as the one shown in the photo (Dayton Courier 2007). Other State of Nevada records from Lahontan Reservoir include a 33.5 lb. Wiper caught in September, 2004 and a 33 lb. Walleye caught in April 1998.

There is also a commercial fishery at the reservoir conducted by Murray Fish Company (NDOW 2002b). Sacramento blackfish are harvested from the reservoir and sold live as food in San Francisco.

4.5 Distribution of Native Fish Species

4.5.1 Lahontan Cutthroat Trout

LCT is a subspecies of the wide-ranging cutthroat trout species (*O. clarki)* that includes at least 14 recognized forms in the western United States (USFWS 2005) and has the most extensive range of any inland trout species of western North America. Basins where cutthroat trout are found typically contain remnants of more extensive bodies of water that were present during the wetter period of the late Pleistocene epoch, such as the ancient Lake Lahontan. USFWS (2005) describes these fish as unusually tolerant of both high temperatures (>27 C) and large daily fluctuations (up to 20 C). They are also tolerant of high alkalinity (>3,000 mg/l) and dissolved solids (>10,000 mg/l). However, they seem to be intolerant of competition or predation by non-native salmonids, and rarely exist with them.

LCT was listed by the USFWS as endangered in 1970 and was reclassified as threatened in 1975 to facilitate management and to allow regulated angling. There is no designated critical habitat and the species has been introduced into habitats outside its native range, primarily for recreation fishing purposes (USFWS 1995). According to the USFWS Recovery Plan (1995) historic distributions of LCT in the Carson River basin included most of the drainage downstream from Carson Falls on the East Fork and Faith Valley on the West Fork. It is estimated that at least 300 miles of cold water stream habitat was used by LCT but currently no self-sustaining LCT populations occupy the historic range.

As late as 1911, LCT was numerous in both forks and tributaries in California (CA F&G 2004a). By 1930 there were virtually gone from native habitats and displaced by introduced salmonids. According to NDOW (2002a) LCT were eradicated from the East Fork from the Nevada/California border to Ruhenstroth Dam by the 1880's due to excessive fishing, non-indigenous fish introduction, and

destruction of the river habitat. USFWS (1995) states major impacts to LCT habitat and abundance include: 1) Reduction and alteration of stream discharge; 2) alteration of stream channels and morphology; 3) degradation of water quality; and, 4) introductions of non-native fish species.

Small LCT populations have been established by transplants into fishless headwater tributaries above natural barriers in the upper East Fork drainage. According to Dennis Lee of CA F&G (2003) LCT does reproduce in these protected areas when it is the only species present. Genetically pure populations are found in the East Fork drainage above Carson Falls, Murray Canyon Creek, Golden Canyon Creek and Poison Flat Creek. A hybridized population of the Carson River strain exists in Heenan Creek and downstream of Heenan Lake. The fishery at Heenan Lake is currently managed for LCT and has long served as the source of LCT eggs used in CA F&G hatchery programs. Trophy size LCT can be caught here. Fish from the lake are known to migrate downstream into Monitor Creek and have been found in a flowing reach near the stream's confluence with the East Fork. Leviathan Creek contains a nonviable population consisting of only a few hybridized LCT. A small reproducing population occupies Raymond Meadows Creek; however the harsh environment limits fish abundance.

LCT were captured in two West Fork drainage streams (Red Lake Creek and the West Fork near the confluence of Forestdale Creek), however they were assumed to be migrants from upstream reservoirs and not part of a self-sustaining population (CA F&G 2004b).

Isolated populations, such as those found within the Carson Basin, are at greater risk of extinction than metapopulations. Metapopulation refers to interconnected and interactive subpopulations that tend to be less vulnerable to extinction from catastrophic events. USFWS (1995) states that currently there are six self-sustaining populations with about 9.5 stream miles of occupied habitat on the Carson River, but there is no potential for a metapopulation. The following table shows locations where LCT currently exists according to USFWS Recovery Plan. Note that all locations contain introduced or reintroduced populations.

Table 4.5.1-1 – Current or Recently Existing Population of LCT

Location of Population	Land Management Agency	Reach Length (in miles)	Notes
East Fork Carson River, CA	U.S. Forest Service	5 *	1, 2
Murray Canyon Creek, CA	U. S. Forest Service	2	1, 2
Raymond Meadows Creek, CA	U.S. Forest Service	0.5	1, 2
Poison Flat Creek, CA	U. S Forest Service	1.0	1, 2
Golden Canyon Creek, CA			1
Heenan Lake, CA			1, 3
Heenan Creek, CA			1, 4
Bull Lake, CA			1, 5

Source: USFWS 1995

***** Report does not provide specific location of LCT on East Fork, however, according to CA F&G (2004a) LCT have been found on the East Fork near confluence of Monitor Creek

Notes:

1. Introduced or reintroduced populations
2. Population determined best suited for recovery
3. Artificially maintained population of Independence Lake strain
4. Supports a limited, naturally maintained population of Carson River strain LCT which may be slightly introgressed (movement of a gene from one species into the gene pool of another) with rainbow trout.
5. Supports a naturally maintained population of Carson River strain LCT that may be slightly introgressed with rainbow and Paiute cutthroat trout.

The USFWS recovery plan lists the following sites as potential locations for LCT introduction.

- Horsethief Creek, CA
- Willow Creek, CA
- Charity Valley, CA
- Forestdale Creek, CA
- Mountaineer Creek, CA
- Jeff Davis Creek, CA
- Charity Valley Creek, CA

The USFS conducted stream surveys throughout the upper watershed in 2006 to:

- Evaluate physical characteristics that pertain to the success of the native LCT;
- To provide an inventory of potential fish habitat for LCT; and
- Provide base-line information for future management and LCT re-introduction.

According to the USFS potential LCT habitat would meet the following criteria (Kling 2006):

- Cold, clean water source (Summer avg. 13ºC +/- 4ºC)
  - Growth and survival threatened at 22-24ºC
  - Short-term threshold at 28ºC
  - Spawning 8-16ºC
- Pools in close proximity to cover and velocity breaks to provide cover and spawning areas
- Well vegetated, stable stream banks
- Adequate cover: 50% or more of stream area
- Rocky substrate in riffle-run areas, absent of fine silt
- Continuous stream/absence of barriers
  - Potential for metapopulation
- Complexity of habitat: pool/run/riffle
- Low-moderate gradient: <15%
- Current occupation by salmonids

The following table provides the streams that were surveyed, the rating that was assigned to the stream for its potential as LCT habitat, and the estimated miles of potential LCT habitat.

Table 4.5.1-2: USFS 2006 Stream Survey for LCT Potential Habitat

Stream Name	Priority Rating*	Estimated Potential Habitat (miles)
East Fork Drainage		
Upper East Fork (Gray's crossing to Sonora Peak)		
Poison Flat Creek	Occupied	Occupied by LCT
Silver King Creek	Not provided	2.59
Golden Canyon Creek	Low	2.92
Murray Canyon Creek	Occupied	Occupied by LCT
East Fork	Not provided	9.0
Total for Upper East Fork		14.51
Upper-Middle East Fork (Silver Creek to Gray's Crossing)		
Silver Creek	Low	5.41
Noble Creek	Low	4.4
Raymond Meadows Creek	Low	0.5
Eagle Creek	Low	0.96
Wolf Creek	High	11.5
Dixon Creek	No potential	0
Bull Canyon Creek	Low	1.2
Elder Creek	High	1.5
East Fork	Not provided	5.0
Total for Upper-Middle East Fork		30.47
Lower-Middle East Fork (Markleeville Creek to Silver Creek)		
Hot Springs Creek	Medium	3.8
Spratt Creek	Low	1.72
Charity Valley Creek	Medium	1.04
Pleasant Valley Creek	No potential	0
Raymond Canyon Creek	Low	0.23
Hodge Creek	Low	0.70
Jeff Davis Creek	Medium	1.7
Indian Creek	Low	1.52
East Fork	Not provided	7.0
Total for Lower-Middle East Fork		17.71
Lower East Fork (Ruhenstroth Dam to Markleeville Creek)		
Bryant Creek	Medium	4.8
Mountaineer Creek	High	5.3
Poison Creek	Low	1.8
Leviathan Creek	Low	0
East Fork	Not provided	19
Total for Lower East Fork Drainage		30.9
Total East Fork Drainage		**93.59**
West Fork Drainage		
West Fork	Not provided	18.25
Horsethief Creek	Medium	1.4
Willow Creek	Medium	1.7
Hawkins Creek	Low	1.3
Forestdale Creek	Low	1.8
Red Lake Creek	Medium	2.2
Crater Lake Creek	Low	0.63
Total West Fork Drainage		**27.28**
Total Potential LCT habitat in miles		**120.87**

Source: USFS 2006 Stream Survey Reports

*__Rating Priority__: Low: 0-2 miles potential habitat, no recovery/short-term, barriers abundant, low habitat integrity
Medium: 2-4 miles potential habitat, short-term recovery, barriers dispersed, moderate habitat integrity
High: 4+ miles potential habitat, long-term recovery, barriers scarce, high habitat integrity, metapopulation potential

According to the stream survey report for the East Fork Carson River the entire East Fork between Carson Falls and Ruhenstroth Dam should be considered potential LCT habitat. The report also recommends that the East Fork watershed upstream of Carson Falls be designated a Critical Aquatic Refuge.

4.5.2 Paiute Cutthroat Trout

The PCT was listed as endangered on October 13, 1970 and was reclassified to threatened status on July 16, 1975. The PCT are believed to be native only to the Silver King Creek drainage upstream from an impassable barrier above Snodgrass Creek but downstream from Llewellyn Falls where they occupied about 9 miles of habitat (CA F&G 2004a). According to CA F&G (2004a) they may also have been native to Corral Valley Creek and Coyote Valley Creek. In 1912 a small transplant was made by sheepherders that resulted in the establishment of a population above Llewellyn Falls. The fish were then able to establish populations in tributaries Bull Canyon and Four Mile Canyon creeks. In 1947 PCT were also transplanted into Fly Valley Creek upstream from a natural barrier.

The PCT require cool, well oxygenated waters, undercut or overhanging banks and abundant riparian vegetation (USFWS 2005). To spawn successfully they require access to flowing waters with clean gravel substrate. Paiute trout are piscivorus upon young fish, and when compared to other trout species, their populations are composed of a greater proportion of older, larger fish.

Hybridization with nonnative species is considered a primary threat to the PCT. In 1949 an inadvertent transplant(s) resulted in the hybridization with introduced rainbow trout in all locations occupied by PCT with the exception of Fly Valley Creek and the headwaters of Four Mile Canyon Creek (CA F&G 2004a). Coyote Valley, Silver King, Bull Canyon, and lower Four Mile Canyon were treated to eradicate the hybridized populations during the 1960's and 1970's and again from 1988 to 1992. These reaches were restocked with pure PCT from Fly Valley and upper Four Mile creeks. According to CA F&G (2004a), the populations have recovered to historic levels. The PCT populations downstream from Llewellyn Falls were extirpated by 1930 after years of stocking with hatchery produced rainbow trout fingerlings. Pure strains of Lahontan and Paiute cutthroat trout survived during the last century in the East Fork drainage due largely to transplants above Carson and Llewellyn Falls. No such major headwater barriers that can protect native fish are known to exist in the West Fork drainage.

Currently 11.8 stream miles are now occupied by pure strains of Paiute cutthroat trout (CA F&G 2004a): Corral Valley Creek (2.3 miles), Coyote Valley Creek (3.1. miles), Silver King Creek (2.7 miles), Four Mile Canyon Creek (1.8 miles), Fly Valley Creek (1.1 mile), Bull Canyon Creek (0.6 mile), and an unnamed tributary (0.2 mile).

A Recovery Plan was approved by USFWS on January 25, 1985 and revised in January 2005 (USFWS 2005). The first two criteria in the Revision for accomplishing the goal of delisting the species are when: 1) all nonnative salmonids are removed in Silver King Creek and its tributaries downstream of Llewellyn Falls to fish barriers in Silver King Canyon; and 2) a viable population occupies all historic habitat in Silver King Creek and its tributaries downstream of Llewellyn Falls to fish barriers in Silver King Canyon. Currently, CA F&G, USFS and the USFWS are planning to expand the population downstream to a series of inaccessible barriers in Silver King Canyon that would isolate the PCT from other trout species and greatly reduce the likelihood of an illegal introduction. Rotenone treatments would be used to eliminate hybridized trout in 6 miles of mainstem Silver King Creek, 5 miles of associated tributary streams, and Tamarack Lake. Two years of chemical treatments would occur. The

USFWS has taken over the lead for the project and is currently in the process of developing an Environmental Impact Review (EIR) as part of the CEQA process and an Environmental Impact (EIS) as part of the NEPA process. The EIR and EIS should be complete in 2008 and treatments may begin as early as fall of 2008 (Millerson 2007).

The USFWS and USFS have significantly increased benthic macroinvertebrate (BMI) monitoring in the Silver King Creek drainage in preparation for the project (Millerson 2007). The number of sampling sites has been increased 14 to 28. The size of each sampling site has also increased from 3 sq. ft. per sampling location to 8 sq. ft. The BMI monitoring will continue for approximately three years following the treatment.

4.5.3 Mountain Whitefish

Mountain Whitefish were present in all East Fork sample sections up to about Carson Falls, Markleeville and Pleasant Valley creeks, and the lower reaches of Hot Springs, Silver, and Wolf creeks (CA F&G 2004a). They were also captured in Silver King Creek upstream from the confluence with Snodgrass Creek. CA F&G (2004a) suggest that the whitefish probably inhabit several miles of stream from the confluence with the East Fork up to Silver King Canyon Falls. NDOW (2001) states that mountain whitefish were extremely abundant at the East Fork sampling site below Ruhenstroth Dam during the 2001 sampling event (227 were captured), with the majority being juveniles. NDOW suspects that since the adults migrate to and spawn below the dam that the juveniles remain in the area but do not exist much farther downstream of Ruhenstroth Dam due to the many irrigation diversions in Carson Valley. During the 2006 survey conducted by NDOW, 6 fish were collected at the Border site, 3 at the Apple Orchard site and 38 at the Ruhenstroth Dam site.

Although mountain whitefish are known to be native to the West Fork none were collected at any of the West Fork or West Fork tributary sampling locations (CAF&G 2004b). No whitefish were collected from the West Fork drainage in Nevada and it is uncertain if whitefish are still present in the Nevada portion of the West Fork.

4.5.4 Paiute Sculpin

Paiute Sculpin were found in most of the East Fork samples up to about Carson Falls and in Pleasant Valley, Hot Springs, Silver, and Wolf creeks. No sculpin were reported in surveys in the Nevada portion of the East Fork until a single sculpin was found at Sheep Bridge (3.2 miles below the state line) during both 1999 and 2001 sampling events and also one at Apple Orchard in 1999 (NDOW 2002c). During the 2006 survey conducted by NDOW, one fish was collected at the Border site.

Sculpin were collected on the West Fork in California near the state line and up to the middle reaches of the West Carson Canyon. They were not present in any of the surveys conducted in West Fork tributaries. All of the West Fork sections containing sculpin had fairly fast to turbulent flows over cobble and boulder substrates (CA F&G 2004b).

4.5.5 Mountain Sucker

Mountain suckers were captured in only one of six survey sites on the East Fork in California between Wolf Creek and Carson Falls. They were also present near the state line south of Highway 88 in Indian Creek and in Markleeville and Hot Springs creeks. Mountain suckers were found in the lower West Fork sections between state line and Highway 88. According to Sollberger (2003) they are found throughout the Nevada sampling areas. During the 2006 survey conducted by NDOW 8 fish were collected at the Border site, 11 at the Apple Orchard and 10 at the Ruhenstroth Dam site.

Electrofishing for mountain suckers produces sampling problems similar to those encountered with the Paiute sculpin. Both species are commonly found in swifter flowing areas with cobble and boulder substrates. When stunned the fish tend to stay down in the rocks and are not visible to the netters.

4.5.6 Tahoe Sucker

Tahoe suckers were not found during any of the upper East Fork surveys but two were captured from Indian Creek and one each was collected in Markleeville and Hot Springs Creeks. None have been found at the any of the lower East Fork sampling sites in Nevada since 1994. They were present on the West Fork in the low gradient reaches below Sorensen's Resort and at the head end of the West Carson Canyon. They were present in all surveys conducted on Red Lake Creek.

4.5.7 Lahontan Redside Shiner

Lahontan redside shiners were collected at only three sites in the upper East Fork drainage and were not present in the West Fork drainage. NDOW (2001) reports that 10 were collected below Ruhenstroth Dam and 21 were found at the Apple Orchard site.

4.5.8 Speckled Dace

Speckled dace were collected in all surveys on the upper East Fork from Scossa Canyon to the confluence with Silver Creek (CA F&G 2004a). They were also present in sections of Indian Creek, Markleeville, Hot Springs, Red Lake and Forestdale creeks. They were present in the lower West Fork site and Hope Valley samples, but were uncommon in the higher gradient canyon sites. During the 2001 and 2002 surveys conducted by NDOW speckled dace were found at all sampling sites in fairly abundant numbers. During the 2006 survey conducted by NDOW, 10 fish were collected at the Border site, 11 at the Apple Orchard Site, 9 at the Ruhenstroth Dam site and 2 were collected on the mainstem below Mexican Dam.

4.6 Non-native Fish Species Distribution

4.6.1 Rainbow Trout

Rainbow trout have been established in the upper East and West Fork drainages through CAF&G and Alpine County stocking programs. The species was captured at 14 of the 15 sites in the upper East Fork drainage and were present in 17 of 24 tributary streams sampled below Carson and Llewellyn Falls (CA F&G 2004a). The tributary streams not containing rainbows either contained no fish at all or have populations of LCT or PCT.

Rainbow trout found in the West Fork in California were often a combination of naturally reproduced and hatchery-origin fish (CA F&G 2004b). Rainbows were captured on the East Fork in Nevada at all NDOW sampling sites during the 2001 survey with the largest amount caught below Ruhenstroth Dam (NDOW 2001). In 2002 rainbows were reported at sites sampled in the East Fork in Nevada with the greatest amount found at the Apple Orchard site. During the 2006 survey conducted by NDOW, 5 fish were collected at the Border site, 6 at the Apple Orchard site and 18 at the Ruhenstroth Dam site. Rainbow trout are stocked in the mainstem in Nevada but there has been no evidence of self-propagation and none have been collected during fish surveys.

4.6.2 Brown Trout

Brown trout have also been established through stocking efforts. The species was present in 13 of the 15 upper East Fork sites, but is not as widely spread as the rainbow trout (CA F&G 2004a). They were not found in Bryant, Mountaineer or Leviathan creeks and were found only in the lower sites on Hot Springs and Silver Creek. Brown trout were collected in all but one of the West Fork sites from state

line through Hope Valley. They were not found upstream from the confluence of Red Lake Creek. The only tributaries found to contain brown trout were Willow Creek (lower sites) and the lowermost site on Red Lake Creek (CA F&G 2004b). Brown trout were captured at all of the lower East Fork sites in 2001 with the greatest number found below Ruhenstroth Dam (NDOW 2001). Apple Orchard has the greatest amount of brown trout during the 2002 survey by NDOW and they were also present at the Border and Sheep Bridge sites. During the 2006 survey conducted by NDOW 5 fish were collected at the Border site, 4 at Apple Orchard, and 11 at Ruhenstroth Dam. Brown trout are stocked in the mainstem but there has been no evidence that the trout are self-propagating and no fish were collected surveys.

4.6.3 Brook Trout

Brook trout were found in only one of 15 sections in the upper East Fork. East Fork tributaries that contain sustained populations include: Mountaineer Creek, Hot Springs Creek above Grove Hot Springs, upper Charity Valley Creek, upper Silver Creek, Noble Creek, Wolf Creek, and Poison Creek (CA F&G 2004a). In the West Fork drainage brook trout were present in small numbers in a middle reach of the West Fork, in greater numbers between Hope and Faith Valleys, and were abundant in Faith Valley. Brook trout dominated most West Fork tributaries and was the only species present in Horsethief Canyon Creek and the lower and upper-most sections of Willow Creek (CA F&G 2004b). Brook trout were not reported at any of the Nevada sampling locations during any of the surveys conducted by NDOW.

4.6.4 Golden Trout

Only one golden trout was collected during any of the surveys. It was found in Pleasant Valley Creek and was assumed to have migrated downstream from Raymond Lake (CA F&G 2004a).

5.0 Stocking of Fish on the Carson River

The Carson River has a history of fish stocking since the mid 1800's. NDOW (1999) states that "*Exotic fish stocking of catfish, salmon, brown and brook trout began in the 1870's to augment the declining native fish populations and many people noted that non-native species out competed the natives. By the 1880's, both native and stocked trout were rarely caught and chubs, large minnows, catfish and carp were the predominant creel*".

The primary fishes that are currently stocked in the river system are rainbow and brown trout. Stocking dates and numbers greatly depend on water quality (primarily flow rate, turbidity, and temperature), and fish availability. Survival of stocked fish is limited and stocking discontinues when summertime flows diminish and water temperatures exceed 75F. NDOW 2000 suggests that low population densities, small average sizes, and small range of sizes indicate that stocked fish rarely survive beyond their first year in the river.

5.1 East and West Fork Stocking History

Rainbow trout are stocked as fingerlings or hatchery reared catchable size fish throughout the upper East and West Forks and many of the tributary streams by CAF&G. CAF&G (2004a) states that "*Currently, stocking rainbow trout is the primarily method of sustaining sport fisheries in most of the more roadside accessible streams within the drainage."* According to Dennis Lee of CA F&G (2003) fingerlings have a higher mortality rate, but if they can survive they have a higher chance at reproduction. The catchable trout have a much lower chance of survival.

Brown trout are stocked primarily as fingerlings and are occasionally stocked as catchable-size when funds are available from Alpine County to purchase the fish from private hatcheries. CAF&G currently has no catchable size brown trout stocking program. An experimental brown trout fingerling stocking program was implemented on two miles of stream below Hangman's bridge in 1998. Approximately 10,000 unmarked brown trout fingerlings were released but the survival was poor. Brook trout are no longer part of CAF&G roadside stocking program.

Stocking on the lower East Fork in Nevada began in 1879, when McCloud Rainbow trout was stocked, and continues today. During the early years the most commonly stocked fish were rainbow and cutthroat trout. Other fishes that have been stocked include brown and brook trout, bream, crappie, yellow perch, black and white bass, smallmouth bass, and carp. A history of the fish stocking for the lower East Fork from 1879 to 1996 is provided in Appendix C. Table 5.1-1 provides information on more recent stocking efforts on the lower East Fork by NDOW.

Table 5.1-1: Recent Stocking History for the Lower East Fork

Fish Stocked	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Rainbow >8"	9,714	7,666	13,633	8,317	5,550	4,268	8,500	7,848	3,382	9.967
Brown >8"	2,220	2,001	1,575	2,220	2,916	3,780	2,902	5,100	13,655	5,565
Brown <8"	17,475	20,940	8,000	21,135	10,000	28,206	17,670	13,291	26,788	30,000
Cutthroat <8"	0	0	10,432	10,000	34,500	0	0	0	0	0
Cutbow >8"	0	0	1,539	45	115	0	0	0	0	0

Sources: NDOW 2001, 2002a, 2004a

Stocking on the East Fork by NDOW will occur during times of high angler use and when environmental conditions favor immediate trout survival (NDOW 2000). Stocking is usually done in March and April prior to spring run-off and then again in June and July at the end of the high runoff and in the winter when the water temperatures are cooler.

Upstream of Ruhenstroth Dam brown trout eggs (35,000 to 50,000) are planted annually as a result of cooperative efforts between NDOW and the High Sierra Fly Casters. In December of 2001 about 50,000 brown trout eggs were place in Vibert Boxes and buried in the gravel at Ruhenstroth Dam. It was suspected that half of the eggs hatched in February but a flood in mid-February washed the eggs and boxes downstream.

NDOW does not stock the West Fork since most adjacent land is private and inaccessible to anglers.

5.2 Main Carson River Stocking History

Rainbow and brown trout are stocked into the main Carson River primarily during spring, anticipating drought conditions and excessive water temperature during summer. Rainbow and brown trout are also stocked in early winter when discharge improves and water temperatures are cooler. Areas where the trout are released are at Dayton, Deer Run and Lloyds' bridges, Brunswick, and Ambrose Park. Table 5.2-1 provides information on the most recent stocking events on the main stem of the Carson River.

Table 5.2-1: Recent Stocking History for the Main Carson River

Fish Stocked	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Rainbow >8"	12,080	9,059	12,522	12,150	6,804	9,752	5,315	5,999	9,316	3,523
Brown >8"	7,544	2,100	5,500	4,105	5,023	8,166	9,009	7,757	9,583	2,242
Brown <8"	0	11,000	15,160	0	0	0	30,204	1,502	32,108	16,828

Source: NDOW 2001, 2002a, 2004a

5.3 Stocking History at Lahontan Reservoir

Walleye fry, wiper fingerling and adult spotted bass have been stocked in the reservoir since 1998. In 2001 and 2002 only walleye fry and wiper fingerling were stocked, with the greatest number being walleye at 675,000, wiper at 11,592 (NDOW 2002b). Table 5.3-1 provides background on stocking efforts in the reservoir**.**

Table 5.3-1: Introduced Species in Lahontan Reservoir

Common Name	Scientific Name	Year Introduced
Rainbow trout	Oncorhynchus mykiss	1936, NDOW stocking report
Brown trout *	Salmo trutta	
Lahontan Cutthroat trout*	O. clarki henshawi	1929 NDOW stocking report
Sockeye salmon*	O. nerka	1936, NDOW stocking report
Chum salmon *	O. keta	1939, NDOW stocking report
Largemouth bass	Micropterus salmoides	1930, NDOW stocking report
Smallmouth bass	M. dolomieu	1996, NDOW stocking report
Alabama spotted bass	M. punctulatus	1996, NDOW stocking report
Bluegill	Lepomus macrchirus	? Introduced from Carson River
Green sunfish	L. cyanellus	? Introduced from Carson River
White bass	Morone chrysops	
Black crappie	Pomoxis nigromaculatus	
White crappie	P. annularis	
Striped bass*	M. saxatilis	
Wipers	Striped bass x white bass	1993, NDOW stocking report
Walleye	Stizostedion vitreum	1980, NDOW stocking report
Yellow perch	Perca flavescens	
Sacramento perch	Archoplites interruptus	
Channel catfish	Ictalurus punctatus	1956, LaRivers, Fishes of NV
White catfish	Ameiurus catus	
Black bullhead	A. melas	
Brown bullhead	*A. nebulosus*	
Sacramento blackfish	*Orthodon microlepidoptus*	About 1959, Cooper, Life History of Blackfish
Fathead minnow	Pimephales vigilax	? Introduced from Truckee River (via canal)
Common carp	Cyprinus carpio	1915, Introduced from Carson River
Goldfish	*Carassius auratus*	? Bait introduction
Lahontan redside shiner	Richardsonius egregious	Native from Carson River
Lahanton tui chub	*Gila bicolor*	Native from Carson River
Mosquito fish	*Gambusia affinnis*	? Introduced from Carson River
Tahoe sucker	*Catostomus tahoensis*	Native from Carson River

* Fish no longer present Source: NDOW 2002b

6.0 Fisheries Management Strategies

The management program in California has centered mostly on habitat concerns including concerns for the yellow-legged frog and the Yosemite toad. Population surveys are not conducted on a regular basis. If resources and priorities permit, CA F&G will continue to monitor trout populations in the upper river at about 5 year intervals (Lee 2003). Volunteer angler survey reports are currently being used to follow trends in wild trout fisheries and may identify any major changes in angling quality on the upper river.

NDOW has developed a Draft Fisheries Management Plan for the East Carson River for FY 2002 – 2011 (NDOW 2000). The objective of the plan is to continue monitoring angler use and harvest and fish populations. Also, they will monitor environmental conditions such as turbidity, temperature, pH, and dissolved oxygen. Actual implementation of the plan will depend upon available funding and staff.

NDOW manages the lower East Fork Carson River as a cold-water put and take fishery. A "put and take" fishery is defined as providing fishing opportunities for hatchery stocked catchable sized fish with rapid harvest turnover in the fish population structure. NDOW (2000) states that this management strategy is implemented where there is less natural opportunity for fish to reproduce or where harvest is great in a limited resource. NDOW management strategies also include roving creek surveys at least twice a month and mail-in creel surveys collected once a year from NDOW Reno staff. Fish survival and possible wild trout production will be monitored through annual electrofishing surveys.

NDOW (2000) states several issues with regard to the physical and biological conditions in the Carson River system:

1) Little regulation of flows during high seasonal runoff.
2) Sediment pollution. Suspended silt and sand typically increases from November through June and generally exceeds water quality standards. Observations by NDOW document that extreme muddy water conditions dominate the river for nearly two months out of the year. They suggest that more information is needed regarding seasonal water temperatures and how they respond to flow rates and air temperatures.
3) Acid runoff and heavy metals leaching from tailings are still great concern in the East Fork;
4) Poor water quality resulting from orthophosphate, ammonia and nitrate and mercury within the water column.

7.0 Benthic Macroinvertebrate Populations

Several programs are currently being conducted to look at the benthic macroinvertebrate (BMI) populations in the watershed. Both California and Nevada are planning to develop indexes of biological integrity (IBI)'s for the Carson River. The following paragraphs discuss the studies that have been conducted in the past or are currently in progress.

In 1995 the Lahontan Regional Water Quality Control Board (LRWQCB) began a stream bioassessment program in order to monitor the success of remediation efforts at Leviathan Mine. In 1999, these efforts were expanded into a region-wide bioassessment program. The objectives of this program are:

1) to establish regional reference conditions;

2) to assess the impacts of human activities on the biological integrity of streams and rivers;

3) to evaluate the effectiveness of restoration efforts, best management practices implementation, and permit conditions; and

4) to develop narrative and numeric biocriteria or Index of Biological Integrity (IBI) for the eastern Sierra Ecoregion.

Sites that are being sampled as part of this program in the upper Carson Watershed are shown in the following table:

Table 7.0-1: Bioassessment Sites for Lahontan Regional Water Quality Control Board Program

Site Name	Reference Site		Year(s) Sampled			
	Yes	No	1999	2000	2001	2002
West Fork Drainage						
West Fork, lower BLM		x	x			
West Fork, upper Faith Valley	x		x			
Willow Creek	x		x			
Forestdale Creek		x	x			
Red Lake Creek	x		x			
East Fork Drainage						
Upper Leviathan Creek	x		x			
Heenan Creek	x		x			
Upper Indian Creek		x	x			
Lower Noble Creek	x		x			
Silver Creek	x		x			
Bagley Valley Creek (control)		x	x			x
Bagley Valley Creek, meadow		x	x			
Bagley Valley Creek, restoration project	x					x
Silver King Creek, above valley	x			x		
Tributary above Silver King Cr	x			x		x
Wolf Creek, above trailhead	x			x		
Spratt Creek, above road crossing	x			x		
East Fork, above Bagley Valley	x			x		
Hot Springs, above Grover SP	x				x	
Lower Dixon Creek, above trail	x					x

Source: Sierra Nevada Aquatic Research Laboratory (2003)

According to David Herbst of Sierra Nevada Aquatic Research Laboratory of the University of California the model of biological water quality standards for the Lahontan region should be ready in the near future. This will include streams within the Upper Carson River Watershed but no specific reports will be generated on the BMI for the Carson River (Herbst 2005).

A report has been prepared on the status of bioassessment monitoring in the Leviathan Mine Watershed. This report entitled "Bioassessment Monitoring of Acid Mine Drainage Impacts to Streams of the Leviathan Mine Watershed: An Update for 2003 Surveys" (SNARL 2004) states that

over 20,000 individual organisms were counted and identified, comprised of 149 taxa. Sites samples as part of this assessment are showing signs of recovery and progressive improvement in the biological integrity on Aspen and Leviathan Creek below the mine site is being seen.

In 2002 USGS published a report that provided data for BMI populations for the Carson and Truckee Rivers. Data was collected from the Carson sites during the periods of August to September 1993, July 1994, and September 1995. This assessment was prepared as part of the National Water-Quality Assessment Program.

One of NDOW's objectives is to sample BMI three times a year in the lower East Fork to observe densities, composition, and impacts from Leviathan Mine run-off and high flows. NDOW has been collecting BMI samples at Sheep Bridge or Apple Orchard during the Fall since 1994 (NDOW 2000). According to NDOW (2000) important trout prey (Ephemeroptera, Plecoptera, and Tricoptera) are well represented. Species richness appears to be greater in the lower East Fork than the mainstem, however the total invertebrate abundance in the East Fork is usually half that found in the main Carson River near Carson City and Dayton. Species richness refers to the diversity of the species represented whereas species abundance refers to the actual number of individuals present regardless of species. So if you have an environmental that has great numbers of pollution tolerant species (like the mainstem Carson River) the overall abundance will be higher but the richness or diversity will be lower. More diverse or rich environments are typically considered to be healthier.

The most recent sampling events conducted by NDOW were in 2002 and 2003 from the Stateline to Ruhenstroth Dam (NDOW 2002, 2003). The common species were caddis flies, mayflies, and stoneflies. Other species collected included beetle and dipteran. Yearly average BMI densities showed no significant difference by site. However, during the 2002 survey January and September sampling densities were lower at Apple Orchard than the other sites. NDOW suggests that this site could be experiencing negative impacts from Leviathan Mine. Density was highest at the Ruhenstroth site in January and September, 2002 but had the lowest density of the three sites in July. For both years the lowest densities were found in July. High spring run-off and high turbidity are suspected to be the cause.

Sampling was conducted in 2001 on the East Fork by NDOW at the Border, Apple Orchard and Ruhenstroth sites. The site above Ruhenstroth Dam showed a greater composition, especially caddis flies. Total abundance was also greater at this site. NDOW 2000 states that a study was conducted to examine the in-channel and riparian zone habitat. This study found that the quality of substrate diminishes slightly downstream of the Ruhenstroth Dam site. Differences include larger size gravel and more compacted substrates upstream than downstream. In addition, the more downstream sites have an increase in fine, sandy sediment.

The NDEP has been sampling macroinvertebrate populations annually from Stateline at the East/West Forks down to Lahontan Reservoir since 2000 (Vargas 2004). NDEP has 22 sampling sites in the Carson Basin; four sites on the East Fork, two sites on the West Fork and 8 sites above Lahontan Reservoir on the main stem Carson River. The sampling sites are provided in Table 7.0-2. The remainder of the sites are located on smaller tributaries to the Carson River. In addition to macroinvertebrates collections, the NDEP also considers water chemistry, land use, and physical habitat in their annual surveys. Using the above mentioned surveys, the NDEP has contracted with the Ecological Division of Tetra Tech to develop a macroinvertebrate IBI and a physical habitat index from Stateline on the East and West Forks and the mainstem above Lahtontan Reservoir. The intent of

the IBIs is to begin the process of developing the necessary tools to be used in evaluating the overall aquatic health and physical habitat for the Carson River in Nevada.

Table 7.0-2 : Carson Basin NDEP Macroinvertebrate Sampling Sites

Waterbody Name	Location
West Fork Carson River	Paynesville, Ca
	Above confluence with East Fork
East Fork Carson River	Above Bryant Creek
	Above Riverview Mobile Home Park (near old dam)
	Above Lutheran Bridge (Waterloo Lane)
	Above confluence with West Fork
Bryant Creek	Upper Bryant Creek above Doud Srings Confluence
Bryant Creek	Lower Bryant Creek above confluence with East Fork Carson River
Main Carson River	Above US Highway 395 above Cradlebaugh Bridge
	South of the State Prison property
	Above Lloyd's Bridge (Eagle Valley)
	Near Moundhouse (lower Carson Canyon)
	Below Brunswick Canyon Road (upper Carson Canyon)
	Above Dayton Bridge
	Below Dayton (Glancy property)
	Below Weeks Bridge at the State Park
Daggett Creek	Upper Daggett Creek above upper Kingsbury Grade Highway
	Lower Daggett Creek above Foothill Road
Clear Creek	Upper Clear Creek on Clear Creek Road
	Lower Clear Creek adjacent to State Prison
Kings Canyon	North Kings Canyon above residential area
Ash Canyon	Upper Ash Canyon
	Lower Ash Canyon near USGS gage

In addition to the macroinvertebrate and physical habitat index development, the NDEP in coordination with the Pyramid Lake Paiute Tribe, contracted with Robert Hughes, Oregon State University to develop an Eastern Sierra Fish IBI. This index is currently in draft form. The NDEP is anticipating that this index will be useful in evaluating the fish biological integrity for the Truckee, Carson and Walker Rivers. The NDEP, in coordination with NDOW, is anticipating they will begin the process of evaluating the index in the near future (Vargas 2004).

8.0 Amphibian Populations

NDOW conducted amphibian surveys four times during July 1, 2003 to July 31, 2004. The objective of the surveys was to inventory amphibians in the Middle Carson River from Cradlebaugh Bridge to Deer Run Road Bridge for approximately 13.5 river miles (NDOW 2004). Frogs that were noted included Pacific chorus frogs, western toads and bullfrogs.

During their stream habitat surveys conducted in 2005 the USFS surveyed any suitable amphibian habitat within the Golden Canyon Creek watershed for the presence of mountain yellow-legged frogs (MYLF) and Yosemite toads (YT) (USFS 2005). No suitable habitat for MYLF was found in the watershed and minimal habitat for YT was found. No MYLF or YT were found, although the report does note that if YT were present they would be very difficult to detect within the heavily vegetated areas.

9.0 Special Designations for Upper Watershed

The Upper East Fork Carson River was one of the original six canyon streams designated as Wild Trout waters. This designation is not due to exceptional trout populations but to help maintain wilderness fishing experiences. There are three designated trout waters within the East Fork Drainage: 1) The East Fork from Wolf Creek to Carson Falls (a trailside Wild Trout Stream), 2) Heenan Lake (a combination Heritage and Catch and release water), and 3) the East Fork from Hangman's Bridge to the Nevada Stateline (a trailside Catch and Release Stream).

The Watershed Management Initiative (WMI) 2002, developed by the California State Water Resources Control Board, states that a segment of the East Fork between Hangman's Bridge and the Nevada state line is designated as a State Wild and Scenic River and that the U.S. Forest Service is studying some reaches of the East Fork in California for possible inclusion in the federal Wild and Scenic River system.

The WMI also states that the East Fork Carson River has been recognized as a potential "Aquatic Diversity Management Area", and its tributaries, Silver King Creek above Llewelyn Falls and Whitecliff Lake as "Significant Natural Areas (Aquatic). According to the Sierra Nevada Ecosystem Project the East and West Forks were given an "Index of Biological Integrity (IBI) score, based on the diversity of aquatic communities, in the "good" range.

The Pacific Rivers Council in 1998 identified the East Fork as an Aquatic Diversity Area due to the presence of eight native fish species and the mountain yellow legged frog. The East Fork above Carson Falls, Murray Canyon, and Poison Flat Creeks were identified in the WMI as "Critical Refuges" for LTC. Silver King, Corral Valley, and Coyote Valley Creeks have been identified as "Critical Refuges" for the PCT.

9.0 REFERENCES CITED

Dayton Courier. 2007. "*Dayton Man Catches Wiper Bass in Lahontan – Could Set World Record*". Karren Rhodes, 8/29/07

Hannigan, Robin Ph.D. 2005. Species Update by Age and Growth. Arkansas State University, accessed on May 6. http://www.cas.astate.edu.geochemistry.

Herbst, David, Ph.D. 2005. Sierra Nevada Aquatic Research Laboratory, University of California. Personnel communication via email with Genie Azad, May 10.

Horton, G. 1997. *Carson River Chronology: A Chronology History of the Carson River and Related Water Issues.* Prepared for the Nevada Division of Water Resources.

Kling, Jason & Brian Hodge. 2006. Presentation: Carson River Watershed 2006 Stream Habitat Survey Results. USFS Carson Ranger District: Humboldt-Toiyabe National Forest.

Lee, Dennis. 2003. California Department of Fish and Game. Personnel communication with Genie Azad on November 19.

Millerson, Chad. 2007. U.S. Fish and Wildlife Service. Personnal communication with Genie Azad on November 20.

Nevada Division of Environmental Protection (NDEP). 2004. History of Carson River Water Quality Standards. December.

Nevada Department of Wildlife (NDOW). 1998. Report on Carson River Fisheries by Pat Sollberger, January.

NDOW. 1999. Historical Records for the Carson River Fisheries. Memorandum dated July 30, 1999.

NDOW. 2000. East Carson River Draft Fisheries Management Plan. Federal Aid Project No. 03-20-A1.

NDOW. 2001. East and Main Carson Rivers Federal Aid Job Progress Report. F-20-36.

NDOW. 2002a. East and Main Carson Rivers Federal Aid Job Progress Report. F-20-37.

NDOW. 2002b. Lahontan Reservoir Federal Aid Job Progress Report. F-20-37.

NDOW. 2002c. Correspondence between NDOW and CA F&G dated May 1, 2002.

NDOW. 2003. East and Main Carson Rivers Federal Aid Job Progress Report. F-20-38

NDOW. 2004a. 2002 – 2004 Field Sheets for Fish Stocking in East Fork and Main Carson River.

NDOW. 2004b. Carson River Amphibian Survey Field Trip Report.

NDOW. 2006. Data from 2006 Electroshocking Survey Field Sheets

Sierra Nevada Aquatic Research Laboratory (SNARL). 2004. Bioassessment Monitoring of Acid Mine Drainage Impacts in Streams of the Leviathan Mine Watershed: An Update for 2003 Surveys-Final Report to the Lahontan Regional Water Quality Control Board, October 24.

Sollberger, Pat. 2003. Fisheries Biologist, NDOW. Personnel communicaton with Genie Azad November 6.

State of California Department of Fish and Game (CAF&G). 2000. Leviathan Mine Natural Resources Damage Assessment Phase I Fisheries Assessment.

CAF&G. 2004a. Survey of Fish Populations in Streams of the East Fork Carson River Drainage, California. Fisheries Programs Branch Administrative Report No. 2004-8.

CAF&G. 2004b. Survey of Fish Populations in West Fork Carson River Drainage Streams, California. Fisheries Programs Branch Administrative Report No. 2004-1.

U.S. Fish and Wildlife Service (USFWS). 1995. Recovery Plan for the Lahontan Cutthroat Trout. U.S. Fish and Wildlife Service Region 1, Portland Oregon.

USFWS. 2001. Fish Population Dynamics and Concentrations of Selected Trace-Elements in Salmonid Tissues and Aquatic Invertebrates, Lower Bryant Creek and East Fork Carson River, Douglas County, Nevada.

USFWS. 2005. Recovery Plan for the Paiute Cutthroat Trout Region 1, Portland Oregon. Original approved: January 25, 1985 Revised approved: January 30, 2005.

U.S. Forest Service (USFS). 2005. Golden Canyon Creek, 2005 Stream & Riparian Habitat Survey Report. Carson Ranger District: Humboldt-Toiyabe National Forest.

USFS. 2006. Stream Habitat Survey Report Series. Carson Ranger District: Humboldt-Toiyabe National Forest.

U.S. Geological Service (USGS). 2002. Physical Data and Biological Data for Algae, Aquatic Invertebrates, and Fish from Selected Reaches on the Carson and Truckee Rivers, Nevada and California 1993-97. Open File Report 02-012.

Vargas, Karen. 2004. Bioassessment Coordinator, Nevada Division of Environmental Protection (NDEP), Water Quality Planning Bureau. Personnel communication with Genie Azad January 22.

APPENDICES

Appendix A

Table 1: Estimated Native Fish Densities by Reach in Carson River and Tributaries

Table 2: Estimated Non-Native Fish Densities by Reach in Carson River and Tributaries

Appendix B Fish Population Sampling Locations

Figure 1: Upper East Fork in California

Figure 2: Upper West Fork in California

Figure 3: Lower East Fork in Nevada

Appendix C History of Fish Stocking for the East Fork of the Carson River

Appendix A
Fish Densities by Reach for Native and Non-native Species

Table 1: Estimated Native Fish Densities by Reach in Carson River and Tributaries
Table 2: Estimated Non-Native Fish Densities by Reach in Carson River and Tributaries

Table 1: **Estimated Native Fish Densities (fish per mile) by Reach in Upper Carson River and Tributaries (Based on most current fish surveys)**

Reach	Survey Date	LCT	PCT	MW	PS	MS	TS	LRS	SD	TOTAL
CA-E-1[1] (Stateline to Hangman's)	1988	0	0	1,397	161	13,305	0	208	40,412	55,483
CA-E-2[1] (Hangmans to Wolf Creek)	1994	0	0	1,122	199	0	0	24	964	2,309
CA-E-3 [1](Wolf Creek to Carson Falls)	1996	16	0	21	1,056	0	0	0	0	1,077
CA-E-4 [1] (Above Carson Falls)	1989	202	0	0	0	0	0	0	0	202
Bryant Creek[1]	1998	0	0	0	0	0	0	0	0	0
Mountaineer Creek[1]	1998	0	0	0	0	0	0	0	0	0
Leviathan Creek[1]	1998	17	0	0	0	0	0	0	0	17
Markleeville Creek[1]	1995	0	0	25	0	135	12	0	4,724	4,896
Pleasant Valley Creek[1]	1995	0	0	0	1,077	0	14	0	0	1,091
Hot Springs Creek[1]	1995	0	0	18	909	0	0	0	37	964
Spratt Creek[1]	1983	0	0	0	0	0	0	0	0	0
Silver Creek[1]	1995	0	0	0	398	0	0	0	0	398
Wolf Creek[1]	1994	0	0	15	0	0	0	0	0	15
Silver King Creek[1]	1990	0	772	0	0	0	0	0	0	772
Corral Valley Creek[1]	1997	0	116	0	0	0	0	0	0	116
Coyote Valley Creek	1997	0	698	0	0	0	0	0	0	698
Bull Canyon Creek[1]	1990	0	306	0	0	0	0	0	0	306
Four Mile Creek[1]	1997	0	227	0	0	0	0	0	0	227
Fly Valley Creek[1]	1998	0	190	0	0	0	0	0	0	190
Poison Flat Creek[1]	1981	869	0	0	0	0	0	0	0	869
Murray Canyon Creek[1]	1981	241	0	0	0	0	0	0	0	241
CA-W-1[2] (Stateline to Woodfords)	1995	0	0	0	2,191	200	133	0	1,158	3,682
CA-W-2[2] (Woodfords to Hope Valley)	1996	0	0	0	0	0	705	0	0	705
CA-W-3[2] (Hope Valley)	1991	0	0	0	0	0	4,410	0	79,594	84,004
CA-W-4[2] (Hope Valley to Faith Valley)	1993	0	0	0	0	0	0	0	0	0
CA-W-5[2] (Faith Valley)	1993	14	0	0	0	0	0	0	29	43
Horsethief Canyon Creek[2]	1993	0	0	0	0	0	0	0	0	0
Willow Creek[2]	1994	0	0	0	0	0	0	0	0	0
Red Lake Creek[2]	1995	10	0	0	0	0	263	0	300	573
Forestdale Creek[2]	1993	0	0	0	0	0	0	0	20	20
NV-Border[4]	2006	0	0	28.7	4.78	38.3	14.3	0	387.4	473.48
NV-Apple Orchard[4]	2006	0	0	25.3	0	160.2	0	0	92.8	278.3
NV-Sheep Bridge[3]	2003	0	0	217.7	0	532.2	0	6	266.1	1,022
NV-Ruhenstroth Dam[4]	2006	0	0	189.1	0	154.3	0	89.6	94.5	527.5
TOTALS		1369	2309	3,058.8	5,995.78	14,525	5,551.3	327.6	128,078.8	161,199.28

Notes:
CA - California
E – East Fork Carson River
LCT – Lahontan Cutthroat Trout
LRS – Lahontan Redside Shiner
MS – Mountain Sucker
MW – Mountain Whitefish
NV - Nevada
PCT – Paiute Cutthroat Trout
PS – PaiuteSculpin
SD – Speckled Dace
TS – Tahoe Sucker
W – West Fork Carson River
[1] – Data from CAF&G 2003a, appendix tables 1 and 9
[2] – Data from CA F&G 2003b, appendix tables 1 and 8
[3] – Data from NDOW 2003 field sheets and personnel communication with Pat Sollberger 3/2004
[4] – Data from NDOW 2006 field sheets
CA-E-1: California/Nevada Stateline to Hangman's Bridge, East Fork, Sections 8 and 13
CA-E-2: Hangman's Bridge to Wolf Creek, East Fork, Sections 2, 3, 12, 13
CA-E-3: Wolf Creek to Carson Falls, East Fork, Sections 4,5, 6, 14
CA-E-4: Above Carson Falls, East Fork, Section 15
CA-W-1: California/Nevada Stateline to Woodfords, West Fork, Sections 8 and 13
CA-W-2: Woodfords to Hope Valley, West Fork, Sections 2, 11, 14, 15, 16, 17
CA-W-3: Hope Valley, West Fork, Sections 1, 3, 4, 5, 6, 7
CA-W-4: Hope Valley to Faith Valley, West Fork, Section 9
CA-W-5: Faith Valley, West Fork, Section 10

Please Note: Sampling methods may vary between agencies.

Table 2: Estimated Non-Native Fish Densities (fish per mile) by Reach in Upper Carson River and Tributaries (based on most current fish surveys)

Reach	Survey (year)	Rainbow Trout	Brown Trout	Brook Trout	Total
CA-E-1[1] (Stateline to Hangman's)	1988	424	1,097	0	1,521
CA-E-2[1] (Hangman's to Wolf Creek)	1994	39	113	0	152
CA-E-3 [1] (Wolf Creek to Carson Falls)	1996	178	188	913	1,279
CA-E-4 [1] (Above Carson Falls)	1989	0	0	0	0
Bryant Creek[1]	1998	64	0	16	80
Mountaineer Creek[1]	1998	2,356	0	460	2,816
Leviathan Creek[1]	1998	756	0	0	756
Markleeville Creek[1]	1995	243	163	0	406
Pleasant Valley Creek[1]	1995	114	182	0	296
Hot Springs Creek[1]	1995	718	0	50	768
Spratt Creek[1]	1983	1,267	0	0	1,267
Silver Creek[1]	1995	281	0	0	281
Wolf Creek[1]	1994	663	0	377	1,040
Silver King Creek[1]	1990	0	0	0	0
Corral Valley Creek[1]	1997	0	0	0	0
Coyote Valley Creek[1]	1997	0	0	0	0
Bull Canyon Creek[1]	1990	0	0	0	0
Four Mile Creek[1]	1997	0	0	0	0
Fly Valley Creek[1]	1998	0	0	0	0
Poison Flat Creek[1]	1981	0	0	0	0
Murray Canyon Creek[1]	1981	0	0	0	0
CA-W-1[2] (Stateline to Woodfords)	1995	812	282	0	1,094
CA-W-2[2] (Woodfords to Hope Valley)	1996	307	836	53	1,196
CA-W-3[2] (Hope Valley)	1991	120	903	0	1,023
CA-W-4[2] (Hope Valley to Faith Valley)	1993	36	0	424	460
CA-W-5[2] (Faith Valley)	1993	0	0	4,666	4,666
Horsethief Canyon Creek[2]	1993	0	0	3,489	3,489
Willow Creek[2]	1994	205	15	1,721	1,941
Red Lake Creek[2]	1995	210	0	719	929
Forestdale Creek[2]	1993	39	0	5,338	5,377
NV-Border[4]	2006	23.9	23.9	0	47.8
NV-Apple Orchard[4]	2006	50.6	33.7	0	84.3
NV-Sheep Bridge[3]	2003	12 (*6)	98.8 (*32.3)	0	110.8
NV-Ruhenstroth Dam[4]	2006	89.6	59.7	0	149.3
TOTALS		9,008.1	3,995.1	18,226	31,229.2

Notes:
* Documented wild fish (only applies to NV estimates; not documented in CAF&G data))
CA - California
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MS – Mountain Sucker
MW – Mountain Whitefish
NV - Nevada
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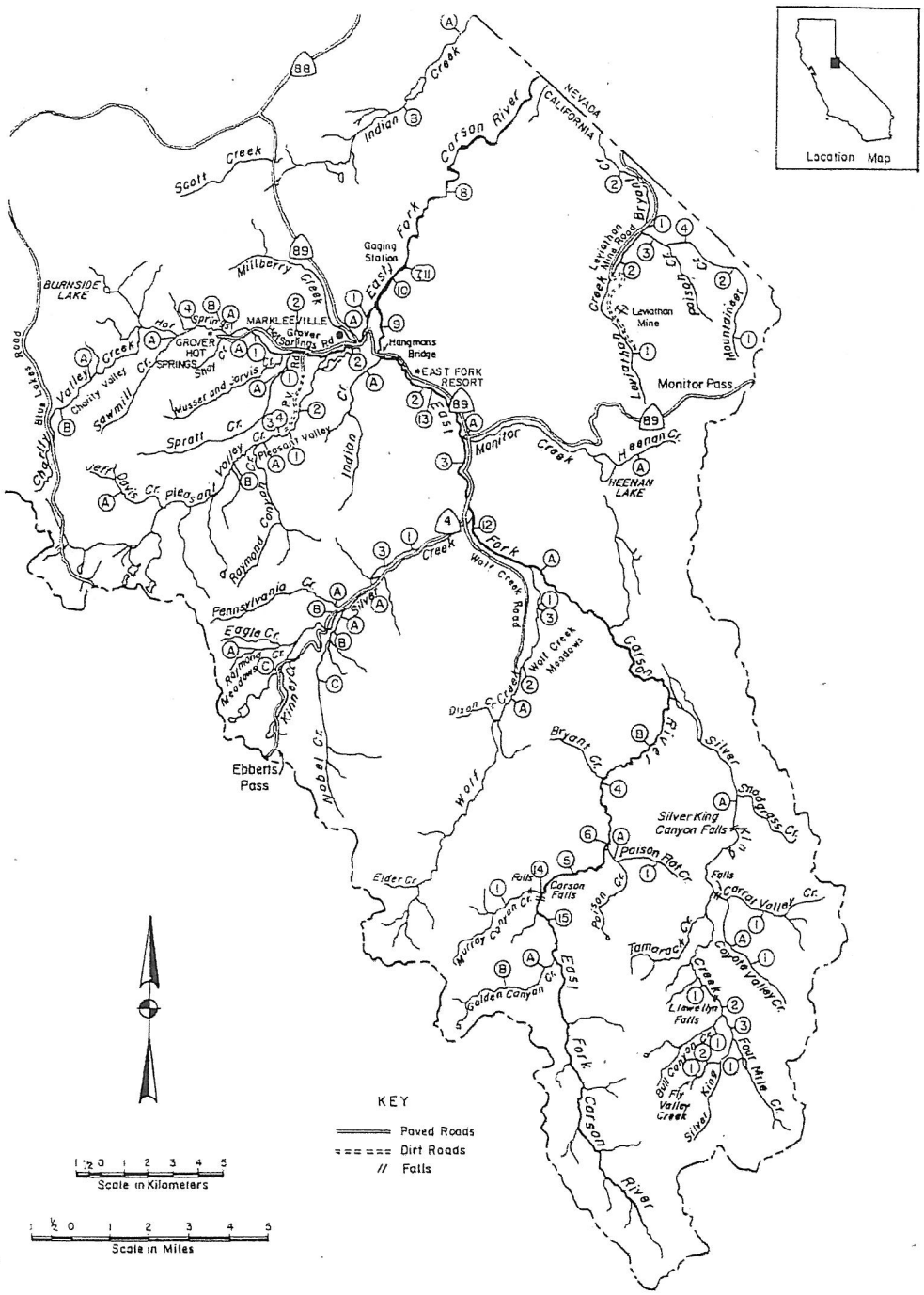
CA-W-2: Woodfords to Hope Valley, West Fork, Sections 2, 11, 14, 15, 16, 17
CA-W-3: Hope Valley, West Fork, Sections 1, 3, 4, 5, 6, 7
CA-W-4: Hope Valley to Faith Valley, West Fork, Section 9
CA-W-5: Faith Valley, West Fork, Section 10

Please note: Sampling methods may vary between agencies.

Appendix B
Fish Population Sampling Locations

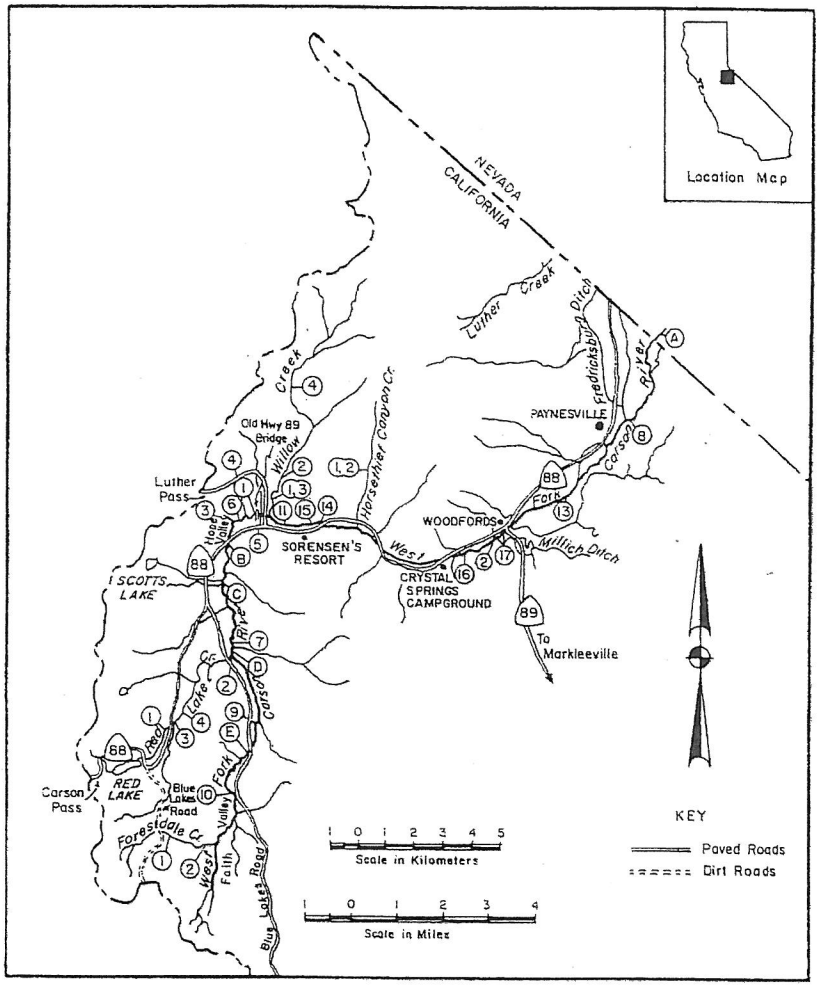
Figure 1: Upper East Fork in California
Figure 2: Upper West Fork in California
Figure 3: Lower East Fork in Nevada

Figure 1: California Fish and Game Sampling Locations on East Fork



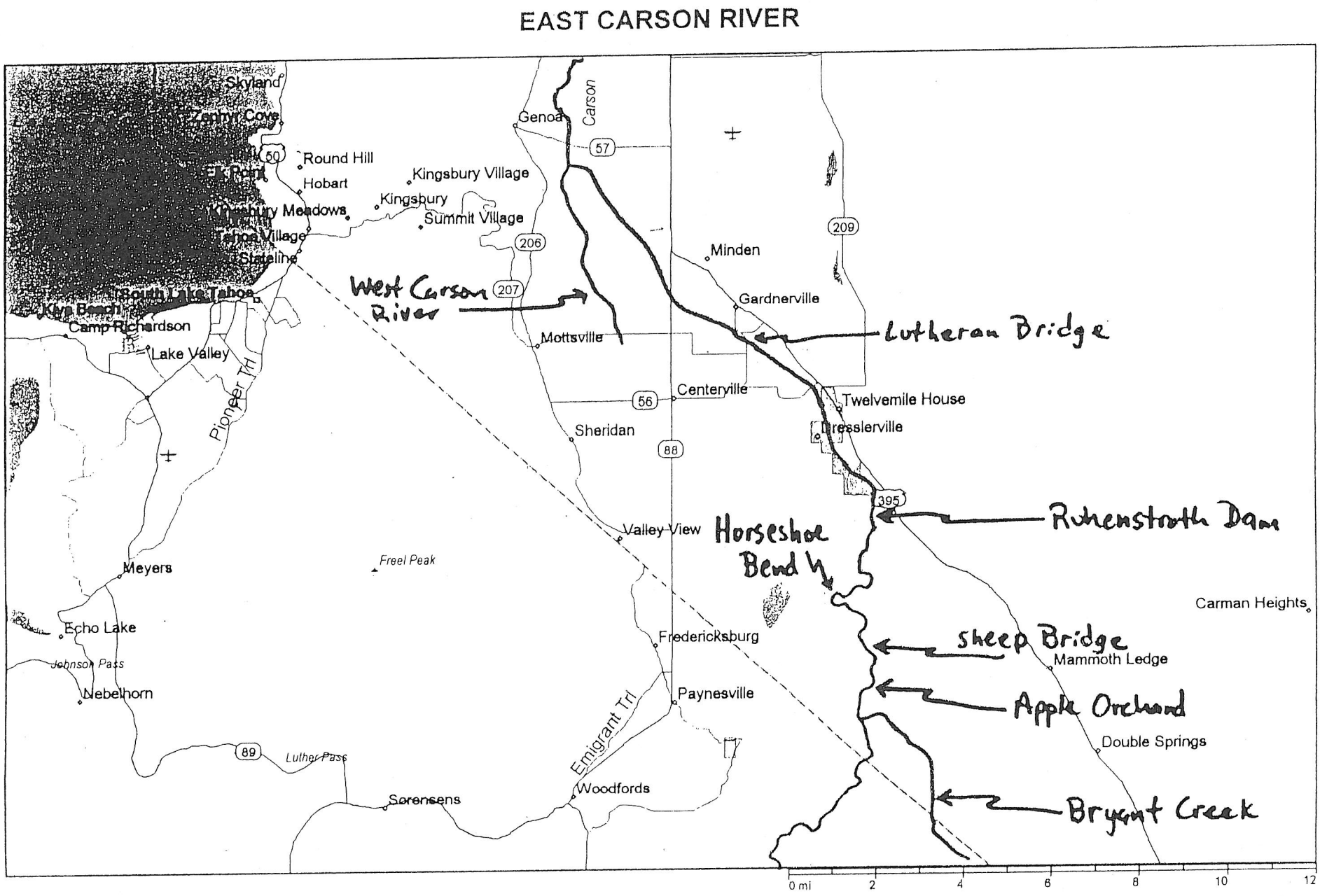
Highways, streams, fish population sample sections, and other East Fork Carson River drainage landmarks.

Figure 2: California Fish and Game Sampling Locations on West Fork



.. Survey sites on the West Fork Carson River and tributaries.

Figure 3: Nevada Department of Wildlife Sampling Site on East Fork



Appendix C

History of Fish Stocking for the East Fork of the Carson River

HISTORY OF FISH STOCKING
IN THE EAST FORK OF THE CARSON RIVER, NV

Fish stocking in the east fork of the Carson River possibly begin in 1879 . Records from 1879 to 1948 are stated as summarized by the Commission for Douglas County. The remaining stocking records are summarized from various reports.

YEAR	*TYPE OF FISH*	*NUMBER*	*COUNTY*	*WATER*
1879	McCloud rainbow	unknown	unknown	Carson R.
1880	McCloud rainbow	unknown	unknown	Carson R.
1883	brook trout	unknown	unknown	Carson R.
	white bass	unknown	unknown	Carson R.
1885	trout fry	55,000	Douglas	Carson R.
1887	cutthroat /brook trout	75,000	Douglas	Upper Carson
	black bass	unknown	unknown	Carson R.
1891	brook trout	120,000	unknown	Carson R.
	Atlantic salmon (?)	2,500	unknown	Carson R.
1892	brook trout	75,000	unknown	Carson R.
	Atlantic salmon	4,000	unknown	Carson R.
1893	rainbow trout fry	100,000	unknown	Carson R.
1894	rainbow trout fry	100,000	unknown	Carson R.
1895	rainbow/brook trout fry	91,765	Douglas	Carson R.
1896	rainbow/brook trout fry	40,000	Douglas	Carson R.
	trout fry	62,100	unknown	Carson R.
1907	black bass	150	Douglas	Carson R.
1911	rainbow trout	12,000	Douglas	Carson R.
	cutthroat trout hybrid	10,000	Douglas	Carson R.
	blackspotted trout	6,000	Douglas	Carson R.
1913	rainbow trout fry	10,000	Douglas	East Carson R.
	blackspotted trout fry	42,000	Douglas	Carson R.
1914	rainbow trout fry	7,500	Douglas	East Carson R.
	blackspotted trout fry	10,800	Douglas	East Carson R.
1915	rainbow trout fry	25,000	Douglas	Carson R.
	blackspotted trout	25,000	Douglas	Carson R.
1917	rainbow trout	45,000	Douglas	Carson R.
	blackspotted trout	20,000	Douglas	Carson R.
1918	rainbow trout	20,000	Douglas	Carson R.
	blackspotted trout	120,000	Douglas	Carson R.
1919	rainbow trout	70,000	Douglas	Carson R.
	blackspotted trout	40,000	Douglas	Carson R.
1920	rainbow trout	80,000	Douglas	Carson R.
	blackspotted trout	95,000	Douglas	Carson R.
1921	rainbow trout	40,000	Douglas	Carson R.

YEAR	*TYPE OF FISH*	*NUMBER*	*COUNTY*	*WATER*
1921	blackspotted trout	225,000	Douglas	Carson R.
1923	rainbow trout	107,000	Douglas	Carson R.
	blackspotted trout	165,000	Douglas	Carson R.
1924	rainbow trout	40,000	Douglas	Carson R.
	blackspotted trout	168,000	Douglas	Carson R.

In 1925, hatcheries reared fish to a larger size for stocking. There is no indication to what size fish were reared, but judging by the total number stocked, most were probably fingerling size. It is assumed that trout stocked previously were mostly, if not all, fry.

1925	rainbow trout	138,000	Douglas	Carson R.
	brook trout	2,500	Douglas	Carson R.
1926	rainbow trout	112,500	Douglas	Carson R.
	brook trout	7,500	Douglas	Carson R.
1930	bream	640	Douglas	Carson R.
	crappie	500	Douglas	Carson R.
	yellow perch	27	Douglas	Carson R.
	black bass	500	Douglas	Carson R.
1931	unknown	211,559	Douglas	unknown
1932	unknown	132,816	Douglas	unknown
1933	unknown	345,500	Douglas	unknown
1934-35	rainbow trout	82,000	Douglas	unknown
	brook trout	76,500	Douglas	unknown
1936-37	rainbow trout	235,000	Douglas	unknown
	brook trout	76,500	Douglas	unknown
1938	rainbow trout	70,000	Douglas	unknown
	brook trout	60,000	Douglas	unknown
	sockeye salmon	100,000	Douglas	unknown
1939	rainbow trout	105,000	Douglas	unknown
1940	rainbow trout	175,000	Douglas	unknown
	brook trout	30,000	Douglas	unknown
1941	rainbow trout	175,000	Douglas	unknown
	brook trout	45,000	Douglas	unknown
	brown tr. (Lock Leven)	61,000	Douglas	unknown
1942	rainbow trout	187,000	Douglas	unknown
1943	rainbow trout	190,000	Douglas	unknown
1944	rainbow trout	185,000	Douglas	unknown
1945	rainbow trout	150,000	Douglas	unknown
1946	rainbow trout	205,392	Douglas	unknown
	blackspotted trout	75,000	Douglas	unknown
1947	rainbow trout	180,000	Douglas	unknown
	blackspotted trout	100,000	Douglas	unknown

YEAR	*TYPE OF FISH*	*NUMBER*	*COUNTY*	*WATER*
1948	rainbow trout	95,000	Douglas	unknown

Beginning in 1949, fish sizes are noted in reports. To simplify, fish sizes are classified accordingly: 0 (eggs), 1 (0.5-1.9 in.), 2 (2-5.9 in.), 3 (6-9.9 in.), and 4 (10 in. and larger).

1949	rainbow - 2	28,750	Douglas	E.Carson R.
	rainbow - 3	1,500	Douglas	E.Carson R.
	cutthroat - 3	19,000	Douglas	E.Carson R.
	brown - 2	14,220	Douglas	E.Carson R.
1950	rainbow - 2	9,300	Douglas	E.Carson R.
	rainbow - 3	6,800	Douglas	E.Carson R.
	blackspotted - 3	7,000	Douglas	E.Carson R.
	brown - 2	7,000	Douglas	E.Carson R.
1951	rainbow - 1	24,400	Douglas	E.Carson R.
	rainbow - 2	1,260	Douglas	E.Carson R.
	rainbow - 3	29,400	Douglas	E.Carson R.
1952	rainbow - 2	64,500	Douglas	E.Carson R.
	rainbow - 3	9,728	Douglas	E.Carson R.
	cutthroat - 2	3,900	Douglas	E.Carson R.
1953	rainbow - 2	14,466	Douglas	E.Carson R.
	rainbow - 3	20,558	Douglas	E.Carson R.
1954	rainbow - 3	24,317	Douglas	E.Carson R.
	rainbow - 4	4,362	Douglas	E.Carson R.
	brown - 3	2,864	Douglas	E.Carson R.
1955	rainbow - 3	19,223	Douglas	E.Carson R.
	rainbow - 4	1,353	Douglas	E.Carson R.
1956	rainbow - 3,4	25,251	Douglas	E.Carson R.
1957	rainbow - 3,4	9,025	Douglas	E.Carson R.
	brown - 3,4	5,270	Douglas	E.Carson R.

No stocking records for the East Carson River were found from 1958 to 1965.

YEAR	*TYPE OF FISH*	*NUMBER*	*AREAS STOCKED ON E.CARSON R.*
1966	rainbow - 3	13,111	Ruhenstroth, Horseshoe, Sheep Brdg.
	rainbow - 3	861	River Ranch
	brown - 2	23,620	Ruhenstroth, Sheep Brdg.
	brown - 3	1,348	Horeshoe Bend
1967	rainbow - 3	4,972	Ruhenstroth, Horseshoe, Sheep Brdg.

YEAR	TYPE OF FISH	NUMBER	AREAS STOCKED ON E. CARSON R.
1967	rainbow - 4	7,333	Ruhenstroth, Horseshoe, Sheep Brdg.
	brown - 3	1,200	Ruhenstroth, Horseshoe, Sheep Brdg.
1968	rainbow - 3,4	10,088	Sheep Bridge
	rainbow - 3,4	5,506	Horseshoe Bend
	rainbow - 3,4	3,869	Ruhenstroth Dam
	rainbow - 3	2,154	at Bryant Creek
	brown - 3	1,281	Sheep Bridge
	brown - 3	610	Ruhenstroth Dam
	brown - 3	1,598	at Bryant Creek
1969	rainbow - 3,4	7,606	Sheep Bridge
	rainbow - 3,4	4,225	Ruhenstroth Dam
	rainbow - 3,4	3,098	Youngs Crossing
	rainbow - 3,4	1,795	Park
	rainbow - 3,4	126	at Allerman Canal
	brown - 3	2,963	unknown
1970	rainbow - 3	8,057	Youngs Crossing
	rainbow - 3	1,200	Apple Orchard
	rainbow - 3	9,596	Sheep Bridge
	rainbow - 3	6,973	Ruhenstroth Dam
1971	rainbow - 3	6,402	Apple Orchard
	rainbow - 3	6,855	Sheep Bridge
	rainbow - 3	4,500	Ruhenstroth Dam
	brown - 3	1,282	Apple Orchard
	brown - 3	1,994	Sheep Bridge
	brown - 3	2,493	Ruhenstroth Dam
	brook - 3	235	Sheep Bridge
	brook - 3	157	Ruhenstroth Dam
1972	rainbow - 3	9,056	Sheep Bridge
	rainbow - 3	12,585	Ruhenstroth to Muller Ln.
	rainbow - 3	9,650	Park
1973	rainbow - 3, 4	6,228	Sheep Bridge
	rainbow - 3, 4	6,528	Ruhenstroth to Muller Ln.
	rainbow - 3, 4	8,855	Park
1974	rainbow - 3	8,920	Sheep Bridge
	rainbow - 3	4,040	Ruhenstroth to Muller Ln.
	rainbow - 3	6,900	Park
1975	rainbow - 3	7,180	Sheep Bridge
	rainbow - 3	3,620	Ruhenstroth Dam
	rainbow - 3	1,000	Golf Course
	rainbow - 3	4,360	Park
	brown - 3	2,040	Ruhenstroth Dam
	brown - 3	680	Golf Course
	brown - 3	1,836	Park

YEAR	TYPE OF FISH	NUMBER	AREAS STOCKED ON E.CARSON R.
1976	rainbow - 3	7,157	Sheep Bridge
	rainbow - 3	2,458	Ruhenstroth Dam
	rainbow - 3	7,036	Park
	brown - 3	669	Sheep Bridge
	brown - 3	687	Ruhenstroth Dam
	brown - 3	954	Park
1977	rainbow - 3	7,900	Sheep Bridge
	rainbow - 3	1,550	Ruhenstroth Dam
	rainbow - 3	3,394	Park
1978	rainbow - 3	6,151	at Bryant Creek
	rainbow - 3	7,562	Apple Orchard
	rainbow - 3	14,400	Sheep Bridge
	rainbow - 3	3,068	through Gardnerville
1979	rainbow - 3	6,354	Sheep Bridge
	rainbow - 3	3,966	through Gardnerville
	rainbow - 3	6,379	Park
1980	rainbow - 3, 4	6,405	Sheep Bridge
	rainbow - 3	5,020	through Gardnerville
1981	rainbow - 3	1,539	2-miles below border
	rainbow - 3	8,733	Sheep Bridge
	rainbow - 3	7,920	through Gardnerville
	rainbow - 3	1,539	Park
1982	rainbow - 3	5,405	Sheep Bridge
	rainbow - 3	4,243	through Gardnerville
1983	rainbow - 3	6,040	through Gardnerville
1984	rainbow - 3	1,380	above Ruhenstroth Dam
	rainbow - 3	9,599	through Gardnerville
1985	rainbow - 3	1,800	Sheep Bridge
	rainbow - 3	3,830	above Ruhenstroth Dam
	rainbow - 3	7,640	through Gardnerville
1986	rainbow - 3	4,960	Sheep Bridge
	rainbow - 3	4,135	above Ruhenstroth Dam
	rainbow - 3	492	Riverview Bridge
	rainbow - 3	4,080	through Gardnerville
1987	rainbow - 3	6,669	Sheep Bridge
	rainbow - 3	3,580	above Ruhenstroth Dam
	rainbow - 3	2,808	through Gardnerville
	brown - 3	1,100	Sheep Bridge
1988	rainbow - 3	1,495	Sheep Bridge
	rainbow - 3	5,395	above Ruhenstroth Dam
	rainbow - 3	3,280	through Gardnerville
1989	rainbow - 3	1,424	Sheep Bridge
	rainbow - 3	5,145	above Ruhenstroth Dam

YEAR	TYPE OF FISH	NUMBER	AREAS STOCKED ON E.CARSON R.
1989	rainbow - 3	3,608	through Gardnerville
	brown - 3	5,451	above Ruhenstroth Dam
	brown - 3	477	through Gardnerville
	brown - 2	19,947	Sheep Bridge
1990	rainbow - 3	2,904	Sheep Bridge
	rainbow - 3	4,075	above Ruhenstroth Dam
	rainbow - 3	2,341	through Gardnerville
	brown - 3	1,180	above Ruhenstroth Dam
	brown - 3	320	through Gardnerville
	brown - 2	10,000	Sheep Bridge
1991	rainbow - 3	3,611	above Ruhenstroth Dam
	rainbow - 3	1,158	Riverview Bridge
	rainbow - 3	1,927	through Gardnerville
	brown - 3	2,145	Sheep Bridge
	brown - 3	1,758	above Ruhenstroth Dam
	brown - 3	371	through Gardnerville
	brown - 2	20,090	Sheep Bridge
1992	rainbow - 3	18,118	unknown
	brown - 3	1,518	unknown
	brown - 2	34,978	unknown
1993	rainbow - 3	2,996	above Ruhenstroth Dam
	rainbow - 3	644	Riverview Bridge
	rainbow - 3	5,210	Golf Course
1994	rainbow -3	1,000	Sheep Bridge
	rainbow - 3	1,889	above Ruhenstroth Dam
	rainbow - 3	1,889	Riverview Bridge
	rainbow - 3	555	Golf Course
	brown - 3	1,125	Sheep Bridge
	brown - 3	525	above Ruhenstroth Dam
	brown - 3	525	Riverview Bridge
	brown - 2	15,026	Sheep Bridge
1995	rainbow - 3	4,672	above Ruhenstroth Dam
	rainbow - 3	4,109	Riverview Bridge
	rainbow - 3	932	through Gardnerville
	brown - 3	5,006	Sheep Bridge
	brown - 3	6,834	above Ruhenstroth Dam
	brown - 3	7,334	Riverview Bridge
	brown - 3	500	through Gardnerville
1996	rainbow - 3	1,828	above Ruhenstroth Dam
	rainbow - 3	5,260	Riverview Bridge
	rainbow - 3	578	through Gardnerville
	brown - 4	2,001	Riverview Bridge

YEAR	TYPE OF FISH	NUMBER	AREAS STOCKED ON E. CARSON R.
1996	brown - 2	10,000	Sheep Bridge
	brown - 2	5,940	above Ruhenstroth Dam
	brown - 2	5,000	Riverview Bridge
	brown - 0	34,272	above Ruhenstroth Dam
1997	rainbow - 3, 4	2,461	above Ruhenstroth Dam
	rainbow - 3,4	7,769	Riverview Bridge
	rainbow - 3,4	1,667	through Gardnerville
	brown - 2	1,400	Sheep Bridge
	brown - 2	5,900	Horseshoe Bend
	brown - 2	700	Golf Course
	brown - 0	49,395	above Ruhenstroth Dam
	cutthroat - 3	3,260	above Ruhenstroth Dam
	cutthroat - 3	2,282	Riverview Bridge
	cutthroat - 3	4,460	through Gardnerville
	cutthroat - 2	215	above Ruhenstroth Dam
	cutthroat - 2	215	Riverview Bridge