III. Eagle Lake Rainbow Trout/Fishes of Pine Creek and Eagle Lake

It is from a storied prize catch that comes a secretive past: the Eagle Lake rainbow trout of disagreed upon origin is no longer naturally reproducing. History has been less than kind to the ELRT as actions of the past created potential extinction. Timely intervention and persistence in restoration efforts has brought the ELRT to a sort of crossroads today: hatchery production provides a quality fishing experience for visitors to Eagle Lake (and other waters in the western United States), while efforts to improve habitat has likely made spawning grounds accessible once again. The missing link at this point is whether the fish still have the capability to ascend Pine Creek at an opportune time to spawn and return (or for progeny to return) to complete their life cycle. All fish have been completely stopped by the dam in their upstream quest to migrate at the trapping and spawning facility near Spalding. From 1959 through 1994, ELRT were known to migrate past the dam during years of high flow when conditions allowed them to pass. Reconstructed in 1995 to more effectively prevent erosion and upstream movement of fish, it is highly unlikely that any ELRT have made it over the barrier. Questions arise as to the ability of these "hatchery" fish to know when to migrate, and where or how far upstream to go. Have we raised fish that are programmed to spawn earlier now than in the past? If fish today are many generations removed from upstream migration, will they know how far to go, or know which stream or segment provides spawning gravels? Is it important to have these fish spawn naturally and occupy their "original" habitat? The CRMP group must continue to work on the answers to these questions.

Figure 3a. Dam on Pine Creek at fish trapping facility near Spalding, upstream from confluence with Eagle Lake.

The focus of this section is to describe what we know of the fishes in Eagle Lake and Pine Creek. This assemblage of fish and their interactions within the lake or stream environment is poorly understood. In-depth analyses of the local life histories (within Pine Creek and Eagle Lake) of the five native lake species are absent: a worn-down binder of Dr. Peter Moyle's Wildlife/Fish Biology 102 class from UC Davis holds a number of fish and limnological studies by college students in the 1980's and early 1990's, but thorough investigations regarding the relationships and inter-relationships amongst the five native species have not been accomplished. Much information is known about the culture of ELRT, and to a small degree their behavior in the lake environment, but any information related to stream dwelling, habitat needs for spawning, and the timing of migration are educated guesses.

Native Fishes Occupying Eagle Lake

Common Name	Scientific Name	Adult Size (average)
Eagle Lake Rainbow Trout	*Oncorhynchus mykiss aquilarum*	17-22 inches
Eagle Lake Tui Chub	*Siphateles bicolor*	11-16 inches
Lahontan Redsides	*Richardsonius egregius*	2.5-3 inches
Speckled Dace	*Rhynichthys osculus*	2-2.5 inches
Tahoe Sucker	*Catostomus tahoensis*	12-14 inches

Table 1., Source: Moyle, 2002.

Figure 4. Fishes occupying Pine Creek. Top, Eagle Lake rainbow trout (lake specimen), second row: speckled dace (left), Lahontan redsides (right), bottom row: Tahoe sucker (left), non-native brook trout (right).

While it has been said that work on Pine Creek was to restore the riparian system, it appears that the goal of restoring ELRT as well as the stream system has been brewing for the past century. Snyder in 1913 was one of the earliest to note low numbers of ELRT from the lake and its spawning run in Pine Creek, and Meadowcroft of the USFS acknowledged as early as 1936 that the ELRT were in need of a more consistent stream flow to maintain their existence. While the goal of returning ELRT to its native environment is worthy, certainly there are as many reasons to see the ecological restoration of Pine Creek from a broader perspective. It would be careless to focus on the ecological recovery of Pine Creek without a good background of the fish species present including ELRT, and vice-versa.

A. Native Range of Eagle Lake Rainbow Trout and Environmental Setting

Eagle Lake rainbow trout are endemic to the Eagle Lake basin and have only one stream with available habitat in which to spawn, Pine Creek, and one that may have historically provided spawning habitat in some years, Papoose Creek (Moyle 2002). Pine Creek is by far the stream providing the most habitat, but its availability to migrating fish has been hit and miss due to variable stream flow conditions, both seasonally and between years.

The very nature of Pine Creek even before modern settlers arrived was likely one of inconsistent flows and flashy duration. Jones and Stokes (1992) looked at soil conditions in Pine Creek Valley and noted that indicators of wetland conditions were either weak or absent in many of the soil profiles, and that these showed stable land surfaces over time indicating flows may have been intermittent through Pine Creek Valley. It has been speculated for years by CDFG that drought cycles have resulted in ELRT becoming a long-lived species, one that can take advantage of migration and spawning even if the opportunities don't occur on an annual basis (CDFG 1998, 2005).

Figure 5. Pine Creek at County Road A-1 Bridge during spring runoff.

Pine Creek can be characterized as having two distinct streamflow regimes. Generally speaking, one would classify the stretch of Pine Creek upstream of Highway 44 as perennial (flowing year round), and below Highway 44 as intermittent (flows dry up during a portion of the year). Added to that would be an ephemeral headwater stretch (flow in direct response to runoff) of Pine Creek upstream of Forest Road 10, and west to Triangle Lake in the Caribou Wilderness. A series of springs form the first perennial flows of Pine Creek upstream of Leaky Louie's pond. From this point and downstream, no less than 21 springs (CDFG 1998) contribute to the flows making up Pine Creek, which in most years, persist year-round to Highway 44. Downstream of Highway 44, flows usually cease by mid-June or later in some years. Water persists through the year in many of the ponds at the culvert outlets, as well as in some of the deeper pools within the channel. Fish can be found in these pools in late summer, as was noted in September

2006 by Dr. Peter Moyle and his meadow survey crew. Seining results from the upstream 105 road culvert outlets revealed the presence of ELRT, Tahoe suckers, and speckled dace.

The perennial section of Pine Creek runs through a large meadow (Stephens Meadow) at approximately 6400 feet in elevation. Fish species present in September of 2006 (Moyle pers. comm.) included the non-native brook trout, rainbow trout (planted ELRT), and speckled dace, Tahoe sucker, and Lahontan redsides. Brook trout numbers were very high (169 fish) in the 50 meter section sampled. Habitat is comprised of runs and pools, with gravel substrates that afford spawning opportunities, as seen every autumn during the brook trout spawning period. Stephens Meadow is under private ownership, and is managed under a conservation easement put in place in 1992 (CRMP notes 1992). Downstream of the meadow the creek runs through a forested setting for approximately 6 miles, with pool/riffle habitat types, prior to entering another broad meadow downstream of Bogard Campground near McKenzie Cow Camp. Habitat within this meadow is similar to Stephens Meadow, with more runs and pools with undercut banks. Substrate here consists of fewer gravels and more silt, with ever increasing vegetation along the banks and within the channel due to reduced grazing pressure begun in 1993.

Figure 6. Example of habitat conditions in Pine Creek in the upper watershed, perennial reach near headwaters downstream of Leaky Louie's pond.

Figure 6a. Example of habitat conditions in Pine Creek in the watershed, intermittent/perennial channel in upper Pine Creek valley near Highway 44.

Platts and Jensen (1991) described the upper portion of Pine Creek Valley, Champs Flat, and McCoy Flat, as each representing an alluvial non-graded valley bottom type. Areas within this classification are low gradient streams, with wide and unconfined valleys and generally contain a single channel with erodable soils. In Platts and Jensen's assessment, they described seven condition levels within this category, with no "*natural*" states found. They categorized 73% of this valley bottom type as in the "*blown out*" or severely-degraded state. Recommendations offered in their report were for management "*aimed at decreasing livestock impacts within the stream channels, enhancing vegetative recovery on streambars, enhancing aggradation of stream channels, and retaining runoff in the channel for a longer period*". Effective restoration would likely allow these areas to recover to condition classes of "*stabilized streambottom*" and "*achievable*", both desirable ratings of their condition classes.

In the perennial reaches west of Highway 44, Platts and Jensen (1991) described it as a priority area for protection of habitat for Eagle Lake rainbow trout and an area of opportunity to enhance perennial flows into downstream areas. At the time, most of the stream/riparian habitat in this area was considered in a "critical" state and further deterioration would lead to long-term loss of the resource. In 1995, the decision in the Pine Creek EA was to improve stream/riparian conditions through changes in livestock management. While compliance with "no grazing by management" or "occasional graze" was not always consistent, as reflected in NRST report (1999) the riparian/stream channel is improving today as evidenced by the increases seen in riparian vegetation. While some real problems in stream channel conditions upstream of Highway 44 were indicated in Platts and Jensen's report in 1991, just seven years later (in the absence of

widespread cattle grazing), the NRST found channels in proper functioning condition. Young (1989) rated the area near McKenzie Cow Camp as "mostly stable", and that browsing of aspen suckers by cattle could be reduced to increase stand vigor. Each of the analyses has become a snapshot in time of conditions viewed from the author's own objectives.

Figure 7. Conditions of stream in Upper Pine Creek Allotment. top, 1993, grazed. Bottom, 1997, after 4 seasons of no livestock use under "occasional graze" strategy.

While Platts and Jensen (1991) and Jones and Stokes (1992) differ in their assessment of whether or not the stretch of Pine Creek (Pine Creek Valley from Camp 10 to Highway 44) was wetter in the past and therefore was more conducive either to fish passage or rearing, it is clear today that streamflow during the right period of time is essential for ELRT to successfully migrate upstream.

Few reliable records are available describing fish numbers and angling experiences on the lake. J.O. Snyder reported in 1913 that anglers weren't successful for trout in Eagle Lake either due to low population numbers, or to a high amount of prey for them within the lake. He was disturbed by the local practice of harvesting most of the fish that entered the tributary to spawn, and mentioned that this practice was occurring by native peoples prior to European arrival. He pleaded at that time for the practice to be stopped or that it would put the species was at risk of extinction. Published again in 1940, Snyder reiterated the problem of the trout leading a "precarious" existence due to poor flows in Pine Creek, but no further mention of trout abundance (or lack of) was mentioned.

The most complete fish information may be extrapolated from CDF&G's data on fish stocking records in Eagle Lake from 1879 through 1956. See "Stocking History of Eagle Lake" (**Table 2**). No less than twelve species of fish were stocked in various years and at widely varying numbers.

Stocking History of Eagle Lake

Year	Species	Number Stocked	Size (grams each)	Source
1879	Great Lakes Whitefish *(Coregonus clupeaformis clupeaformis)*	225,000	--	CDFG
1879	Brown bullhead *(Ameiurus nebulosus)*			Purdy
1901	Largemouth bass *(Micropterus salmoides)*	147		Purdy
1902		200		Purdy
1914	Brown trout *(Salmo trutta)*	10,000		Purdy
1920's	Rainbow trout *(Salmo gairdnerii)*			Purdy
1924	Lake Trout *(Salvelinus namaycush)*	25,000	--	CDFG
1930	Crappie *(Pomoxis sp)*	150	--	CDFG
1930	Bluegill *(Lepomis macrochirus)*	650	--	CDFG
1930	Largemouth Bass *(Micropterus salmoides)*	700	--	CDFG
1931	Brown trout *(Salmo trutta)*	50,000	--	CDFG
1932		50,000		
1933		200,000		
1932	Rainbow trout *(Salmo gairdnerii)*	20,000	--	CDFG
1953		1,000		
1934	Silver salmon *(Oncorhynchus kisutch)*	250,616	--	CDFG
1935		227,800	--	
1952	Kokanee salmon *(Oncorhynchus nerka)*	36,000	.14	CDFG
1953		67,000	.09	
1954		90,750	.11	
1955		450,000	.14	
1956		243,000	.14	
1953	Eagle Lake rainbow trout *(Salmo gairdnerii aquilarum)*	34		CDFG
1956		199	443	
1955	Lahontan cutthroat trout *(Salmo clarkii henshawi)*	100,890	.93	CDFG
1956		143,200	.14	
1960 to present	Eagle Lake rainbow trout *(Oncorhynchus mykiss aquilarum)*	Varies	Varies	CDFG

Table 2. From CDF&G file report King and Weidlein, 1976, Purdy's Eagle Lake, 1988.

Between 1935 and 1952, there is a noticeable gap in fish plants as shown in the table above. Referring to figure 3 showing surface elevation of Eagle Lake from 1875 to the present, a large drop in lake elevation can be seen beginning after the modern-day high reading of 5,125 feet elevation in 1916. By 1934, the lake level had dropped to a modern low of 5,091 feet, a drop of 34 feet in 18 years. Two reasons are generally given for this decline: 1.) A widespread drought, and 2.) The construction and operation of the Bly irrigation tunnel which became functional in 1923 and operated through 1935 (Purdy 1988). Water quality would have been marginal from a standpoint of supporting fish life in those low water years. Anecdotal information suggests that of all of the introduced species, only the largemouth bass and brown bullhead flourished or persisted in the lake for any great length of time.

B. Taxonomy of Eagle Lake Rainbow Trout

J.O. Snyder (1918) first described the Eagle Lake rainbow trout as a subspecies of rainbow trout in 1913. Since that time, others have placed it as a hybrid between Lahontan cutthroat trout and introduced rainbows, as well as calling it a descendant of an immigrant trout from the Feather or Pit River systems. Behnke (2002) suggested that ELRT are derived from a redband trout ancestor, possibly from the Northern California Sacramento/Pit River system. Moyle (1995) included a table from Busack (1980) in his report to the CDFG that displayed meristic characteristics of ELRT and other trout of the western US. Given the data in this report and in the table showing very distinctive characteristics, Moyle suggests it to be very unlikely that ELRT resulted from an introduction of another similar species. Rather, it may have gained access to upper Pine Creek during ancient history through a connection with the Feather River or Pit River headwaters (Behnke 2002, Moyle 2002).

Taylor (1985) may give evidence for a Pit River connection where gastropod (mollusk, i.e., clams, snails, slugs) distribution makes a strong argument for an ancient link between the Pit River, Snake River (Idaho), and Honey Lake (and hence the Feather River through Sierra Valley), of which Eagle Lake may have once had a surface connection. Found south of the Honey Lake Valley in the Sierra Valley (Feather River of the Sacramento system) is a freshwater mussel *Anodonta oregonensis*, whose closest southward presence to Eagle Lake is in the Pit River. A Sierra Valley connection to the Snake River would have most likely been via the Honey Lake Valley (Taylor 1985). Eagle Lake molluscan fauna include the Great Basin ramshorn snail (*Helisoma newberryi*) and the montane peaclam (*Pisidium ultramontanum*), species that are also found in the Snake River system and through southeastern Oregon. Further studies to confirm the link amongst these river systems at the right time in the evolutionary history of the ELRT would be valued by those studying the taxonomy of these trout.

C. General Life History and Growth of ELRT and Fishes of Pine Creek/Eagle Lake

By far the most widely known and perhaps most understood fish species is the ELRT. Plenty of information is known about the life history of the Tahoe sucker from other systems, while the Eagle Lake tui chub gets lost in obscurity due in part to its "perceived" status over time as a competitor with ELRT. Anglers in the past have readily admitted their proclivity to remove the chub from the lake in order to "boost" the ELRT population. The Lahontan redside and speckled dace have usually been seen merely as forage for fish or other wildlife to consume. The brook trout is an introduced species and is present in self-sustaining numbers at the headwaters of Pine Creek, from approximately Highway 44 upstream. All but the Eagle Lake tui chub have an affinity for the stream environment as well as the lake. The brook trout does not appear to tolerate the water quality in the lake itself. During spring migration period, ELRT, Tahoe sucker, speckled dace and Lahontan redside can be found in the lowermost portions of Pine Creek blocked by the fish trap.

Habitat needs for most trout species are variable, with the correct water temperatures being of great importance. Moyle (2002) describes life history strategies as either migratory or resident, with some populations sharing both. Eagle Lake trout, like its neighbors, the Goose Lake redband from Modoc County and Lahontan cutthroats from Pyramid Lake in northwestern Nevada migrate from a large, alkaline body of water to cool, well-oxygenated streams to spawn, an adfluvial (migrating between lakes and streams) population. Generally, it is thought that young ELRT would remain in the stream environment for one to two years. In the Pine Creek system, it is thought that ELRT would occupy habitat above Highway 44 for year-round rearing, as conditions below Highway 44 can rapidly deteriorate into intermittent flows during years of average to low rainfall. It appears that even in years of greater than average precipitation or runoff, rapid changes in flow are possible that may cause poor migration conditions for trout. Periods of hot weather in the spring, such as the occurrence in 2000 that resulted in a rapid runoff may be more of a factor for influencing fish migration than strictly looking at flows or stream temperatures alone. Snyder (1940) mentioned ELRT's "precarious existence" in association with Pine Creeks "fitful" flow and "Often many spawning fish are cut off by low water before returning to the lake, and many young trout are destroyed in like manner."

1. Growth of Eagle Lake Rainbow Trout/Tahoe Sucker

Ask any angler today about the trend in ELRT sizes through the years they have fished Eagle Lake and invariably the answer will be that the sizes have decreased. It does seem reasonable to suggest that larger ELRT would have been available and caught in the 1960's when planting by the CDFG began in earnest. Due to the lack of a top food chain predator in the lake for many years prior to the time ELRT were planted in the 1960's, the initial trout planted would have likely grown quickly and robustly with the available food sources that had years of unchecked growth. Results from CDFG creel surveys (Table 3) suggest that the average fish length at harvest is static or a slightly increasing number of 17.5" from data gathered in 1999 –2004 (CDFG 2005). An earlier report from CDFG (2000) showed fourteen years worth of data from (1983 – 1999) for an average ELRT creel length of 17.1" (range of 14.3" to 19.2").

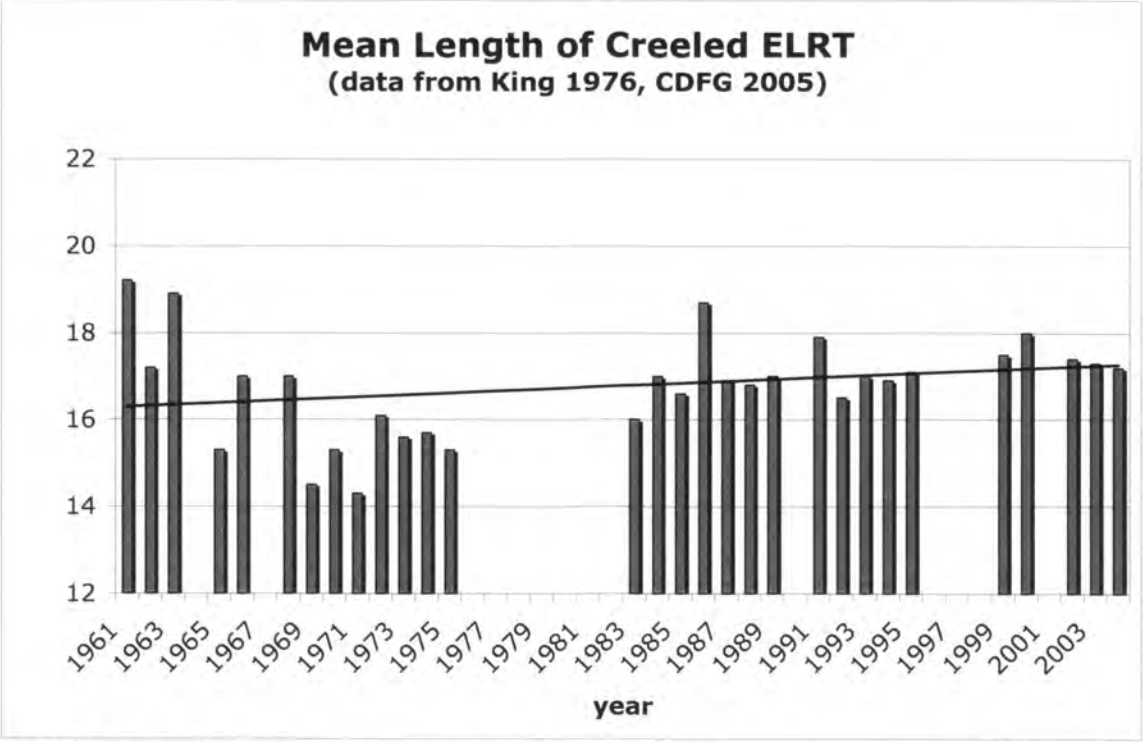

Table 3. Length of Eagle Lake Trout from creel census, in inches.

Figure 8. Eagle Lake rainbow trout catch in 1923. Information on the back of the photo states that this is one half of the catch of fish taken by pitchfork, just above the CDFG trapping facility (at this point an undetermined location). The largest fish was estimated to weigh 10 pounds.

Snyder (1918) was one of the earliest to describe the five species of fish present in Eagle Lake during his sampling trip to collect specimens in 1913. He included measurements for 4 individual ELRT and 10 individual Tahoe sucker. It is interesting to note that Snyder's measurements of the ELRT ranged from17.2 to 18.8 inches (mean length 17.9") of the four captured at the mouth of Pine Creek. He stated:

> *"Through the clear water, they were seen to be* ***remarkably uniform in size*** *and color, the males being easily distinguished by their deep, coppery sides and rich red cheeks. Several dead specimens along the shore were of the same size as those secured."*

Further length data comes from Garcia and Gold (1986), who showed a high age class frequency at 17.1" from creel census at the lake and through fish caught during their study. Somewhat remarkably, data from 100 ELRT tagged and sent upstream in April of 2006 averaged 17.9 inches, a figure identical to that found by Snyder in 1913. Further studies could be undertaken to assess a shift in size over time, as these examples are only anecdotal and limited in sample size.

It will be important to answer the question of the potential shifts in fish sizes. This may eliminate a concern by a few within the CRMP group that the selection of larger ELRT for trophy trout propagation may be "unnaturally" selecting and altering genetics to such a degree that ELRT are no longer capable of finding their way upstream. This concern was brought forward after CDFG's release of their management plan for ELRT in 2005. In response to this issue, CDFG stated that they agreed "that selection for larger fish is unnatural and may have selected against those most able to make the 'historic spawning run'" (CDFG 2005a). However, it is unknown what genetic attributes contribute to the success of upstream spawning migration, and the only comparison of fish spawning sizes that can be made may indicate that size is not a critical issue. For example, information from CDFG files show that in 1949-50, and 1959-76, the average length of ELRT that were collected and spawned during the spring migration was 19.3 inches, with males averaging 18.4 inches and females at 20.3 inches (see table 4). These were fish that were collected at the estuary in seines in 1949-50, then at the trap from 1959 (Wildlife Conservation Board funding was used to construct the present day fish trap near Spalding in1958) through the present. From 1951 through 1956, ELRT were collected in Pine Creek near Bogard Ranger Station and Highway 44. Average length of the fish captured there (presumed to be upstream migrants) was 19.8 inches, with males averaging 18.9 inches and females 20.8 inches. From these data, it would be hard to argue that selective breeding by CDFG has resulted in larger fish unable to migrate upstream when the numbers of fish in the early 1950's, that in fact did migrate upstream to Highway 44, on average were larger than those collected and spawned at the lake through 1976. Data is likely available from CDFG on the timeframe from 1977 through the present. However, as of this writing, only data through 1976 were compiled and are presented here.

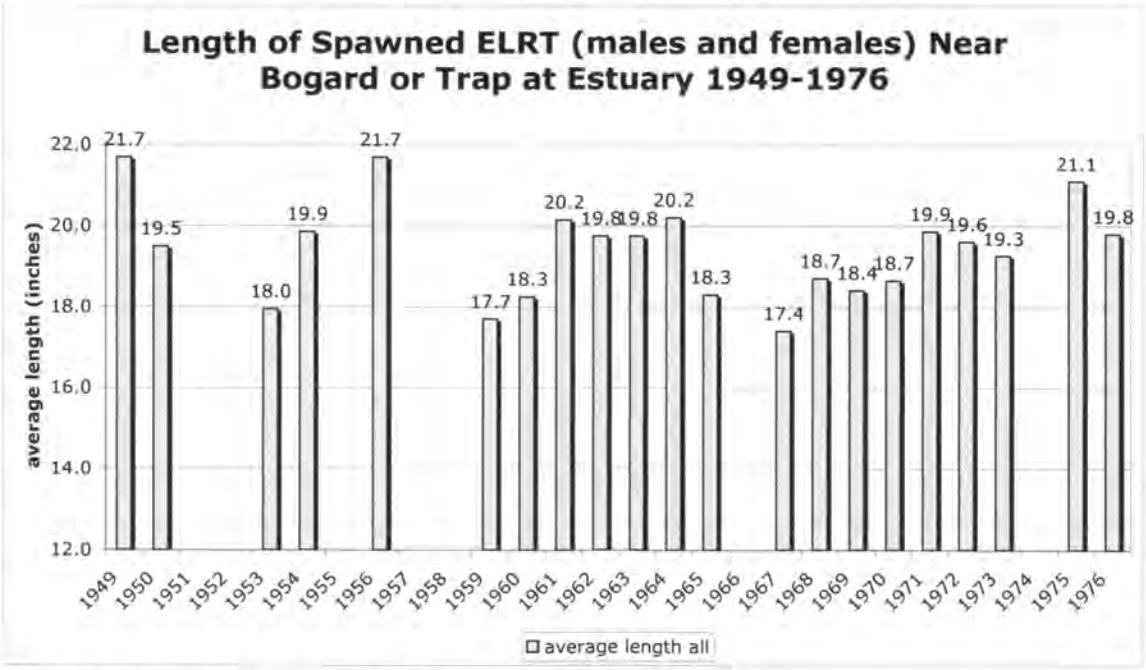

Table 4. Length of Eagle Lake trout during spring trapping, in inches.

The difference in figures (creel versus trap data) may suggest the selection for larger breeding fish that are chosen once entering the trap, and not a true picture of all the fish that enter the facility. Another possible explanation is that the larger fish entering the trap are simply more wary in the lake and therefore more difficult for anglers to land. It may also be that older, and presumably larger ELRT enter the trap on their journey upstream.

Dates of spawning for ELRT vary, but typically occur from March thru May. ELRT are known to begin their upstream migration at temperatures of 40°F (CDFG 2005). CDFG records show remarkable sucker runs (41,600 in 1960) dating back to the early 1960's at the fish trap, while present day numbers pale in comparison (figure in the hundreds, personal communication with Chappell, 2005). Tahoe sucker, Lahontan redsides, and speckled dace are found upstream above Highway 44 in the perennial portion of Pine Creek, and even in the intermittent portion (Logan Springs area) of the creek in permanent pools (November 2005). It is unknown what the numbers of the fish (all species) of the stream was pre-settlement, if indeed the stream carried more of a year-round flow. A different vegetative regime prior to settlement of the west would likely have resulted in a series of habitats different than what is present today, thus supporting different species or populations.

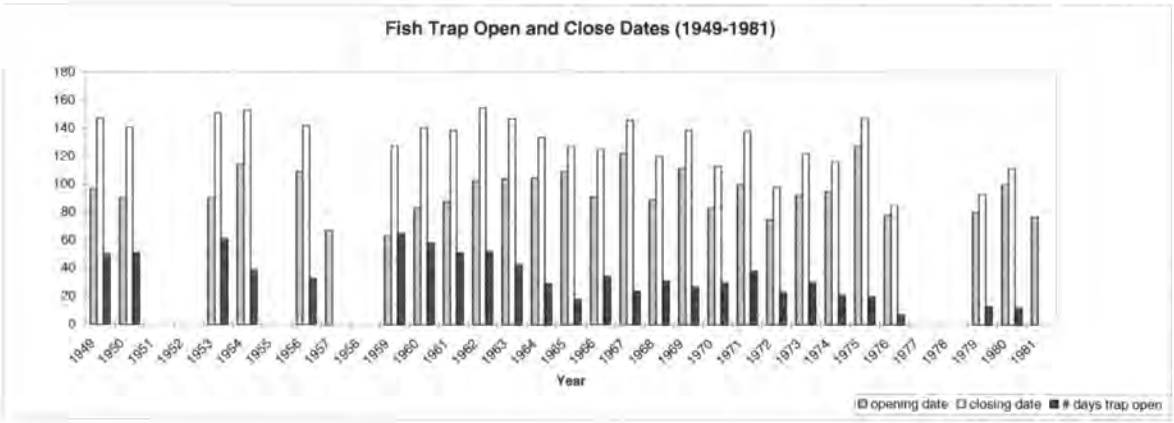

Table 5. Opening and closing dates (Julian date on y axis) of Eagle Lake trout spawning facility near Spalding (Day 94 = April 4, day 130 = May 10).

Tahoe Sucker

Snyder's measurements for the Tahoe sucker ranged from 10.3 - 14.3 inches in length, with a mean length of 12.4 inches. There are no data on lengths from recent years, so no comparisons or conclusions can be made with present day sucker length. What may be of more usefulness is the numbers that enter the trap each season. Further information could also be gathered on the stream-dwelling population of sucker; with determination of age classes to discern whether or how often individuals gain access to the upper stretches of the stream. It appears that Tahoe sucker are prone to migration at a certain temperature and flow toward the latter part of the runoff period for Pine Creek. Moyle (2002) lists spawning temperatures for stream migrating suckers at 52-57°F, and lake spawning suckers at 54-73°F. It is likely that sucker occupied habitat that was marginal for trout in Pine Creek.

D. Status of Eagle Lake Rainbow Trout

It has been a goal of the CRMP group to prevent ELRT from being listed as a federally threatened or endangered species. The rationale has been that the group effort has been effective in restoring habitat and access for the species, and that control would be best handled within the local and active CRMP. Continued monitoring and successful passage of ELRT may be the only way to avoid petitions to list the species in the future.

The ELRT has been petitioned for listing as threatened or endangered twice during the CRMP era, once in 1994 (two petitioners), and again in 2003. In 1995, the petitioners were denied the request, based on ongoing and productive efforts to restore habitat and access to habitat within Pine Creek. In their response to the petitioners, the USFWS (1995) stated:

"Despite the limited distribution of the Eagle Lake trout, the petition included insufficient information regarding the present fish population numbers and trends. In addition, the petition failed to provide substantial threat data concerning projected and ongoing management considerations with respect to the existing popular sport fishery and the stocking program for the trout. The petition also did not address the extent to which the threats have been lessened by the significant recovery efforts now underway. More importantly, the future status of the subspecies may improve because of the significant recovery efforts now underway and the ongoing stocking program. Therefore, the Service finds that the petition does not present substantial information indicating that the listing of the ELRT may be warranted."

The USFWS (2004) responded to the petition submitted in 2003 by concluding that an emergency listing for the ELRT was not warranted at the time, but that an initial finding was anticipated to occur early in 2005, to determine whether action was warranted. The CDFG prepared a response to that petition and its recommendations and disagreed with the content, disputing most points made by the petitioner that the trout should be recommended for listing.

Status of Eagle Lake Trout

Agency	Status	Year
US Fish & Wildlife Service	None	1995
US Forest Service	R5 Sensitive Species	1998
California Department of Fish & Game	Species of Special Concern Wild Trout Heritage Trout	1995 1999

Lassen County as well has placed ELRT as a species of importance to the economy in that fishing represents a significant income from the angling public. Passing resolutions in 1994, the Eagle Lake Interagency Board (Resolution No. 94-1) and the Lassen County Board of Supervisors (Resolution No. 94-60) included these statements:

"It is recognized that the Coordinated Resource Management Plan (CRMP) process, including the Eagle Lake and Pine Creek CRMP programs, provides a valuable and productive process by which interested agencies and the public can work together to develop plans for the management and improvement of wildlife and fishery habitats in conjunction and compatible with other natural resource uses..."

and:

"This Board supports efforts on the part of all involved parties to take all practical efforts to provide for the restoration of fishery habitat in the Eagle Lake watershed and at Eagle Lake, and to implement what is essentially a recovery plan for the Eagle Lake Rainbow Trout to address, within the Eagle Lake watershed, those problems recognized by the U.S. Fish and Wildlife Service in their evaluation of the species under the Endangered Species Act.

The foregoing resolution was adopted at a special meeting of the Eagle Lake Interagency Board held in Susanville, California on April 22, 1994..."

From the Lassen County Board of Supervisors:

"This Board calls for the use of Federal and State fishery and wildlife restoration funds to assist in improving the habitat of concern and maintaining the availability of the trout to the public for its regional recreational and economic benefits. The foregoing resolution was adopted at a regular meeting of the Board of Supervisors of Lassen County held in Susanville, California on May 10, 1994..."

E. Management Concerns Related to Eagle Lake Rainbow Trout

Over the course of the CRMP era, and even before, management concerns have been and continue to be raised regarding establishment of ELRT into the headwaters of Pine Creek. At the forefront in achieving this goal was promoting the restoration of hydrologic function of the riparian system, and to provide for suitable passage for the migration of ELRT. In addition to restoration of the habitat and fish passage, the following are other management concerns that have been raised:

- Habitat Quality
- Barriers to Fish Passage
- Brook Trout in the Headwaters
- Loss of Instinct/Release of Fish

1. Habitat Quality

Habitat distinctions for ELRT can be described as 1.) A migration corridor from the lake upstream to Highway 44, and 2.) Spawning and rearing habitat upstream of Highway 44, beginning in the vicinity of Bogard Barn. At the origin of the CRMP era, Pine Creek was described as "a degraded stream especially in the lower (downstream) half of the drainage", and "streambanks...have poor stability and are constantly eroding", as well as "Pine Creek is not successfully handling its delivered stream power, therefore stability is poor and Pine Creek is attempting to gain more footage (sinuosity) to compensate for this lack of ability to handle stream power" (Platts 1987). Conditions upstream in the perennial section fared slightly better in that areas that were protected from excessive livestock use showed signs of more natural states (Platts 1991).

Further studies of habitat will be important to be able to detect a positive trend in conditions that the CRMP set out to achieve. Data from Sierra Province Aquatic Monitoring (1997) and Stream Condition Inventory (1998) can be collected again to determine trend, as well as information on fish presence and absence from the periodic studies of UC Davis students. Trend data for vegetative plots to assess ecological status are just becoming available (Weixelman 2006).

2. Barriers

During the early years of the CRMP process, it was thought that ELRT were unable to make it upstream due to the presence of barriers. Numerous locations were identified as possible barriers to fish passage, although only the culvert on FS road 31N08 and the road culverts (FS Road 31N25) at Leaky Louie's pond were the only two positively identified as blocking fish movement. A detailed discussion of projects completed to remove passage barriers can be found in the Past Conservation Actions beginning in section IV. C..

Other general locations of barriers include debris jams above Bogard Campground and near FS road crossing 33N93 (Corbin Crossing). Years of variable flow conditions have moved the debris and/or the channel, and each is no longer considered to be a passage problem. The section of the stream between Highway 44 and the railroad grade, known as the "superditch", caused enough concern over fish movement that the creek in this location was relocated into an historic channel on the south side of Pine Creek Valley. This was accomplished to clear up any doubt that existed over fish movement there, in addition to restoring hydrologic function in the valley. It is unknown whether ELRT have migrated upstream from the lake and into the new channel. Another barrier may be an invisible one: thermal conditions in Pine Creek Valley may preclude an urge to move upstream at critical times. Stream conditions are certainly different than in the pre-settlement era in that little vegetation remains at the end of the grazing season. Channels may be broader and shallower than in the past, and coupled with little vegetative structure to shade the stream, heating of the creek could be an issue for passage. To date, the farthest upstream ELRT positively confirmed during the radiotelemetry study has been near Camp 10, downstream of Pine Creek Valley in early April of 2000 and 2004. Data from the mid 1950's show ELRT moving upstream to the vicinity of present day Highway 44 in May of 1956, and in April of 1957. This issue warrants further study to determine temperature patterns in Pine Creek Valley when trout migrate through.

Of considerable interest since 2002 is the remnant of the gauging station weir left over from the United States Geological Survey (USGS) that was in use from 1950 through 1961. See discussion in section IV. C. 2. Fish Passage. While it appears that the structure may impede passage of ELRT and other fish species at certain times of the year, it is currently unknown whether it is a complete barrier since ELRT have not advanced upstream from the lake to this location.

3. Brook Trout

Planted for angling opportunities in 1940, brook trout quickly established a stream population in the cool headwaters above Highway 44. Although planting of brook trout was discontinued in 1949, the species still maintains a high population to this day. It has been thought that brook trout displace rainbow trout through sheer numbers and through predation on newly emerging fry in the spring, although no documentation of this

occurring in the Pine Creek drainage can be found in print. Displacement of ELRT or other native fishes has been a topic of discussion at many CRMP meetings.

ELRT were planted in Pine Creek in 1952, 1961, 1966, and 1969-75 as fingerlings. Plantings were discontinued until approximately 2000, when catchable sized (1/2 lb each) ELRT were released. At the present time, approximately 1000 ELRT are planted annually upstream of Highway 44, with the hopes that ELRT may naturally displace some of the brook trout (CDFG 2005).

In anticipation of treating Pine Creek with rotenone (a piscicide) to eliminate and/or reduce the numbers of brook trout, CDFG used USFWS funds in 1997 to prepare a report on stream conditions which included temperature monitoring, flow data, mapping of all water bodies, and fish species identification and populations of the headwater lakes (specifically Triangle Lake in the Caribou Wilderness) that are periodically connected to Pine Creek in very high water years (CDFG 1998). During that time period, Lake Davis in nearby Plumas County was treated with rotenone (to remove the predacious non-native Northern Pike), but the action resulted in disastrous public opinion. It was determined by the CRMP group that eradicating brook trout with rotenone at that time could be very difficult to achieve. Concerns were also raised by the USFS about the uniqueness of the stream system, and that rare or endemic species of invertebrates may also occupy the creek and be inadvertently removed with the application of rotenone. Until public opinion changes, or a new approach to targeting the intended species is accomplished, rotenone will likely be shelved as a potential tool to use.

4. Loss of Upstream Instinct/Release of Fish

In the situation of ELRT and Pine Creek, the obvious lack of success in gaining access and spawning has inevitably led to the question, by some members of the CRMP, over whether these fish still know where and how far to ascend. It does appear that the temperatures, flows, and perhaps odor offer cues to ELRT to come to the barrier at the mouth of Pine Creek and this has resulted in an excellent response by the fish. Recommendations in the past have been to suggest releases of fish when a certain snow pack was reached, or when stream temperatures were "right", or when personnel were available to carry them over the barrier in buckets. All fish that use to migrate upstream have been put in an unnatural situation due to humans deciding when it is right for them to gain unrestricted access to the creek. It would be incorrect to assume that the ELRT do not have the instincts to travel upstream. Certainly many members of our community have seen numbers of fish crossing Highway 139 during periods of high flow, only to be stuck upstream without any chance to successfully spawn. The same situations occur in most of the tributaries around the lake, prompting the CDFG to construct barriers to prevent upstream losses, primarily in Papoose Creek, Merrill Creek, and in Little Merrill Creek adjacent to Christie Campground. Their opportunistic behavior in seeking out fresh water shows "plasticity" in their life history that indicates adaptability to environmental conditions. While the topic of upstream instinct continues to be debated, there will be no definite resolution unless a spawning run shows success in multiple years.

Figure 9. Spawning barrier constructed in 1997 near Christie Campground on Little Merrill Creek.

While it is argued that hatchery fish lose their abilities to navigate to their natal grounds, there are published data that show straying of salmonids to occur. Imprinting clues may not be absolute necessities for salmonids to find and select suitable spawning sites (Griffith et al 1998). Indications are that these fish clearly have a strong sense of finding fresh water and show relentless energy to pass upstream. NRST's (1999) conclusion was that ELRT would be expected to, in adaptation to the hydrologic regime, *"exhibit a high degree of "**pioneering**" behavior in seeking suitable spawning/rearing habitats"* and is supported by the fact that fish still try to migrate upstream in Pine Creek as observed at the fish trap.

It should be noted that Tahoe sucker enter the trap later than ELRT, and CDFG policy has always been to pass these fish over the barrier (Chappell pers. comm. 2006). Tahoe sucker can be found in Pine Creek in numerous ponds below and above Highway 44 (Honma et al 1988, Grant and Kuda 1990, Monji et al 1986, Moyle pers. comm. 2006). Large (approximately 10-12 inch) adult sucker have been observed upstream of Highway 44 during late summer. While Tahoe sucker occupy different habitat and have other passage needs, it is likely that during some years, they are able to successfully migrate upstream and indeed do have a stream dwelling population.