Upper Klamath River fishery management plan

State of California

Natural Resources Agency

Department of Fish and Wildlife

January 2016

Prepared by

Dave Rogers, Dennis R. Maria and Michael Dean

Revised and updated by

Samuel L. Plemons and Michael Dege

Heritage and Wild Trout Program, Northern Region

2016

Contents

EXECUTIVE SUMMARY

California Fish and Game Code (Chapter 7.2, Section 1726.4 (b)) states that it is the intent of the Legislature that “the department [specifically, the California Department of Fish and Wildlife (CDFW) Heritage and Wild Trout Program (HWTP)], in administering its existing [heritage and] wild trout program, shall maintain an inventory of all California trout streams and lakes to determine the most suitable angling regulations for each stream or lake. The department shall determine for each stream or lake whether it should be managed as a wild trout fishery, or whether its management should involve the temporary planting of native trout species to supplement wild trout populations that is consistent with this chapter.” Section 1726.4 (b) additionally states that “biological and physical inventories prepared and maintained for each stream, stream system, or lake shall include an assessment of the resource status, threats to the continued well-being of the fishery resource, the potential for fishery resource development, and recommendations, including necessary changes in the allowed take of trout, for the development of each stream or lake to its full capacity as a fishery.”

Furthermore, California Fish and Game Code (Chapter 7.2, Section 1727 (d)) requires that the CDFW “shall prepare and complete management plans for all wild trout waters not more than three years following their initial designation by the commission, and to update the management plan every five years following completion of the initial management plan.” For clarification, wild trout waters, as stated above, represent waters that have been formally designated by the California Fish and Game Commission as Heritage and/or Wild Trout Waters.

Wild Trout Waters are those that support self-sustaining trout populations, are aesthetically pleasing and environmentally productive, provide adequate catch rates in terms of numbers or size of trout, and are open to public angling. Wild Trout Waters may not be stocked with catchable-sized hatchery trout. Heritage Trout Waters are a sub-set of Wild Trout Waters and highlight wild populations of California’s native trout that are found within their historic drainages.

In an effort to comply with existing policy and mandates, the HWTP has prepared a fishery management plan (FMP) for the Upper Klamath River. This FMP is intended largely as an operations guide for internal planning purposes to communicate management direction to the public, other agencies, and trout angling organizations. This FMP is intended to provide direction and list actions necessary to sustain the recreational fishery for the benefit and enjoyment of the angling public. However, actions associated with this FMP are initiated independently, thus any environmental review/permits needed to implement the actions are separate from the FMP itself.

RESOURCE STATUS

Area description

The Klamath River originates from the waters of Lake Ewauna, near Klamath Falls, and flows more than 250 miles through southern Oregon and northern California before emptying into the Pacific Ocean (Figure 1). It enters California in northern Siskiyou County and flows in a south-westerly direction to northern Humboldt County. It then enters the southwest corner of Del Norte County and drains to the Pacific Ocean, near the town of Requa. The Klamath River drains an area of nearly 16,000 square miles with a mean annual discharge rate of 17,000 cubic feet per second (cfs), making it the second largest river in California. The Klamath River Basin provides natural resources and economic opportunities related to fisheries, farming, ranching, timber harvest, mining and recreation, which have economically sustained many communities throughout the basin for decades.

The Klamath River Wild Trout Area (WTA) encompasses 6.2 miles of river, between Copco Reservoir and the Oregon border, in northern Siskiyou County. The WTA is approximately 25 miles northeast of Yreka, near the Oregon border (Figure 2). The California Fish and Game Commission (CFGC) designated this stream section in 1974 because of its excellent wild trout angling opportunities.

The Upper Klamath WTA is a low-gradient stream (0.41%), from approximately 2,735 ft. at the California/Oregon border, to 2,600 ft. at Copco Lake. Stream habitat is mainly characterized by low velocity runs with few shallow riffles and pools. Stream depth varies, with a maximum of about 10 ft. and the width is nearly constant at 110 ft. The streambed is mostly large cobble and boulders. Rooted, submerged vegetation is abundant and cattails and bulrush line much of the shoreline. Only one tributary of substantial size, Shovel Creek, enters the WTA. The lower two miles of Shovel Creek is an important spawning area for Upper Klamath River wild trout.

Flows through the WTA are controlled by numerous upstream reservoirs and diversions. PacifiCorp manages a 169-megawatt Klamath Hydroelectric Project (Project), which spans from rural southwestern Oregon (Klamath County) to northern California (Siskiyou County). The Project (FERC No. 2082) generates approximately 716 gigawatt-hours to supply approximately 70,000 households. The Project was constructed between 1903 and 1962 and consists of seven hydroelectric developments; three are located upstream of the WTA in Oregon (Eastside, Westside and JC Boyle) and four are downstream of the WTA in California (Copco No. 1, Copco No. 2, Fall Creek and Iron Gate). Two additional dams are important to Project operations: the Link River and Keno dams. Link River Dam, located upstream of the Project, controls water storage within and releases from Upper Klamath Lake. Releases from Upper Klamath Lake, through Link River Dam, are directed by the Bureau of Reclamation (Bureau) to provide regulated Klamath River flows to benefit fish and wildlife, meet irrigation demands and provide flood control. Keno Dam is owned and operated by PacifiCorp. This dam was built to more efficiently regulate flow releases from Link River Dam to the Four Facilities downstream (J.C. Boyle, Copco 1, Copco 2, and Iron Gate). Keno Dam does not divert water or generate hydroelectric power.

There are no flow or temperature monitoring stations located within the WTA. The nearest flow (USGS gauge 11510700) and temperature (USGS gauge 11509500) gauging stations are upstream of the WTA approximately 11 (RM 219.7) and 23 (RM 231.9) miles, respectively. Thus, with few major tributaries in this reach, it is presumed that flow and temperatures readings at these gauges are representative of flow and temperature in the WTA.

Upper Klamath River flows are highly manipulated, due to Project operations and/or recreational use. Typical daily flows can fluctuate over 1,000 cfs, depending on power demand and time of year (Figure 3). Although daily flows can fluctuate dramatically, daily temperatures oscillate only a few degrees (Figure 4). Average discharge in the Upper Klamath River, as measured at USGS gauge 11510700 during the period of record (Water Years 1960-2012), was 1,735 cfs (Figure 5, Appendix 1). Extreme streamflows for the period of record are a high of 11,600 cfs (2/21/1996) and low of 273 cfs (9/25/2004). Cold air temperatures and precipitation generally occur from November to March, corresponding to periods of higher flows and colder water temperatures. Warmer air temperatures and drier conditions occur from April to October, corresponding to periods of lower flows and warmer water temperatures (Figure 6).

Land ownership/administration

☐ United States Forest Service ☒ Bureau of Land Management

☐ State Parks ☐ National Parks

☐ Fish and Game ☒ Private

☐ Other

Public access

☒ Roadside ☐ Remote/hike-in ☐ Boat

Designations

☒ Wild Trout Water ☐ Heritage Trout Water

☐ Federal Wild and Scenic River ☐ Wilderness

☐ Other

Area maps

Figure 1. Map of the Klamath River Basin and major tributaries

Figure 2. Location of the Klamath River WTA (6.2 miles from the Oregon border downstream to Copco Reservoir) and surrounding area

Figure 3. Typical mid-summer week, depicting daily flow fluctuations >1000 cfs, as measured near Keno, OR, approximately 11 miles upstream of the WTA (RM 219.7)

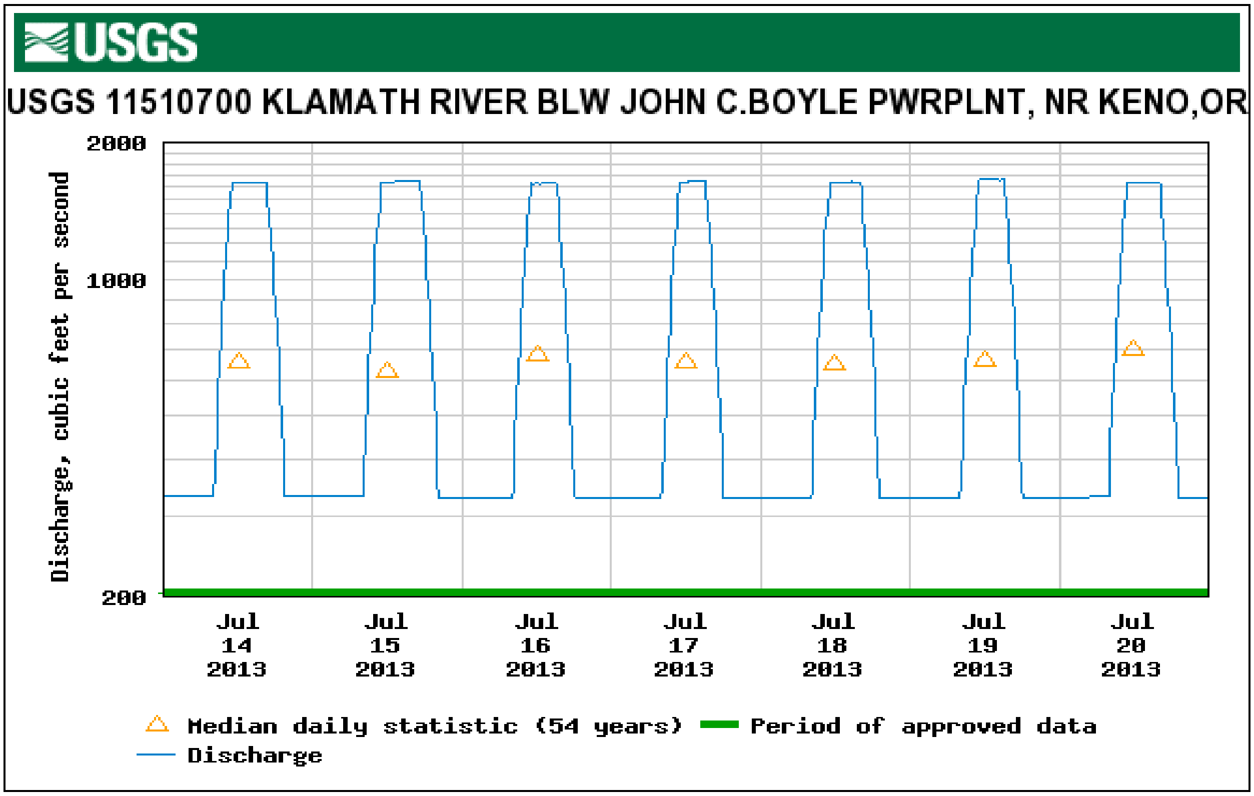


Figure 4. Typical mid-summer week depicting daily temperature fluctuations, as measured near Keno, OR, approximately 23 miles upstream of the WTA (RM 231.9).

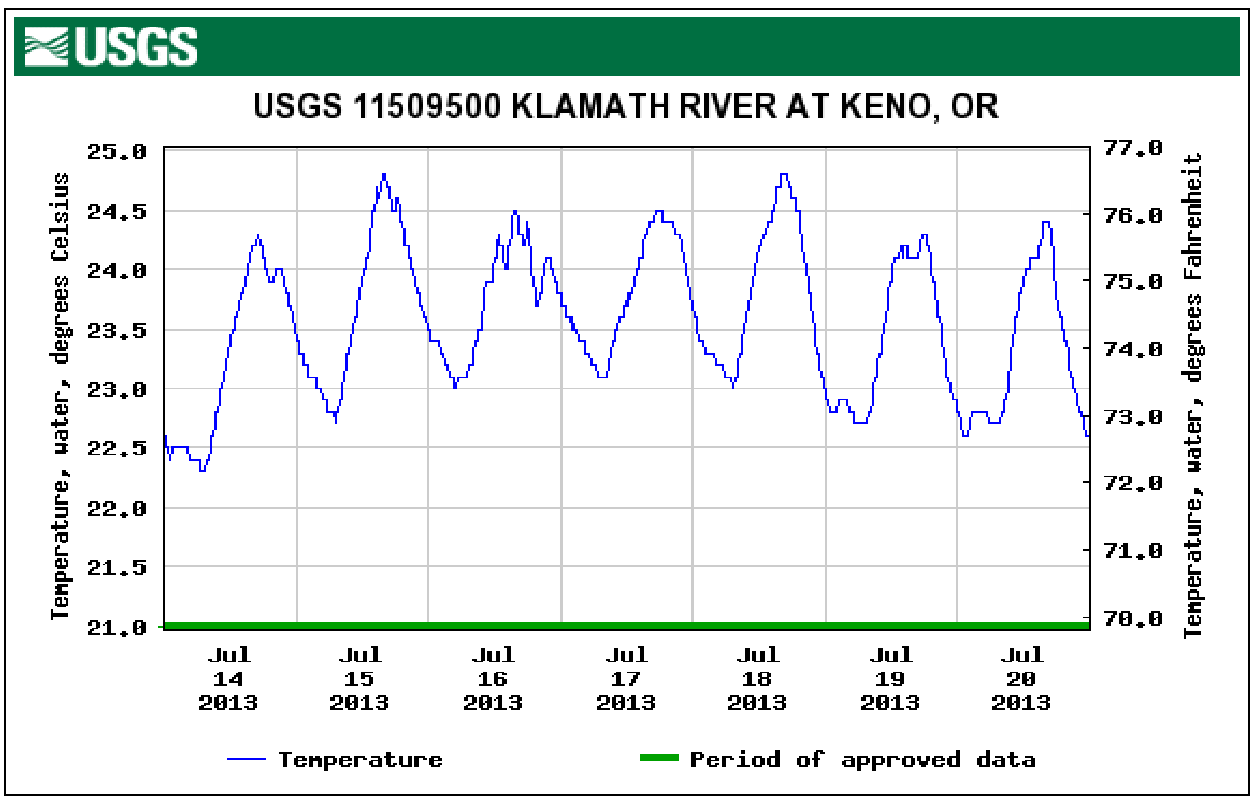


Figure 5. Monthly average flow (10/1/1959 through 5/31/2013) measured near Keno, OR., approximately 11 miles upstream of the WTA (RM 219.7).

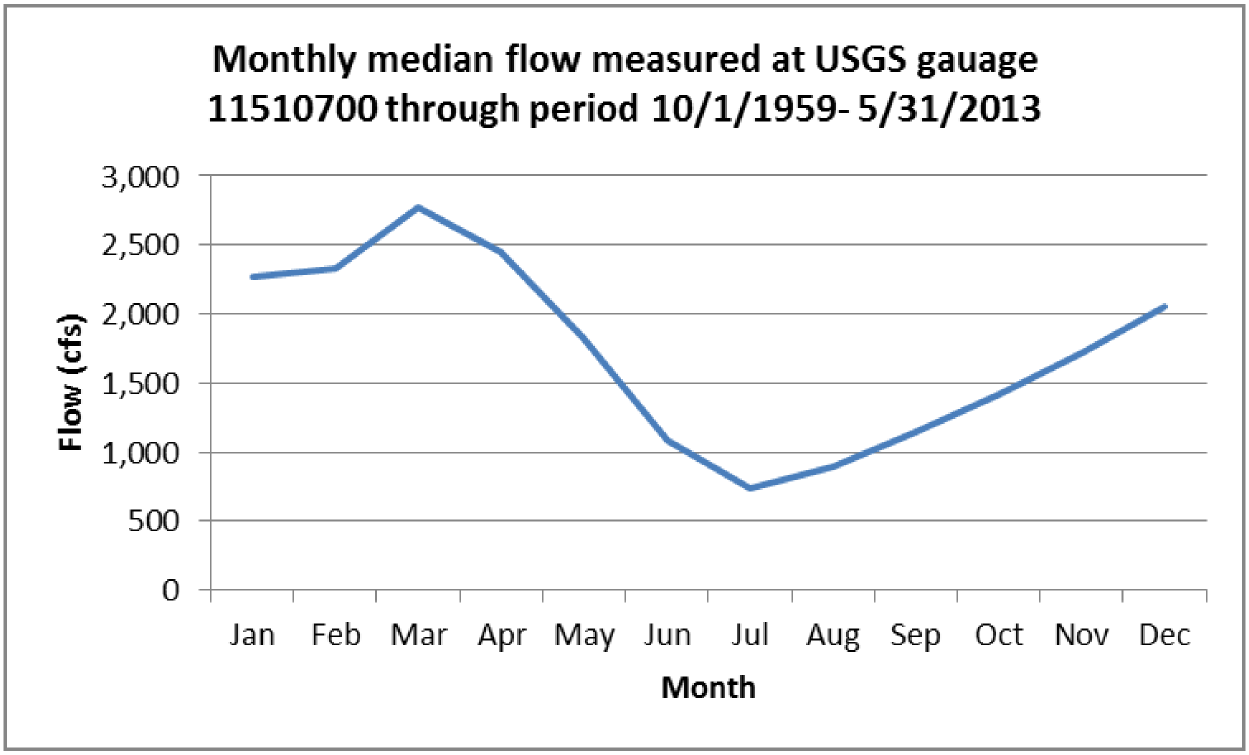
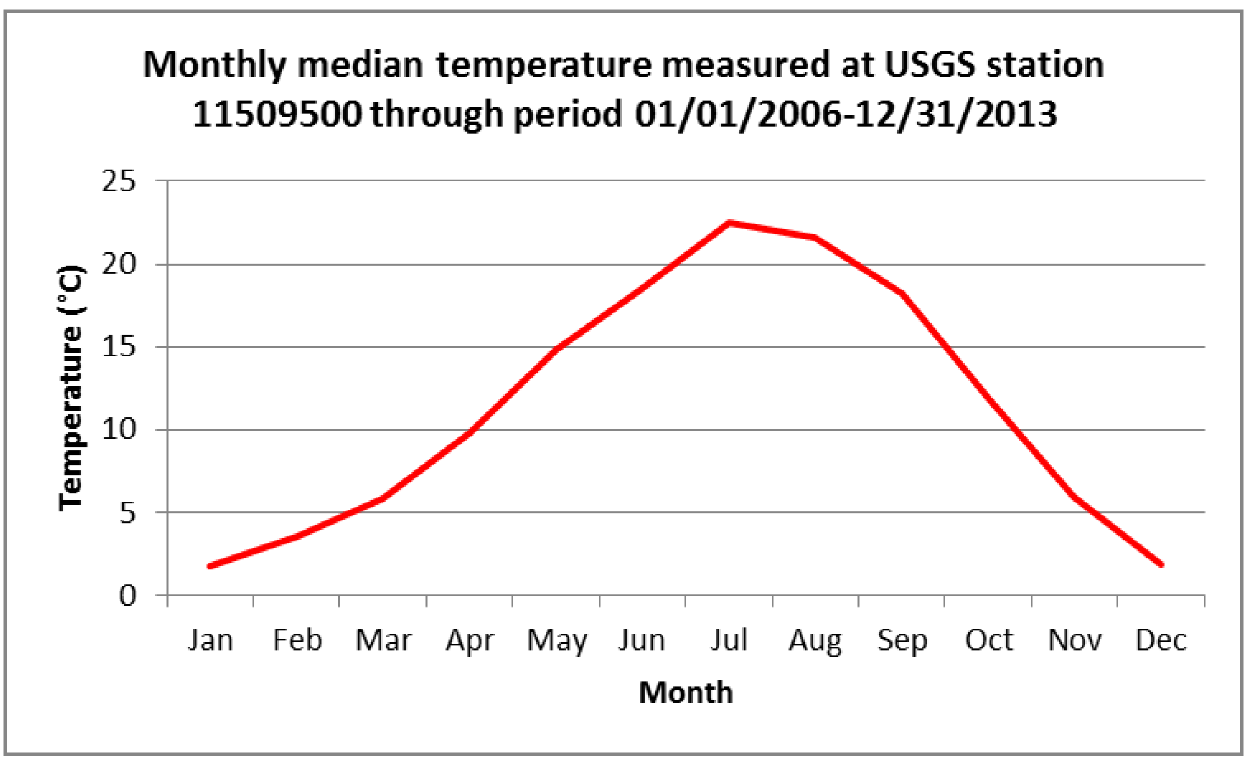


Figure 6. Monthly average water temperature (01/01/2006 through 12/31/2013) measured near Keno, OR., approximately 23 miles upstream of the WTA (RM 231.9).



FISHERY DESCRIPTION

Current Fishery

Numerous fish species, both native and non-native, occur in the Upper Klamath River (Table 1). Hydroelectric project operations, particularly dam building to create multiple reservoirs for storage and release, have reduced available habitat to anadromous species. The reservoirs themselves have provided suitable habitats for, and encouraged the proliferation of, many non-native warm water species. For example, when Iron Gate Dam was built, the reservoir it created was colonized by lake-dwelling fishes from the upper basin. Eleven native fish species are present in the Upper Klamath River (Iron Gate to Oregon border): Pacific lamprey (*Lampetra tridentata* (landlocked form)), Klamath River lamprey (*Lampetra similis*), rainbow/redband trout (*Oncorhynchus mykiss* spp.), blue chub (*Gila coerulea*), Klamath tui chub (*Siphateles bicolor bicolor*), Klamath speckled dace (*Rhinichthys osculus klamathensis*), Lost River sucker (*Catostomus luxatus*), shortnose sucker (*Chasmistes brevirostris*), Klamath smallscale sucker (*Catostomus rimiculus*), Klamath largescale sucker (*Catostomus snyderi*) and Upper Klamath marbled sculpin (*Cottus klamathensis*). Anadromous species (Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*Oncorhynchus kisutch*), steelhead trout (*Oncorhynchus mykiss irideus*) and Pacific lamprey) formerly utilized varying portions of the upper drainage for spawning and rearing, but have been physically blocked by Copco Dam since 1917 and, further downstream, by Iron Gate Dam since 1961. In addition to the native fish fauna, 11 introduced species have been documented, or have been known to exist, in the Upper Klamath River and/or WTA. Numerous native aquatic amphibian and mollusk species have also been documented in the Upper Klamath River (Table 2).

Two federal (ESA) and state (CESA) listed fish species are known to occur in the vicinity of the WTA. These species include: shortnose sucker (federal and California Endangered and California Fully Protected) and the Lost River sucker (federal and California Endangered and California Fully Protected). Based on past surveys, the shortnose sucker is the more abundant of the two; however, only few are present in Iron Gate and Copco reservoirs. The current distribution of Lost River sucker is limited to small portions of the Upper Klamath and Lost River watersheds. Their distribution ranges from the Williamson and Sprague rivers in Oregon, downstream to Copco Reservoir and, probably, Iron Gate Reservoir (Moyle 2002). To date, no Lost River suckers have been documented in the WTA. Analysis by the Federal Energy and Regulatory Commission (FERC) suggests that the population of Lost River and shortnose suckers in Copco 1 Reservoir is supported primarily by recruitment of juvenile and adult suckers from Upper Klamath Lake and J.C. Boyle Reservoir (FERC 2007). It is generally believed both sucker species are established in California as far down as Iron Gate Reservoir, as a result of downstream movement from the portion of the watershed in Oregon. However, populations in California are not thought to be self-sustaining (Hamilton et al. 2011) and are likely supported through recruitment from the upper watershed.

In 1974, the CFGC recognized the Upper Klamath River as an outstanding wild trout fishery and formally designated it a “Wild Trout Water.” Although primarily a rainbow trout fishery, the Upper Klamath River has self-sustaining populations of both wild rainbow and brown trouts. Catch rates and angler satisfaction are among the highest of all CDFW Northern Region designated Wild Trout Waters (CDFW 2014).

Voluntary angler survey forms indicate excellent catch rates; however, there are no population estimates for the Klamath River WTA. The Upper Klamath River is not easily surveyed due to its size, daily fluctuations in river flows, turbidity and safety considerations. Traditional survey techniques (backpack electrofishing, direct observation) used to generate population and density estimates in other streams are not feasible in the WTA. On the other hand, the Upper Klamath River is too small and shallow to conduct boat electrofishing surveys. Therefore, Shovel Creek has been used as a surrogate to the Upper Klamath River WTA to generate estimates of abundance via spawning surveys and population studies.

Shovel Creek

Assessments on Shovel Creek date back to the 1930's when Leo Shapavalov (Division of Fish and Game) documented lower stream diversions. In 1951 and 1952, the first California Fish and Game (CDFG) fishery creel and diet study was conducted on Shovel Creek and, in 1959, a comprehensive stream survey was conducted from the headwaters to the confluence with the Klamath River (CDFW 2012). In the 1970's, Copco Lake Sportsman's Club expressed concerns regarding anglers harvesting trout before and/or during the spawn and resulting negative impacts to the recreational fishery. This led to multiple CDFG studies to evaluate and determine the most biologically appropriate timing of the trout angling season's opening day. The findings from these studies indicated spawning and recently spent trout are not common in Shovel Creek during the end of May and the Club's request to further delay the timing of opening day or to close the Creek was not warranted at that time. Current fishing regulations (2015-16) can be found in Table 5.

A fish habitat enhancement project was completed in 1987, which involved construction of rock weirs, spawning riffles, channel realignment, rearing pools, cover development and bank stabilization in the lower half mile of Shovel Creek. As part of the project, biologists performed surveys and developed multiple pre- and post-restoration trout population estimates to evaluate project success and monitor population trends (Table 3). The lower 2.77 miles of Shovel Creek (the entire section available to fluvial trout via the Klamath River) was delineated by habitat type in June, 1991. This survey indicated that the upper-most unscreened diversion was a threat to spawning adult fish, emigrating fry and juveniles, and out-migrating adults. Consequently, this diversion was screened in 1993 and is maintained by the CDFW, as is the lower diversion. Heritage and Wild Trout Program personnel conducted a Shovel Creek fish population survey in September, 1992. This survey indicated relatively high trout densities (approximately 4,200 fish/mile) (Table3). Another survey was conducted in Shovel Creek in 2012 to update the fish population estimate and compare results against previous surveys. Results indicated a significant decrease in trout density compared to the 1992 estimate (585 fish/mile); however, average length of both rainbow and brown trouts increased (CDFW 2012). The reason(s) for the apparent decrease in trout density from 1992 to 2012 are unknown, but fish condition in 2012 appeared healthy. Given the apparent decrease in abundance, a repeat population survey should be performed within five years, and every five years thereafter, to monitor trends.

Water source

☐ Spring ☐ Rain ☐ Snow ☒ Tailwater

Gradient

☒ Low (< 2%) ☐ Medium (2-4%) ☐ High (>4%) ☐ N/A

Fish species

Table 1. Fish species known to occur in the Upper Klamath River

Common name	Scientific name	Native (Y/N)	Listing status
Pacific lamprey	*Lampetra tridentatus*	Y	none
Klamath River lamprey	*Entosphenus similis*	Y	none
rainbow trout	*Oncorhynchus mykiss*	Y	none
brown trout	*Salmo trutta*	N	none
blue chub	*Gila coerulea*	Y	Species of Special Concern
fathead minnow	*Pimephales promelas*	N	none
golden shiner	*Notemigonus crysoleucas*	N	none
Klamath tui chub	*G. b. bicolor*	Y	none
Klamath speckled dace	*R. o. klamathensis*	Y	none
Klamath largescale sucker	*Catostomus snyderi*	Y	Species of Special Concern

Klamath smallscale sucker	*Catostomus rimiculus*	Y	none
Lost River sucker	*Deltistes luxatus*	Y	Endangered (state and federal) and Fully Protected
short-nose sucker	*Chasmistes brevirostris*	Y	Endangered (state and federal) and Fully Protected
brown bullhead	*Ameiurus nebulosus*	N	none
channel catfish	*Ictalurus punctatus*	N	none
Upper Klamath marbled sculpin	*Cottus klamathensis klamathensis*	Y	none
green sunfish	*Lepomis cyanellus*	N	none
pumpkinseed	*Lepomis gibbosus*	N	none
largemouth bass	*Micropterus salmoides*	N	none
white crappie	*Pomoxis annularis*	N	none
black crappie	*Pomoxis nigromaculatus*	N	none
yellow perch	*Perca flavescens*	N	none

Other aquatic species

Table 2. Other aquatic species known to occur in the Upper Klamath River

Common name	Scientific name	Native (Y/N)	Listing status
northwestern pond turtle	Actinemys marmorata marmorata	Y	Species of Special Concern
foothill yellow-legged frog	*Rana boylii*	Y	Species of Special Concern
western toad	*Bufo boreas*	Y	none
coastal giant salamander	*Dicamptodon tenebrosus*	Y	none
Oregon floater	*Anodonta oregonensis*	Y	none
California floater	*Anodonta californiensis*	Y	none
western rigid mussel	*Gonidia angulata*	Y	none

Fish population estimates

Table 3. Fish population estimates for Shovel Creek (1987-2012)

Water	Section	Date	Survey type	Reference data/summary report
Shovel Creek	Lower	7/1987	Backpack electrofishing- multiple pass	Northern Region Files
Shovel Creek	Lower	7/1988	Backpack electrofishing-	Northern Region Files

			multiple pass	
Shovel Creek	Lower	9/1988	Backpack electrofishing-multiple pass	Northern Region Files
Shovel Creek	28, 51, 59, 60, 61, 90, 98	9/1992	Backpack electrofishing-mark/recapture	Northern Region Files
Shovel Creek	8, 18, 24	6/2012	Backpack electrofishing-multiple pass	Northern Region Files

Angler survey data

Table 4. Angler surveys performed in the Upper Klamath River (1951-present)

Water	Date range	Survey type	Reference data/summary report
Klamath River/Shovel Creek	1951-1952	Creel Surveys	Northern Region Files
Klamath River WTA	1974-1978	Creel Surveys	Northern Region Files
Klamath River WTA	1981-1982	Creel Surveys	Northern Region Files
Klamath River WTA	1988	Creel Surveys	Northern Region Files
Klamath River WTA	1992-present	Angler Survey Box	Northern Region Files
Klamath River WTA	1996	Creel Surveys	Northern Region Files

Angling regulations

The CFGC approved reducing the daily bag in the upper reach of the WTA in 1991 (Shovel Creek to Oregon border) from a 5 to 2 trout limit, while maintaining the 5 trout limit downstream of Shovel Creek. The regulation change also included an artificial lure gear restriction. These changes were implemented in 1992. The intent of the regulation change was to increase the opportunity to catch trophy-size rainbow trout (>18 inches total length) by reducing harvest and improving survival rates of released fish.

After six years of monitoring and evaluation, no notable differences in trout sizes or catch rates were observed between the two reaches. Consequently, in 1998, the CDFG recommended the CFGC readopt the previous 5 trout bag limit with no special gear restrictions. This regulation was reinstated in 1999 and appears to be providing a satisfactory fishery, in terms of size of fish caught, with excellent catch rates. Unless new information from future angler surveys suggests otherwise, the CDFW recommends continuing with this regulation. The 2015-16 fishery regulations for the Klamath River WTA can be found in the Freshwater Sport Fishing Regulations under 7.50 (b) of the Special Fishing Regulations and are summarized below:

Table 5. Klamath River fishing regulations above Iron Gate Dam

Klamath River above Iron Gate Dam	Open Season and Special Regulations	Daily Bag and Possession Limit
(A) Klamath River main stem and all tributaries above Iron Gate Dam, except Shovel Creek and tributaries. The Klamath River main stem within 250 feet of the mouth of Shovel Creek is closed to all fishing Nov. 16 through June 15.	Last Saturday in Apr. through Nov. 15.	5 per day 10 in possession
(B) Shovel Creek and tributaries above mouth of Panther Creek.	Last Saturday in Apr. through Nov. 15.	5
(C) Shovel Creek and tributaries up to and including Panther Creek.	Closed to fishing all year	

Known stressors/issues

Hydroelectric projects/activities

The Klamath River wild trout fishery has been affected by hydroelectric operations since the early 1900's. Operations for peaking power within the reach between J.C. Boyle Powerhouse and Copco No. 1 Reservoir may stress fish and likely results in some mortality and may cause stranding and/or entrainment of fry, juvenile and adult trout.

Future changes to existing operations in terms of flow variation and timing or adjustments to address climate change could further affect the wild trout fishery, particularly related to lower instream flows, higher water temperatures and associated lower dissolved oxygen levels.

In 2010, the Klamath Hydroelectric Settlement Agreement was finalized to address the resolution of litigation, evaluate options for possible facilities removal, and other items related to hydroelectric operations in the Klamath River basin. In addition, a joint EIS/EIR was finalized in April, 2013 to analyze the potential impacts to the environment from the proposed removal of PacifiCorps' Four Facilities (DOI 2013).

Grazing

Cattle grazing is a principal land use and important economic resource in the Klamath basin, including areas around the WTA. Intensive grazing may lead to erosion, weakened streambanks, altered stream channel profiles (wider and shallower), devegetation of the riparian zone, head cuts in meadows and increased water temperatures and sedimentation rates. These impacts can negatively affect fish populations and the fisheries they support.

Water temperature

The operation of the Four Facilities in the Upper Klamath affects many aspects of water quality in the Klamath River, including water temperature (Figure 4). Higher water temperatures can create conditions unsuitable for cold water-dependent species (salmonids), including exceeding thermal tolerances (leading to stress, increased incidence of pathogen or disease outbreaks, reduced metabolic efficiency or direct mortality), encouragement of algal blooms and reduced dissolved oxygen levels.

Algal blooms

Since 2005, toxic algae blooms (cynobacteria) behind Copco 1 and Iron Gate dams have resulted in posted health warnings against water contact in the two reservoirs, as well as the lower Klamath River. Algal blooms can travel long distances downriver in short periods of time and accumulate to concentrations that can pose health risks to people, pets and wildlife, including fishes. The frequency, duration and magnitude of harmful algal blooms appears to be increasing in the Klamath River system.

Invasive Species

Invasive species such as New Zealand mudsnail (*Potamopyrgus antipodarum*), quagga mussel (*Dreissena rostriformis bugensis*), zebra mussel (*Dreissena polymorpha*), Eurasion watermilfoil (*Myriophyllum spicatum*) and didymo (*Didymosphenia geminate*), can negatively impact aquatic ecosystems, creating unnatural trophic or other ecological imbalances that can ultimately limit fishery potential; however, none of the listed invasive species have been detected in the Klamath WTA.

MANAGEMENT

Management goals and objectives

☒ Fast action (catch rates > 2 fish/hour)

☐ Trophy (trout > 18 inches)

☐ Heritage trout

☒ Other

1. Maintain the current recreational trout fishery to provide a continued quality angling experience with a mean catch rate of at least one trout per hour.

2. Maintain instream habitat, health of riparian corridor and water quality.

3. Protect native fishes in perpetuity.

4. Maintain and enhance trout habitat conditions:

    a. Water temperatures conducive to cold-water aquatic organisms with an emphasis on trout physiology and condition factor.

    b. Water clarity and suspended sediment loads that do not exceed standards set by the North Coast Regional Water Quality Control Board (NCRWQCB).

    c. Minimize pollutants negatively impacting the fishery or further detracting from the aesthetic quality of the WTA.

    d. Protect spawning habitat in Shovel Creek to ensure optimal juvenile trout recruitment to the wild trout fishery. This includes maintenance of existing cattle exclusion fencing and gravel monitoring.

    e. Flows should be maintained at a level sufficient to support the fishery at existing or greater levels.

    f. Peaking flows should be minimized and ramped appropriately to minimize stranding and other negative effects to the fishery.

5. Maintain or enhance angler access to the river throughout the WTA, including keeping the existing access points (through PacifiCorp land) open and encouraging a one-way drift fishery.

6. Preserve the aesthetic character of the stream and riparian habitat.

Monitoring

Monitoring and adaptive management are key components to maintaining a high quality wild trout fishery. Surveys will be implemented on the Upper Klamath River and Shovel Creek, to assess the current status of the fishery and angler use and satisfaction (Table 6).

Table 6. Monitoring elements for the Upper Klamath River WTA and Shovel Creek

Water	Date range (month/year)	Survey type	Survey interval
Klamath River WTA	April-November	Angler Survey Box	Annual
Klamath River WTA	April-November	Creel Census Survey	5 years or as necessary
Shovel Creek	June-July	Backpack Electrofishing	5 years or as necessary
Shovel Creek	June-July	Habitat Typing	5 years or as necessary
Shovel Creek	March-June	Spawning/Redd surveys	5 years or as necessary

Angling regulations

Current angling regulations for the Klamath River (above Iron Gate Dam) were proposed and adopted to provide protection for the trout population while maintaining management goals and objectives. The HWTP will continue to monitor the fishery, along with angler satisfaction and preferences, to guide and direct any future regulatory changes, as needed. Regulations will be used in an adaptive manner to optimize angler opportunities, while adhering to the management goals/objectives outlined herein.

Addressing stressors/issues

Hydroelectric Projects/Activities

The Klamath River Hydroelectric Project (FERC No. 2082) is currently under review. The Bureau and CDFW have conducted an environmental review of potential removal of Four Facilities on the Klamath River; removal of the dams will dramatically change the dynamics of the WTA, including habitat, flows, geomorphology and fish fauna, return this stretch of the river to a more natural state, and potentially restore anadromous life history patterns to the upper river.

Grazing

Restoration projects have been implemented in areas around the WTA, including Shovel Creek. Cattle exclusion fencing and bank stabilization structures have been installed in the upper and lower portions of the Shovel Creek watershed. This has allowed for recovery of riparian vegetation, improved stream bank integrity and increased instream cover and shading (Pacific Power and Light Company 1984).

PacifiCorp currently leases the land adjacent to the WTA for cattle grazing. With mitigation measures and modified grazing practices in place, cattle grazing impacts appear to have been largely addressed within the WTA. CDFW staff maintains riparian fencing along Shovel Creek and will continue to work closely with PacifiCorp and the lessees to ensure adequate protective measures are implemented.

Bank stabilization projects such as rip-rapping, tree planting, log/boulder weirs and gabions have been completed in Shovel Creek to curtail erosion, increase streambank stability, improve fish habitat and enhance spawning potential. All stream banks in the lower ¾ mile of Shovel Creek that were compromised by historic cattle grazing have been repaired and are now functioning as intended. The CDFW will continue to monitor the effectiveness of these projects and will seek funding for additional projects as necessary.

Water temperature

The most common water quality impacts from hydroelectric projects are a result of changes to stream hydrodynamics. Dams dramatically alter flow regimes, attenuate seasonal variations in discharge, and can be utilized to artificially manipulate instream flow. They also intercept and retain sediments, organic matter, nutrients, and other natural or artificial components of a stream system that would otherwise be transported downstream (sometimes concentrating agricultural effluents or other pollutants). Water temperatures are generally altered and do not follow seasonal patterns that would otherwise occur under natural, free-flowing conditions.

Deep reservoirs often stratify and retain a cold water “pool” in deeper areas, generally providing colder tailwater releases. Other reservoirs, such as J.C. Boyle Reservoir, do not thermally stratify (FERC 2007; Raymond 2008, 2009, 2010) and do not provide a source of cold water to downstream reaches during warmer months (National Research Council [NRC] 2004). However, during peaking power operations on the Klamath, warm reservoir discharges are diverted from the bypass reach allowing cold groundwater springs to provide cooler instream flows (PacifCorp 2006a). As a result, water temperatures in the bypass reach can drop by 5-15°C while bypass operations are underway (Kirk, et. al. 2010). Although peaking power operations may temporarily reduce water temperatures and provide suitable thermal conditions for salmonids, they may have other negative effects, including stranding and stress, due to dramatic fluctuations in flow and temperature over a short period of time (Figures 3 and 4).

Timber harvest

Current regulations and timber harvest practices appear to be adequate to protect the wild trout fishery and the aesthetics of the area surrounding the WTA. Current harvest rates are believed to have a negligible effect on fish populations and, correspondingly, the recreational fishery in the WTA. Heritage and Wild Trout Program staff will review any updates or proposed modifications to USFS timber harvest plans in order to ensure continued protection of the designated Wild Trout reach of the Klamath, particularly related to direct instream impacts from harvest operations or indirect impacts from potentially increased sedimentation.

Algal blooms

Although algal blooms have not been documented in the WTA itself, they appear to be increasing in frequency, duration and magnitude in other areas of the Klamath River, have recently become widely recognized as an ecological problem in aquatic ecosystems and have the potential to negatively affect fish and other wildlife, including causing mortality. If algal blooms are detected in the WTA, CDFW staff, in consultation with the NCRWQCB, will develop a monitoring plan to assess water quality and potential impacts to fish populations.

The NCRWQCB has collaborated with the Oregon Department of Environmental Quality to develop Total Maximum Daily Loads (TMDLs) for impaired water bodies within the Klamath Basin. TMDLs are water pollution control plans that identify pollutant load reductions that are required in order to meet water quality standards. The TMDLs focus on reducing elevated water temperatures, increasing dissolved oxygen levels, and reducing nutrient concentrations in the main-stem Klamath River over a 50-year time period (NCRWQCB 2010b).

Invasive species

Anglers can inadvertently become a vector for aquatic invasive species, largely through transport of live adult or larval organisms in wading boots, wading socks, waders or other fishing gear that comes into contact with infected waters. The CDFW has an invasive species program, focused on education and enforcement to reduce the spread of non-native invasive species in the wildlands and waterways of California. This statewide program employs educational campaigns, boat inspection check points, and other methods of informing the public about the dangers of invasive species and their potential ecological impacts. Informational posters are displayed at angler access sites in the WTA and CDFW staff will continue to monitor the WTA for the presence of invasive species through coordinated sampling efforts with the regional invasive species coordinator.

Adaptive strategies

This FMP provides guidance and management direction for the wild trout fishery in the Klamath River WTA. These management recommendations are based on existing conditions and should be used or modified in accordance with updated information over time. Long-term monitoring of the fishery and associated angler preference and satisfaction will be central to the development of future management prescriptions. Expected outcomes and success criteria will be established prior to implementation of any management changes and intervals for post-implementation monitoring will be established. Modifications to the management strategies outlined in this FMP will be based on updated quantifiable data, stakeholder input, the CFDW HWTP Policy, the Trout and Steelhead Conservation and Management Planning Act (F&G Code Section 1725 et. seq.), and collaborative HWTP review.

REFERENCES

CDFW 2012. California Department of Fish and Wildlife, Heritage and Wild Trout Program (HWTP) field report for Shovel Creek.

CDFW 2014. California Department of Fish and Wildlife, Northern Region. Unpublished Angler Survey Box Data- Upper Klamath River. 2014.

Department of the Interior (DOI). 2013. Klamath Facilities Removal Environmental Impact Statement/Environmental Impact Report (EIR/EIS). April 2013. Available online at: http://klamathrestoration.gov/Draft-EIS-EIR/download-draft-eis-eir

FERC 2007. Final Environmental Impact Statement for Hydropower License, Klamath Hydroelectric Project, FERC Project No. 2082-027, FERC/EIS-0201F. Washington, DC, Federal Energy Regulatory Commission, Office of Energy Projects, Division of Hydropower Licensing.

Hamilton, J.B., Rondork, D., Hampton, M., Quinones, R., Simondet, J., Smith, T. 2011. Synthesis of the Effects to Fish Species of Two Management Scenarios for the Secretarial Determination on Removal of the Lower Four Dams on the Klamath.

Prepared by the Biological Subgroup for the Secretarial Determination Regarding Potential Removal of the Lower Four Dams on the Klamath River. Accessed on December 21, 2011. Available at: http://klamathrestoration.gov/keep-me-informed/secretarial-determination/ role-of-science/secretarial-determination-studies

Kirk, S., Turner, D., and Crown, J. 2010. Upper Klamath and Lost River sub-basins total maximum daily load (TMDL) and water quality management plan (WQMP). Oregon Department of Environmental Quality, Bend, Oregon.

Moyle, P.B. 2002. Inland Fishes of California. University of California Press.

National Research Council (NRC). 2004. Endangered and threatened fishes in the Klamath Basin: causes of decline and strategies for recovery. The National Academies Press, Washington, DC. Available at: http://www.nap.edu/openbook.php?isbn+0309090970.

PacifiCorp. 2006a. Causes and effects of nutrient conditions in the Upper Klamath River for the Klamath Hydroelectric Project (FERC Project No. 2082). PacifiCorp, Portland, Oregon.

Pacific Power and Light Company. 1984. EEI recreation use and resource management newsletter, riparian habitat.

Raymond, R. 2008. Water quality conditions during 2007 in the vicinity of the Klamath Hydroelectric Project. Prepared by E&S Environmental Chemistry, Inc., Corvallis, Oregon for PacifiCorp Energy, Portland, Oregon.

Raymond, R. 2009. Water quality conditions during 2008 in the vicinity of the Klamath Hydroelectric Project. Prepared by E&S Environmental Chemistry, Inc., Corvallis, Oregon for CH2M Hill, Portland, Oregon and PacifiCorp Energy, Portland, Oregon.

Raymond, R. 2010. Water quality conditions during 2009 in the vicinity of the Klamath Hydroelectric Project. Prepared by E&S Environmental Chemistry, Inc., Corvallis, Oregon for PacifiCorp Energy, Portland, Oregon.

NCRWQCB. 2010b. Final staff report for the Klamath River Total Maximum Daily Loads (TMDLs) addressing temperature, dissolved oxygen, nutrient, and Microcystin impairments in California, the proposed site-specific dissolved oxygen objectives for the Klamath River in California, and the Klamath River and Lost River implementation plans. Stat of California North Coast Regional Water Quality Control Board, Santa Rosa, California.

http://www.swrcb.ca.giv/northcoast/water_issues/program/tmdls/klamath_river/

APPENDIX

Appendix 1. Mean monthly discharge calculated at J.C. Boyle flow gauge from period 10/01/1959- 5/31/2013

YEAR	Monthly mean in ft3/s (Calculation Period: 1959-10-01 -> 2013-05-31)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1959										1,734	1,748	1,695
1960	1,477	1,531	1,436	1,463	1,301	945.7	837.2	1,018	1,222	1,351	1,526	2,246
1961	1,751	1,466	1,644	1,547	1,352	1,238	891.5	964.4	1,270	1,811	2,437	2,228
1962	1,894	1,307	1,328	2,188	1,168	728.3	703.3	868.2	1,253	2,307	2,548	3,128
1963	1,959	1,707	2,347	3,230	2,614	684.9	661	947.7	1,410	1,555	2,285	2,721
1964	2,478	1,643	1,367	2,305	705.5	781.4	596.4	718.2	1,341	1,656	1,508	3,895
1965	7,905	7,780	5,670	1,636	1,372	688.7	571.3	1,054	1,876	2,544	3,989	2,707
1966	1,933	1,229	1,342	1,765	591.2	580.1	592.8	1,034	1,150	1,559	1,612	2,592
1967	2,620	2,692	1,528	1,992	3,447	1,196	529.5	782.3	1,342	1,559	1,644	2,255
1968	1,539	1,486	1,956	1,234	809.4	590.4	551.4	684.4	878.5	1,247	1,235	1,333
1969	1,590	2,665	2,081	4,574	2,563	935.7	639.1	813.1	1,369	1,691	2,447	2,103
1970	3,955	4,654	3,296	1,098	1,190	694	549.3	994.4	1,134	1,271	2,473	3,372
1971	3,229	2,662	3,652	5,524	3,935	1,742	581.9	942.5	1,438	2,568	2,807	3,364
1972	3,384	2,831	8,755	2,956	2,036	593.3	543.1	861.5	1,722	1,684	2,677	3,141
1973	2,947	2,370	2,012	1,092	813.9	669.7	501.5	590.5	776	1,153	1,759	3,558
1974	4,657	3,459	4,647	5,645	2,396	685	612.3	951.2	1,177	1,630	2,615	2,790
1975	2,672	2,649	3,725	3,327	2,910	854.9	644.7	913.5	1,431	2,263	2,899	3,498
1976	2,794	2,420	2,150	1,356	763.6	549.6	517.5	1,034	1,320	1,671	2,790	1,739
1977	1,544	1,091	634.3	722.9	873.2	650.8	638.5	620.3	821.6	1,269	1,294	3,144
1978	3,662	2,961	3,007	3,123	1,837	668.5	591.3	963.9	1,138	1,226	1,475	1,634
1979	1,741	1,296	2,278	1,093	1,244	671.4	633.3	941.3	1,131	1,179	1,165	1,112
1980	2,499	2,934	2,698	1,323	1,275	672.4	587.2	987	1,172	1,200	1,160	1,227
1981	1,174	1,227	1,654	1,305	887.6	723	640.8	938.5	828.1	786.2	897	2,753
1982	3,298	5,288	6,024	4,770	2,138	642	1,339	943.9	1,217	1,739	2,890	3,436
1983	2,701	4,194	6,551	4,531	3,485	2,327	794.1	971.7	1,453	2,595	3,832	5,733
1984	3,522	3,169	4,823	4,314	3,320	1,822	645.5	943.1	1,559	3,157	4,506	3,598
1985	1,988	1,419	2,129	3,786	1,165	989.8	663.8	981.2	1,499	1,562	1,997	2,888
1986	2,090	5,216	6,820	2,690	1,499	649	672.2	991	1,278	1,657	1,785	2,080
1987	1,676	2,355	2,411	1,186	1,025	697.3	731.9	900.6	1,248	1,281	1,223	1,330
1988	1,505	2,071	1,750	1,085	889.1	704.3	606.2	951.9	982.1	976.3	977.6	1,276
1989	1,416	2,050	4,835	4,168	2,172	831	655.7	1,041	1,197	1,256	1,226	1,362
1990	1,681	1,602	1,756	1,276	904.1	668.1	582.3	941.7	1,073	1,234	1,219	1,632
1991	1,256	604.4	653.5	552.8	662.4	527	491.1	595.9	653.3	834.2	734.7	796.3
1992	806.6	488.6	450.2	695.1	417.9	391.2	349.2	348.5	456.6	851.4	857.5	816.5
1993	770.6	647.8	4,284	4,765	2,479	2,160	668	1,038	1,300	1,390	1,330	1,326
1994	1,039	618.3	539.3	537.2	626.3	663.8	516.8	551.9	815.2	813.1	777.3	791.7
1995	849.8	636.1	3,559	2,870	2,983	902.5	676.5	921.8	1,272	1,307	1,218	1,326
1996	3,373	7,302	4,681	3,045	2,988	1,405	972.5	981	1,260	1,309	1,273	2,548
1997	7,730	5,019	2,639	2,153	1,899	1,131	772.5	945.4	932.4	1,436	1,579	2,120
1998	3,144	4,181	4,186	4,208	5,156	2,995	954.5	1,102	1,303	1,166	2,040	3,130
1999	3,171	3,730	6,547	5,085	2,661	1,823	1,194	1,072	1,203	1,283	1,685	1,741
2000	2,469	3,357	3,386	2,312	2,076	1,263	983.4	953	1,057	1,255	1,154	1,173
2001	1,198	1,153	1,175	1,490	1,689	1,825	962	913	924.6	1,182	1,144	1,080
2002	1,604	1,997	2,081	1,499	1,296	848.9	742.1	623.4	715.5	900.7	741	824.9

2003	932.6	791.9	1,354	2,422	2,078	1,117	856.3	915.5	1,038	1,097	1,181	1,389
2004	1,052	1,446	1,564	1,492	1,096	822.6	565	640.2	766.3	655.6	859	881.2
2005	788.1	603.3	653.2	1,129	3,057	1,093	844	898.5	1,056	1,231	1,153	1,696
2006	5,103	3,797	3,209	5,575	3,582	3,038	1,291	892.8	1,011	1,186	1,247	1,135
2007	1,165	1,424	2,873	1,952	1,280	1,449	1,024	989	952	1,151	1,195	1,195
2008	1,123	1,206	1,675	2,422	1,743	1,685	1,007	998.3	1,008	1,183	1,199	1,202
2009	1,090	1,088	1,282	1,312	1,230	1,370	1,035	957.8	918.3	1,192	1,208	1,230
2010	1,223	1,196	1,334	1,190	987.3	849.3	756.8	948.3	926.7	920.9	1,264	1,038
2011	1,093	1,709	2,376	3,325	2,894	2,134	1,064	982.5	1,066	894.1	1,273	1,078
2012	1,081	806.1	1,015	2,776	2,397	1,394	1,033	979.5	1,033	822.9	1,058	824
2013	972.5	747.2	1,494	1,263	1,078							
Mean	**2,270**	**2,330**	**2,770**	**2,450**	**1,830**	**1,090**	**737**	**897**	**1,140**	**1,420**	**1,720**	**2,050**

ACKNOWLEGEMENTS

We would like to thank Jeff Weaver and Stephanie Hogan of the Heritage and Wild Trout Program, Fisheries Branch for their constructive review of this Management Plan and Northern Region personnel that helped monitor and maintain the Klamath River Wild Trout Area.