

Statistical Creel Survey on Upper Klamath and Agency Lakes in 2009 and 2010



William R. Tinniswood
High Desert Region
Oregon Department of Fish and Wildlife

Mary Buckman and Ariel C. Muldoon
Fish Division
Oregon Department of Fish and Wildlife



Abstract

A roving type statistical creel survey was performed in Upper Klamath and Agency Lakes in the years 2009 and 2010 during the peak months of angling effort from March-September. Pressure counts and angler interviews were conducted to determine catch, harvest, and catch per unit effort of the trophy redband trout fishery. The purpose of the survey was to collect information to evaluate potential management changes that have been proposed by the public during multiple Sport Fish Regulation meetings. Overall catch rates were similar in 2009 and 2010. Average catch rates for all anglers in 2009 was 0.11 redband trout/hour (9 hours per redband trout) and 0.10 redband trout/hour (10 hours per redband trout). However, boat anglers had much higher catch rates (range: 3.6-8.5 hours per redband trout) than bank anglers (range: 21-58.8 hours per redband trout). Bank angling at Agency Lake during the spring of 2010 was the lowest catch rate ever recorded (58.8 hours per redband trout) while boat angling on Agency Lake during the summer had the highest catch rate ever recorded (3.6 hours per fish). Most redband trout captured in the fishery were released (88% in 2010 and 83% in 2009) with an estimated 729 harvested in 2010 and 943 harvested in 2009 (Total fishery removal 1582 and 1772). Angler effort was estimated at 49,695 hours in 2010 and 57,769 hours in 2009. Average size of redband trout captured in the fishery was 517 mm (20.35 inches). Anglers harvested larger redband trout than average (544 mm, 21.4 inches fork length). Management implications for the future should consider the high catch rate during the summer in Agency Lake and Pelican Bay Area. Water temperatures at the surface can reach 28° C during the summer where redband trout are caught and subsequently released. Gear restrictions might be considered. High catch and release rates were observed by anglers still fishing with worms in Pelican Bay during the summer which can lead to mortality exceeding 20%. Angler's favorite spoons for redband trout typically have treble hooks which have shown in prior studies on much smaller trophy brook trout to have significantly higher mortality than single hooks. Creel performed outside of the statistical creel showed significant effort and harvest can occur in February and November and possibly other months depending on weather conditions. Further, many areas of the fishery were not measured for effort due to spatial, temporal, and economic constraints. The estimates of catch, effort, harvest and fishery mortality of the 2009-2010 statistical creel surveys should be considered a minimum of the fishery only during the time from March-September.

Introduction

Fish Management

Messmer and Smith (2007) summarized the evolution of fish management of Upper Klamath and Agency Lakes. Fish management in Upper Klamath and Agency Lakes has evolved significantly from stocking hundreds of thousands of various rainbow trout stocks to managing exclusively for trophy, wild redband trout. From 1928 to the 1980's significant number of hatchery coastal rainbow trout were stocked. Other species were also tried including steelhead, cutthroat and brook trout. A study in 1970's showed that the massive trout stocking program was a dismal failure as of the 310,000 fingerling rainbow trout stocked less than 0.4 % contributed to the fishery.

Probably the biggest deterrent to continuing to manage the lakes for stocking of hatchery rainbow trout was the discovery of *Ceratomyxa shasta* in Upper Klamath Lake. *C. shasta* was discovered in Upper Klamath Lake at Barclay Springs in 1979. The hatchery stocks that were utilized and currently available were coastal rainbow trout stocks which lacked resistance to this parasite. Stocking of hatchery rainbow trout in Upper Klamath Lake and Agency Lakes was discontinued in 1979.

In 1978 ODFW developed the Wild Fish Management Policy. A fish management plan was written in 1981 specifically for Upper Klamath and Agency Lakes. This plan stated objectives around maintaining redband trout size and catch rates. The Upper Klamath and Agency Lakes plan which was approved by The Oregon Fish and Wildlife Commission. The plan stated Upper Klamath and Agency Lakes would be managed for wild redband trout only with the following objectives;

- 1) Maintain a fishery for large rainbow trout, 50% over 20 inches in length, with catch rate no more than 17 hours per redband trout.
- 2) Maintain and/or improve habitat conditions for natural production.

In 1997 a Fish Management Plan was completed by ODFW for the Klamath Watershed (ODFW 1997). Klamath and Agency Lakes and tributaries (Wood River, Williamson River, Crystal Creek, Recreation Creek, Short Creek, Odessa Creek, Harriman Creek, and Thomason Creek) will be managed under the Trophy Fish Management Option for wild fish only. Action 2.5 of the 1997 ODFW Klamath River Basin Fish Management Plan states: 1) Conduct periodic angler creel surveys to document effort, catch demographics and preferences.

Historic and Present Redband fishery

In the early 1900's the newspapers Evening Herald and Klamath Republican reported the largest rainbow trout in the United States were captured in Upper Klamath Lake each year. Field and Stream held a big trout contest each year at this time and Upper Klamath Lake was a continual winner. Some of the early headlines include "Second record redband trout taken at Rocky Point by 74-year-old W.H. Barnum" on July 28, 1921. Barnum captured the redband trout using a regulation spoon. In 1921 Dr. A. E. Sykes won a competition by Field and Stream for the largest trout caught west of the Rocky Mountains. The trout was 23.5 pounds and caught near Rocky Point and caught on spoons. The trout was actually the largest caught in the United States that year.

The redband trout fishery in Upper Klamath and Agency Lakes is first described in the ODFW Klamath District files in 1952. In the winter the fishery was primarily a bait fishery in the areas of open water near the outlet of the lake. Effort was higher in the summer at Rocky Point and at the mouth of the Williamson River. Trolling with lures was the most common method of catching trout during the summer. Rocky Point area had the most effort in the redband trout fishery.

The largest trout ever documented by Oregon State Game Commission was a 37 inch 25 pound redband trout caught in August 1956 near Rocky Point. This redband trout is still mounted at Rocky Point Resort. Another comparable redband trout was caught that same year and measured 35 inches.

The historic redband trout fishery likely displayed significantly more effort and harvest than observed currently. This likely was reflected in the fact of numerous redband trout captured less than 20 inches. For example from 1960-1970 many redband trout were captured under 20 inches with the dominant age class in the catch typically ranging from 14-18 inches. The significant harvest fishery was likely affecting the average size of redband trout with only 8 to 38 percent of redband trout exceeding 500mm (20 inches) (Table 1). In more recent surveys over 50% of the trout captured are over 500 mm (20 inches) (Table 1).

Historic Oregon State Game commission monthly reports in the 1960's speak of a good brown trout fishery in Agency Lake and even numerous brook trout captured in Agency Lake. In 1963 forty six percent of the checked catch on opening day on Agency Lake was brown trout. The harvested brown trout ranged in size from 8.4 to 27.8 inches. Harvest of brown trout was only 14.5 percent in 1962. Brook trout were entering the fishery in Agency Lake ranging from 10-14 inches in May 1966.

Creel survey results also showed an extensive fishery for brown bullhead at the mouth of the Williamson River. For example on labor day weekend in 1964 thirty-one anglers caught 1001 brown bullhead at the mouth of the Williamson River. In 1966 Agency Lake was developing a brown bullhead redband fishery.

In the 1960 numerous complaints were received of tui chub interfering with the redband trout fishery. Anglers captured so many tui chub that fishing for redband trout was very slow. One angler on opening day in April 1962 on Agency Lake captured 123 chub from 200-400 mm (8-16) inches in length. Estimates of angler chub catch for the first two months of the season was 86 per day.

Table 1. Historic creel summaries from Upper Klamath and Agency Lakes from 1952-2005. The years of 1964, 1968, 1970 and 1971 included warmwater anglers. The 2005 creel was completed by guides and expert anglers (note: Observed catch and effort, not estimates)

Year	Catch Rate Trout/ Hour	Percent redband > 500mm (20 inches)	Total Redband Trout landed	Total anglers	Total hours fished
1952	0.14	37	251	287	1766
1953	0.19	26	879	701	4617
1954	0.07	37	106	415	1560
1955	0.09	38	76	184	806
1956	0.08	17	64	186	766
1957	0.09	35	118	294	1186
1958	0.09	15	104	333	1094
1959	0.11	30	352	648	3190
1960	0.12	38	118	336	965
1961	0.19	40	48	71	248
1962	0.17	16	51	70	298
1963	0.13	10	64	96	429
1964	0.26	6	849	599	3246
1965	0.37	8	127	143	346
1966	0.2	19	215	314	1122
1967	0.06	26	41	259	650
1968	0.1	19	334	751	3310
1969	0.17	16	219	358	1264
1970	0.14	19	156	310	1070
1971	0.11	15	134	327	1250
1972	0.16	19	157	310	980
1973	0.06	55	36	269	606
1974	0.02	0	1	33	48
1975	0.09	47	76	264	856
1976	0.05	47	30	193	541
1977	0.04	70	27	219	634
1978	0.05	49	105	763	1919
1979	0.06	52	114	641	1890
1980	0.06	56	139	849	2192
1981	0.07	51	68	301	982
1982	0.07	30	293	1423	4167
1983	0.03	61	42	606	1227
1984	0.08	49	184	846	2251
1985	0.13	41	347	816	2734
1986	0.05	57	206	974	2120
1987	0.07	51	119	466	1603
1988	0.06	100	58	310	896
1989	0.13	53	40	137	304
1995	0.03		41	317	1281.75
2005	0.24	59	112	5	466.5

Fisheries were also common for suckers (mullet) at the various springs along Upper Klamath Lake. The most popular fisheries occurred at Harriman, Barkley and Sucker Springs. Spark plugs were used for weight and a large snagging hook. Markle and Cooperman (2001) have described the fishery at Harriman, Barkley and Sucker Springs. Other springs were also likely fishing sites as spark plugs which were utilized for weight were found.

Currently, the primary fishery in Upper Klamath and Agency Lakes is for redband trout yearlong. Typically from October-June redband trout are scattered throughout the lake and fisherman target redband trout at many locations. The most popular locations for bank anglers are Putnam's Point across from Pelican Marina, Social Security Point just north of Moore Park Boat Ramp #2, along highway 140 especially at the pull out before climbing Doak Mountain, the Howard Bay boat ramp, all along the county road that parallels Shoalwater Bay (most popular), the pump station entering Algoma pond and pump station entering Hank's Marsh, and Henzel Park on Agency Lake. Many bank anglers have developed unique electric or spring loaded hook setters so they can sit in their vehicle due to the slow fishing.

From October-June boat anglers in Upper Klamath Lake prefer fishing the shoreline from Eagle Point to Sesti Tgawaals Point. Other popular areas for boat anglers in Upper Klamath Lake include the shoreline along Skillet Handle, along highway 97 near Sucker and Ouxy springs and near the outlet around Putnam's Point. Popular areas in Agency Lake include the area around the straights and around Fourmile Canal.

During the summer from June-September bank angling is rare and most the redband trout fishery occurs from boat in the cold water areas of Pelican Bay (most popular), Odessa Creek, Short Creek, Crystal Creek, Recreation Creek, and Harriman Creek. The area near the mouth of the Wood River is popular. Boat anglers typically troll around the mouth and north to the BLM wetland levee. The redband fishery at the mouth of the Williamson River has received very little effort recently.

A secondary fishery exists for yellow perch in Pelican Bay, Crystal, Recreation, and Fourmile Canal in August and September. Yellow perch have also been captured at Haglestein Park in late winter. A few yellow perch are also captured in the summer in the Wood River and in Agency Lake along the Wood River delta.

The angling regulations allow only one trout to be harvested and when the one redband trout is harvested, the angler has to quit fishing for trout. For this reason, and the popularity of catch-and-release in general, it is likely that people will release quite a few redband trout.

Use of the lake is diverse. In addition to fishing, people come to the lake for bird-watching, canoeing, hiking, sailing and other outdoor recreation. There are numerous day-use areas, camping areas, marinas, and resorts all around the lake. The lake is 17 miles long with varied shorelines and vegetation, several arms or coves, and a number of islands.

Objectives

The objectives of the statistical creel survey are:

- 1) Estimate redband trout harvest and overall fishery mortality of redband trout during peak angling effort (March-September) in Upper Klamath and Agency Lakes.
- 2) Determine catch rate and estimate total catch of redband trout during peak angler effort from March-September.
- 3) Estimate angler effort from March-September.
- 4) Develop potential management options to: 1) Address sport fish regulation concerns from anglers and 2) Improve the trophy trout fishery.

Study Area

Upper Klamath and Agency Lakes is the largest lake in Oregon. Upper Klamath Lake has a surface area of 61,543 acres and Agency Lake has a surface area of 9,298 acres (Johnson et al. 1985). These lakes were once connected by a narrow pathway called the straights. With the breaching of levees by the Nature Conservancy in 2008 the two lakes are much less distinct with an additional 6500 acres of flooded surface area at a lake elevation of 4143.3 feet. Upper Klamath Lake is generally shallow at an average depth of 14 feet at full pool and a maximum depth of 61 feet at full pool as measured by sonar by ODFW in 2009 on the west side of Upper Klamath Lake just north of Sesti Tgawaals Point. The maximum volume of the Upper Klamath Lake before the levee breach at Williamson River Delta was 849,300 acre/feet (Johnson et al. 1985).

Agency Lake is much shallower than Upper Klamath Lake and averages six feet during full pool. Maximum depth is near 25 feet at the mouth of Sevenmile Creek (Canal), near Fourmile Canal, and the outlet of the BOR pump station at Agency Ranch.

Upper Klamath Lake is known for being very productive and classified as hypereutrophic. Due to this productivity the lake experiences a large cyanobacteria bloom known as blue green algae. This bloom and subsequent die off of blue green algae causes significant declines in water quality with a rapid decline in dissolved oxygen to near 0 mg/l, pH can exceed 10 and ammonia levels can increase to toxic levels. Three algae companies harvest the algae for nutritional supplements. Recent concerns of *Microcystis* blooms have prompted diet studies of suckers in Upper Klamath Lake. Suckers that consume midge larvae are being exposed to microcystin and liver tissue has been damaged. Adult suckers are also showing liver damage and a shorter life span. This has implications for the redband trout fishery as midges along with leeches, minnows and sculpins make up a majority of the diet.

Food production in Upper Klamath Lake and Klamath River is abundant in both macroinvertebrate and zooplankton abundance. Midges, oligochaetes and hirudinea are especially abundant in Upper Klamath Lake (Bond et al. 1968). Midges were considered a serious nuisance in the 1930's and can still be a nuisance today. Midge abundance was very high with 542 billion midge larvae estimated in 1932 and in 1968 438 (ca. 600 tons) billion midge larvae were estimated (Bond et al. 1968). The most dominant species collected by the Ekman

dredge by biomass was oligochaetes followed by leeches, midges, clams and snails (Bond et al. 1968). The area near Pelican Bay and just upstream of the Williamson River had the highest biomass. Max numbers of oligochaetes was 52 g/m², leeches 5.3 g/m² and midges 2.35 g/m², amphipods .36 g/m². Very small *Caenis* mayflies are also abundant in Upper Klamath Lake. *Daphnia* are the most abundant zooplankton in the lake by biomass and number. In 1964 and 1965 average daphnia abundance in a 10 liter plankton trap ranged at three sites from 88-105 on the bottom and 183-296 on the surface. Copepods ranged from 71-184 on surface to 76-128 on top (Bond et al. 1968). Diet of Upper Klamath Lake *O. mykiss* typically comprises minnows, sculpins, leeches, midges and water boatmen (ODFW unpublished data). Ehlinger (1992) determined *Daphnia pulicaria* (sometimes referred to as *schroedleri*) abundance peaked in the summer during the *A. flos-aqua* bloom and highest densities exceeded 100 individuals L⁻¹, 6000 ug dry weight, and 95% of the zooplankton biomass.

During the summer redband trout move into the thermal refuge areas of the lake primarily in Pelican Bay and tributaries Crystal, Harriman, Recreation, and Odessa Creeks and the northeast side of Agency Lake around the mouth the Wood River.

Fisherman can be encountered year long. The lake usually freezes for a short time (late December through February) in the winter but has been observed to freeze from late November to early April. The outlet of the lake is the primary fishing location when the lake is frozen. A few anglers will also fish at any open water at Sucker Springs along highway 97. Typically most angling occurring in the winter and early spring are from bait anglers fishing with dead minnows or anglers casting lures at Putnam's Point. As the lake warms trolling becomes popular near the Eagle Ridge area. As the redband trout move to the northern portion of the lake flyfisherman and lure fisherman target the concentrated redband trout. Highest catch rates occur during the summer.

Methods

ODFW conducted statistical roving angler creel surveys on Upper Klamath and Agency Lakes from March 18 – September 27, 2009 and March 8 - September 18, 2010. Because of the large area covered, the lake was split into two sampling areas, north and south (Figure 1-3). Sesti Tgawaals and Modoc Point was the dividing line between the two areas. Agency Lake was included in the north end sampling. Two samplers worked simultaneously in March, July, August, and September, one in each area. During the busiest months (April- June), two more samplers were hired for a total of four samplers working simultaneously. Creel survey personnel sampled both weekend days and two randomly chosen weekdays each week. On each sampled day, the surveyors were randomly assigned either a morning/afternoon shift beginning on lakes at approximately 7AM or an afternoon/evening shift that ended approximately at 8 PM. The creel surveyors were actively surveying on the lake approximately 9 hours each sampled day.

Angler Pressure Counts: Counts of boats and bank anglers were made at approximately 3-4 hour intervals on scheduled sampling days. Two counts were made within each shift. A creel sampler would travel through the area sampled that day, counting angling boats on the water and bank anglers. Counts for the north end of the lake were made by boat for most of the northern section of the lake from April-June 30 (Figure 1). In March 2010 all pressure counts were conducted by vehicle as few boats were on the lakes. Beginning July 1 pressure counts were only conducted from the Rocky Point boat ramp in Pelican Bay to the Wood River Delta and covering the mouth of the Williamson River (Figure 2). Counts for the south end of the lake were made from vehicle and ground from March to June 30 (Figure 3). All counts from Agency Lake were recorded separately. In 2010, additional counts were made of vehicles with trailers that were parked at boat ramps to validate counts of fishing boats or to represent counts of fishing boats on days the boat sampler could not sample due to weather and safety concerns.

A 20 foot Duckworth boat with 115 HP Honda was used to conduct pressure counts on the northern end of the lake (Figure 1). The north part of the Upper Klamath and Agency Lake does not include the tributaries such as Fourmile Canal, Sevenmile canal, Thomason Creek, Crystal Creek, Recreation Creek, Odessa Creek, and Short Creek (Figure 1). After June 30 the north section pressure count only included Pelican Bay to Agency Lake at the mouth of the Wood River to the mouth of the Williamson River.

The south end of the Lake will be covered by vehicle by driving Oregon Avenue to Lakeshore Drive then through Running Y, to highway 140 to Howard Bay at the base of Doak Mountain then backtracking to highway 97 to count anglers at Algoma Pond, Hagelstein Park to Modoc Point.

Pressure counts were conducted in one continuous trip with boat or automobile. Anglers move around so care was taken to ensure a boat or bank anglers were not missed or double-counted. The only reason a pressure count was paused is if the sampler encounters a boat or bank angler leaving at a location where the sampler has not been able to interview many anglers. The sampler paused the pressure count to interview those anglers.

Boats that are traveling across the lake or on the shore for a bathroom break were counted if it looks like they are active fishing boats (i.e. fishing rods or nets, or if they were seen fishing earlier). Boats that are pulled up on shore at a campground or in marinas and not part of an active

fishing trip should not be counted. Pressure counts included all crafts (boats, rafts, canoes, float tubes, etc) whose purpose is fishing, typically by observing fishing gear.

Bank anglers were enumerated in the pressure counts, and similar rules apply. A judgment was made that all bank anglers were fishing for redband trout. Counting rods was the primary method of enumerating bank anglers. If they are fussing around with their gear or off on a short bathroom break the anglers were counted.

Four pressure count times were conducted depending on the am or pm shift (2 per shift). Pressure counts will be spaced approximately every 3-4 hours. The times should be approximately (+/- 30 or so minutes) as listed below.

8:30 AM	0830	Morning	AM Shift
12:00 AM	1200	Mid day	AM Shift
2:30 PM	1430	Mid afternoon	PM Shift
5:00 PM	1700	Early evening	PM Shift

Sampler 1: Primary responsibility was to perform two pressure counts from boat per shift at the times assigned. These pressure counts will include all of Klamath and Agency lakes north of an imaginary line from Sesti Tgawaals Point to Modoc Point (Figure 1). Boats tucked along the west shoreline and bank anglers from Sesti Tgawaals Point north, including Eagle Ridge are included in this count. Sampler one ensured there was a clear delineation between the area the shore sampler and the boat sampler counts boats on the lake so boats or bank anglers do not get counted twice in the same pressure count. The boat pressure count also includes Agency Lake and the Straights (Figure 1 and 2). Between pressure counts, this sampler interviewed anglers primarily around the Rocky Point Boat Ramp area.

Sampler 2: Enumerate boat and bank anglers from vehicle at the south end of Upper Klamath Lake which includes Howard Bay, Running Y, Putnam's Point, Moore Park boat ramps, Highway 97 and Modoc Point at the assumed pressure count times (Figure 3 and 5). Between pressure counts, interview bank anglers and returning boats at locations south of the line from Sesti Tgawaals Point to Modoc Point.

Sampler 3: Interview anglers on Agency Lake boat ramps (Henzel and Agency Lake Resort) and other shore locations on Agency Lake. Although the creel target area did not include the Williamson and Wood Rivers, people using those boat ramps (Petric Park and Wood River Wetland area, in particular) were sampled to determine if they fished in Agency or Klamath Lake (Figure 4). Most boats in Petric Park will be fishing Agency Lake up until April 25 when the Wood River opens. Sampler 3 interviewed anglers at Williamson River Store and Williamson River Resort boat ramps.

Sampler 4: Interview anglers at Eagle Ridge, Rocky Point, Odessa Creek and other areas on the north part of the Upper Klamath Lake (Figure 4).

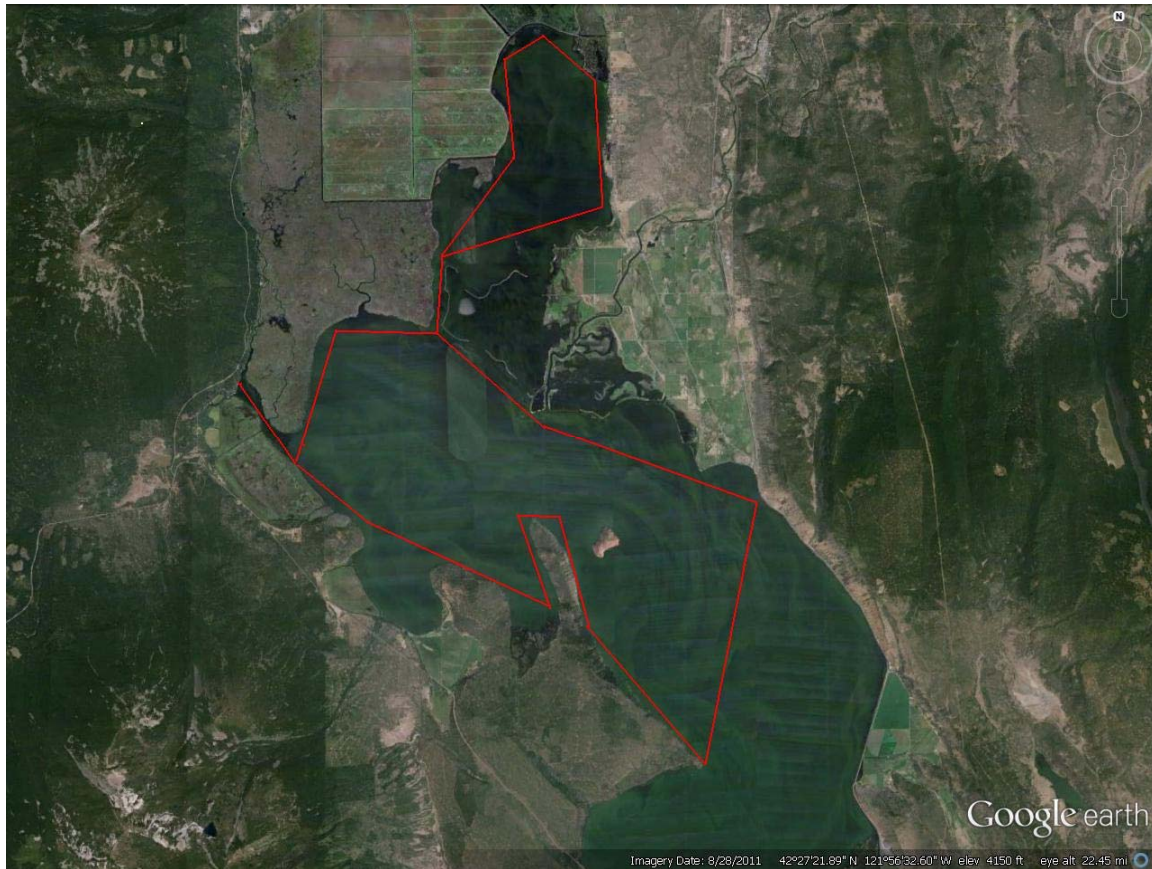


Figure 1. Statistical creel pressure count route by boat from March- June 30 on the northern section of Upper Klamath Lake and all of Agency Lake.



Figure 2. Statistical creel pressure count route by boat from July -September from Pelican Bay to the Wood River Delta to mouth of the Williamson River.



Figure 3. Statistical creel pressure count route by vehicle and ground from March-June 30 on the southern section from Howard Bay to Modoc Point of Upper Klamath Lake.

Angler Interviews: During the time between pressure counts, the samplers travelled along the lake and interviewed anglers at the completion of their fishing trip (primarily boat anglers) or as they were encountered along the shoreline (primarily bank anglers). The boat sampler also performed some interviews while on the water. Angler interviews were classified as completed trips if they were finished fishing for this outing or incomplete if they were still fishing. The creel surveyors asked each party a standard set of questions about their catch, where they fished, time spent fishing in each area, number of anglers in the party, target species, area of residence, angling gear utilized, and if this was a repeat interview. In 2010, any angler fishing with two rods was counted as equivalent to two anglers. Samplers also enumerated number of redband trout caught of each species (kept redband trout only). Similar information was taken about released redband trout, which relied on the recollection of the anglers. The surveyors measured the lengths of all kept redband trout and got an estimate of the length of released redband trout.

Sample days:

Creel samplers surveyed four 10-hour days per week. Most pressure is typically on weekends so the schedule included both weekend days and two weekdays. The creel samplers worked the same four days per week.

The day was divided into two shifts, AM and PM. There is probably little need to start the morning shift earlier unless it appears that people are fishing and leaving before the sampler arrives.

AM	7:00am to 5:00pm
PM	9:00 am to 7:00 pm (March - April 1)
PM	10:00am to 8:00pm (April 1-Sept)

On days when no trailers were remaining at boat ramps or on the lake, the sampler left and use the extra hours on another day or to catch up on other tasks associated with the creel. The schedule should be such that we do not miss the very early and very late anglers on a regular basis.

The samplers traveled among known fishing locations and interviewed all anglers they encounter. Bank anglers will usually still be fishing, while most boat anglers will be encountered when they come to shore, usually to pull their boat out of the water.

Fork lengths were measured for all harvested redband trout. Creel surveyors asked for lengths of redband trout released. Most angler interviews would take place at locations in Table 1, (Figure 4 and 5). If an interview was conducted at a different area the closest interview location was entered with a description of the interview location in the comments.

Table 2. Primary angling location codes on Upper Klamath and Agency Lake where most interviews took place in the 2009-2010 statistical creel.

INTERVIEW LOCATION			
1	Pelican Marina	9	Modoc Point
2	Moore Park 1	10	Petric Park
3	Moore Park 2	11	Neptune Resort
4	Howard Bay	12	Henzel Park
5	Eagle Ridge	13	Hagelstein Park
6	Odessa Creek	14	Williamson River
7	Running Y	15	Social Security
8	Rocky Point	16	BLM Wetland Area



Figure 4. Major interview locations during the 2009-2010 statistical creel survey in the northern section of Upper Klamath Lake and all of Agency Lake.



Figure 5. Major interview locations during the 2009-2010 statistical creel survey in the southern section of Upper Klamath Lake.

Data were stratified by month, day type (weekday or weekend/holiday), whether the party fished from the bank or by boat (trip type), and area fished (Upper Klamath Lake or Agency Lake). Catch rate was estimated for each species, kept or released, within each stratum by summing catch and dividing by angler hours sampled. Complete and incomplete angler trips were pooled. Catch rate for each species k within a stratum (month, day type, trip type, section) was estimated as:

$$C / H_k = \sum_{i=1}^m \sum_{j=1}^n C_{ijk} / \sum_{i=1}^m \sum_{j=1}^n H_{ij}$$

Where;

C/H_k = catch per angler hour of species k within a stratum

C_{ijk} = total catch of species k by party j on day i within a stratum

H_{ij} = total hours fished by party j on day i within a stratum

If there were no interviews in a section, catch rates could not be estimated. This was not an extensive problem in the Upper Klamath Lake creel. However, in 2009 boat catch rates were missing for March and September weekdays in Agency Lake. As there was still boat pressure in Agency Lake on weekdays during those two months, we used the weekend Agency Lake boat catch rates for weekday boat catch rates. In 2010, September weekend and weekday boat catch rates were missing for Agency Lake and so we used August boat catch rates for September.

In 2010, any counts of vehicles with trailers parked at boat ramps had to be assigned correctly to fishing area (either Upper Klamath Lake or Agency Lake), as a boat could launch at a boat launch in one area but actually fish in a different area. The percent of hours spent fishing in each area by interviewed angler parties each month and day type in Upper Klamath and Agency Lake was used to apportion the boat trailer counts. All counts of active angling boats were recorded to area, so no apportioning was needed for boat counts.

Average daily angler hours of effort for each stratum was estimated by calculating the area under the curve (AUC_d) of a trapezoid formed by the average stratum pressure counts during five time intervals: before 8:30 AM, 8:30 AM – 12:00 PM, after 12:00 PM – 3:00 PM, 3:00 PM – 6:00 PM, and after 6:00 PM. Number of people fishing was assumed to be zero at the legal start and end of the fishing day (1 hour before sunrise and after sunset, respectively). Counts within each section in a pressure count were summed to get a single section count of boats and bank anglers. The AUC for each trip type (boat and bank) within a stratum was estimated as:

$$AUC_d = 1/2 \sum_{h=1}^5 (T_h - T_{(h-1)}) * (E_h + E_{(h+1)})$$

Where:

T_h = Average time of day of count h within a stratum, T_0 is legal start time of angling and T_6 is the legal end time of angling

E_h = Average count of anglers (fishing boats or bank anglers) at count h within a stratum, $h = 1-5$ ($E_0 = 0$, the count at legal start time of angling and $E_6 = 0$, count at legal end time of angling)

Because boats were counted by party, party hours was converted to angler hours by multiplying the average party hours of effort from the AUC by the average boat party size for each stratum. Total stratum angler hours of effort were estimated as average daily effort multiplied by the number of days in the stratum. Total estimated catch by species, kept and released, within a stratum was estimated as the product of the catch rate and the estimated hours of effort. Number of angler trips was estimated as the total stratum hours of angler effort divided by the average stratum trip length of a completed angler trip. Estimates were made for March 18-September 30, 2009 and March 1-September 30, 2010.

Percent of redband trout anglers using different types of gear (bait, flies, lures, or combination) for each area was created by weighting each stratum percent by the estimated pressure for that stratum. Percent of kept or released redband trout by gear was created by weighting each stratum percent by the expansion rate (estimated angler hours divided by sampled angler hours).

Results were summarized using literature as described by Jones and Pollock (2012) where the total catch ($C_T = H + C_R$) was equal to total estimated harvest (H) plus total estimated released (C_R). Total fishing removal (R) was calculated as equal to $H + C_R M_R$ where M_R is equal to the proportion of redband trout mortality after release. No estimates of catch and release mortality were made in this study but literature values were utilized (Nuhfer and Alexander 1992). Estimates were made using a 15% catch and release mortality due to the high rate of catch and release using bait, large numbers of redband being released in very warm water temperatures and the increased likelihood of trophy redband trout inhaling lures deeply.

Results

Agency Lake 2009 Creel

Angler Estimated Catch (C_T), Harvest (H) and Total Fishing Removals (R)

Angler estimated catch (C_T) was 2242 redband trout. Total estimated harvest (H) of redband trout was 288. A total 1954 redband trout were estimated released (C_R) in Agency Lake (Table 3). The highest total catch (C_T) occurred in June 2009 where a total of 812 redband trout were estimated released and 25 harvested from boat anglers (Table 4). The month of May had the highest harvest rate where 164 redband trout were estimated harvested from both boat and bank anglers (Table 4). Total estimated fishing removal (R) in Agency Lake was estimated as $R = 284 (H) + 1954 (C_R) * 0.15 (M_T)$ equals 577 redband trout (Table 5). Total fishing removal was much less in the summer than the rest of the fishing season (Table 5).

Angler Estimated Effort (E)

A total of 10,477 hours of angler effort was estimated on Agency Lake from March 18-September 27. Angler effort from boat was much higher than bank angler effort (Table 3). Estimated effort was highest in May for both boat and bank anglers (Appendix A.)

Angler Catch Per Unit of Effort (CPUE)

Overall catch rate in 2009 was 0.22 redband trout per hour. Agency Lake in 2009 had the highest catch per unit effort in the fishery despite bank anglers having the lowest catch rate. Catch rates by bank anglers was 21 hours of effort required to catch one redband trout (Table 3). Bank angling is rare along Agency Lake as there is only a small area of public property at Henzel Park. Bank angling likely occurs along the numerous private residences along Agency Lake and possibly the private boat ramp areas of Oregon Shores 1 and 2 but these anglers were not interviewed. Best fishing by bank anglers occurred in May with a catch rate of 0.07 redband trout/hour (Table 6). Bank anglers had no success in June and ceased fishing at Henzel Park.

Boat anglers in Agency Lake had the highest catch rate of the fishery at 0.44 redband trout/hour in June (Table 7). The second and third highest catch rate also occurred in Agency Lake from boat in August (0.312 redband trout/hour) and July (0.287 redband trout/hour) (Table 7). Most redband trout captured in Agency Lake occurred in the area near the mouth of the Wood River in the summer by boat anglers trolling lures or fly fisherman. Redband trout concentrate in this area as water quality is much better in this area during the summer. Most angling occurs approximately 100-200 m from the vegetation at the Wood River delta from the levee at Wood River Wetland to the furthest southern confluence of the Wood River.

Other Fish Catch

All other fish species were captured by boat anglers (Table 7). Estimates of 7 brown trout were harvested and 10 released in Agency Lake in April and May (Table 7). A total of 39 yellow perch were estimated harvested and 11 released. Four largemouth bass were estimated harvested in April and June. No suckers were reported captured in Agency Lake (Table 7).

Gear Use

The preferred method of angling in Agency Lake was trolling lures (Table 8). Most bait anglers harvested their redband trout captured whereas most fly fisherman and lure fisherman released

captured redband trout (Table 9). Fly fisherman captured more fish than bait or lure anglers (Table 10).

Agency Lake 2010 Creel

Angler Estimated Catch (C_T), Harvest (H) and Total Fishing Removal (R)

Total estimated catch (C_T) was 2395 redband trout. Harvest of redband trout was reduced in but overall catch increased in 2010. A total of 121 redband trout were estimated harvested and 2274 released in Agency Lake from March 8-September 18, 2010 (Table 1). Unlike 2009 the highest estimated catch occurred in July where an estimated 592 redband trout were released and 32 were harvested from boat anglers (Table 2). Catch was highest from June-August (Table 2). Bank anglers were not observed from July-September and no catch was reported by bank anglers in June. Total estimated fishing removal(R) in Agency Lake was estimated as $R=121 (H) +2274 (C_R)*.15 (M_f)$ equals 462 redband trout (Table 5). Converse to 2009 total fishing removal was higher in the summer than the rest of the fishing season (Table 5)

Angler Estimated Effort (E)

A total of 9,312 hours of angler effort was estimated on Agency Lake from March 8-September 18, 2010. Effort was reduced by bank anglers in 2010 (Table 3). Boat anglers had a similar amount of effort in comparison to 2009. Effort did not increase despite the first year of using two rods. Estimated effort was highest in April for bank anglers and June for boat anglers (Appendix A).

Angler Catch per Unit of Effort (C/E)

Overall catch rate was 0.2 fish per hour in Agency Lake. Catch rate by bank anglers in 2010 was the lowest ever recorded at 58.8 hours/redband trout while in 2009 bank angler success was 2.75 times higher at 21.25 redband trout/hour (Table 3). The considerable differences between the two years were lack of catch in April 2010 by bank anglers and significant catch by boat anglers in July-August 2010 (Table 4). No redband trout were reported caught by bank anglers in April 2010. Highest catch rate occurred in Agency Lake by boat in August 2010 of 0.705 redband trout/hour (Table 3). Boat anglers in Agency Lake in 2010 had the highest catch rate in the entire redband trout fishery for both years (Table 3).

Table 3. Estimated catch, effort and observed catch per unit effort of redband trout in Agency Lake from March 18 – September 27, 2009 and March 8 - September 18, 2010

Year	Harvest (H)	Released (C _R)	C/E		Estimated Effort (E) Boat (Hours)	Estimated Effort (E) Bank (Hours)
			Redband trout/hour (hours/trout) Boat	Redband trout/hour (Hours/trout) Bank		
2009	284	1954	.267 (3.7)	.047 (21.25)	7947	2530
2010	121	2274	.274 (3.6)	.017 (58.8)	7758	1554

Table 4. Estimated catch by month (harvested and released) of redband trout by bank and boat with all gear types in Agency Lake from March 18 – September 27, 2009 and March 8 - September 18, 2010.

Month	Harvest 2010	Harvest 2009	Released 2010	Released 2009
January	No estimate	No estimate	No estimate	No estimate
February	No estimate	No estimate	No estimate	No estimate
March	3	28	10	21
April	0	33	156	23
May	19	164	238	544
June	45	24	475	812
July	32	17	592	298
August	16	18	546	122
Sept	6	0	257	134
October	No estimate	No estimate	No estimate	No estimate
November	No estimate	No estimate	No estimate	No estimate
December	No estimate	No estimate	No estimate	No estimate
Totals	121	284	2274	1954

Table 5. A comparison of redband trout removal (R) in Agency Lake from March-September and the summer period of June 15-September in 2009-2010.

Year	Estimated Harvest (H) Total #	Catch and Release Mortality (M _R) (15%) Total #	Total Fishery Removal (R)	Time period
2009	284	293	577	March 18- Sept 27
2009	47	144	191	June 15-Sept 27
2010	121	341	462	March 8 –Sept 18
2010	77	244	321	June 15-Sept 18

Table 6. Monthly Catch rates of redband trout per hour by bank fisherman in Agency Lake from March 18-September 27, 2009 and March 8 - September 18, 2010.

Month	Angler Hours Sampled 2009	Redband Trout/hour 2009	Angler Hours Sampled 2010	Redband Trout/hour 2010
March	93.4	.031	98.6	.014
April	323.2	.034	87.0	.000
May	212.6	.071	73.0	.045
June	22.7	.000	21.4	.000
July	0.0	--	0.5	.000
August	0.0	--	0.0	.000
September	0.0	--	0.5	.000

Table 7. Monthly catch rates of redband trout, brown trout and yellow perch per hour by boat fisherman in Agency Lake from March 18-September 27, 2009 and March 8 - September 18, 2010.

Month	Angler Hours Sampled 2009	RB Trout Caught 2009	Brown Trout Caught 2009	YEP Caught 2009	Angler Hours Sampled 2010	Redband Trout/Hour 2010	Brown Trout/hour 2010	Yellow Perch/hour 2010
March	24.0	.083	.000	.000	24.0	.042	.000	.000
April	344.8	.035	.007	.000	56.6	.272	.000	.000
May	735.3	.196	.003	.000	286.3	.182	.000	.000
June	1026.8	.442	.000	.000	459.1	.207	.001	.000
July	165.1	.287	.000	.000	332.3	.292	.000	.020
August	140.7	.312	.000	.110	105.5	.815	.000	.255
September	2.9	1.379	.000	.000	0.0	.768	.000	.303

Other Fish Catch

No suckers were reported captured in Agency Lake. A total of 105 yellow perch were estimated as harvested and 218 were reported released from July-September (Table 7). All yellow perch captured were by boat and the yellow perch fishery peaked in August. An estimate of three brown trout was harvested in Agency Lake in June by boat anglers (Table 7).

Gear Use and Two Rod Validation

The preferred method of angling in Agency Lake was trolling lures (Table 7.) All angler gear types released most redband trout captured (Table 8). Unlike 2009 most fish were captured by lure fisherman (Table 9).

Anglers were able to purchase a two rod validation for the first time in 2010. A total of 106 Agency Lake bank anglers were interviewed and only 4 (3%) were using two rods (Appendix A). A total of 290 boat anglers were interviewed in Agency Lake and 12 (4%) were using two rods (Appendix A).

Table 8. Gear use by redband trout anglers in Agency Lake from March 18-September 27, 2009 and March 8 - September 18, 2010.

Gear	Percent Anglers 2009	Percent Anglers 2010
Bait	32.0%	23.2%
Flies	10.5%	10.6%
Lures	52.9%	61.6%
Combo	4.6%	4.6%

Table 9. Redband trout catch by gear type in Agency Lake from March 18-September 27, 2009 and March 8 - September 18, 2010.

Gear	Percent Kept 2009	Percent Released 2009	Percent Kept 2010	Percent Released 2010
Bait	65.6%	34.4%	14.4%	85.6%
Flies	0.6%	99.4%	0.8%	99.2%
Lures	23.1%	76.9%	4.2%	95.8%
Combo	0.0%	100.0%	8.5%	91.5%

Table 10. Overall percent of redband trout released by gear type in Agency Lake from March 18-September 27, 2009 and March 8 - September 18, 2010.

Gear	Percent Released 2009	Percent Released 2010
Bait	23.00%	14.3%
Flies	46.90%	11.6%
Lures	29.00%	71.8%
Combo	1.00%	2.4%

Upper Klamath Lake 2009 Creel

Angler Estimated Catch (C_T), Harvest (H) and Total Fishing Removal (R)

Angler estimated catch of redband trout was 4209. From March 18- September 27, 2009 an estimate of 659 redband trout were harvested and 3550 released (Table 10). From July 1- September 27 all anglers interviewed and enumerated were in Pelican Bay or Odessa Creek. Total estimated fishing removal(R) in Upper Klamath Lake was estimated as $R=659(H) + 3550 (C_R)*.15(M_R)$ equals 1191 redband trout.

Angler Catch Per Unit of Effort (C/E)

Overall catch rate was 0.07 redband trout/hour which was lower than Agency Lake. Bank anglers had lower catch rates than boat anglers (Table 10). The highest catch rate of 0.037 redband trout/hour by bank anglers occurred in April (Table 11). Highest catch rate of 0.221 redband trout/hour occurred by boat in July in Pelican Bay and surrounding area (Table 12). Catch rate by boat anglers in Upper Klamath Lake was lower than Agency Lake. No redband trout were reported captured by bank anglers from July-September. The catch rates by bank anglers in Upper Klamath and Agency Lake were the lowest ever recorded in comparison to non-statistical creel dating to 1952 (Appendix C).

Angler Estimated Effort (E)

A total of 47,291 hours of angler effort was estimated from March 18-September 27, 2009 (Table 10). Similar to Agency Lake more effort occurred from boat than bank. Estimated effort was highest for bank anglers in April but March was similar with only 14 days estimated in the month (Appendix A). Estimated effort was highest for boat anglers in May (Appendix A).

Other Fish Catch

An estimated 14,974 yellow perch were released and 5,509 harvested in Upper Klamath Lake. All interviews took place at Pelican Bay and a large portion of the catch took place in Recreation and Crystal Creeks. Yellow perch were captured from July-September with the fishery peaking in August. Peak catch rate occurred in September with 5.0 yellow perch/hour (Table 12)

A total of 85 suckers were estimated released most from boat in August and five from the bank in May. Most suckers were captured in Pelican Bay and along highway 97 near sucker springs.

No brown trout or largemouth bass were reported captured in Upper Klamath Lake.

Gear Use

The preferred method of angling in Upper Klamath Lake was trolling and/or casting lures (Table 14.) All angler gear types released most redband trout captured (Table 15). Most fish caught and subsequently released were by bait fisherman (Table 16).

Upper Klamath Lake 2010 Creel

Angler Estimated Catch (C_T), Harvest (H) and Total Fishing Removal (R)

Angler estimated catch (C_T) was 4026 redband trout. From March 8- September 18, 2010 an estimate of 608 redband trout were harvested and 3418 released (Table 10). Number of redband trout harvested and released was similar in Upper Klamath Lake in 2009 and 2010 (Table 10). Total estimated fishing removal(R) in Upper Klamath Lake was estimated as $R=608(H) +3418(C_R)*.15(M_R)$ equals 1120 redband trout.

Angler Catch Per Unit of Effort (C/E)

Overall catch rate was the same as 2009 at 0.07 redband trout/hour. Angling from shore was much slower than from boat (Table 10). Bank angling in Upper Klamath Lake followed a similar trend as Agency Lake of reduced catch rate in 2010 but an improved catch rate by boat anglers (Table 10).

Catch per unit effort by boat anglers in Upper Klamath Lake was lower than Agency Lake boat anglers but higher than all bank anglers (Table 10). Catch rate was highest by bank fisherman in May of 0.30 redband trout per hour (Table 11). Highest catch rate 0.329 redband trout/hour occurred by boat in September in Pelican Bay and surrounding area (Table 12).

Angler Estimated Effort (E)

A total of 40,383 hours of angler effort was estimated from March 8-September 18, 2010. Estimated effort by boat anglers was higher than bank anglers (Table 10). Estimated effort was highest in April and June for bank and boat anglers, respectively (Appendix A).

Table 10. Estimated catch, effort and observed catch per unit effort of redband trout in Upper Klamath Lake by all gear types from March 18 – September 27, 2009 and March 8 - September 18, 2010.

Year	Harvest (H)	Released (C_R)	C/E Redband trout/hour (Hours/trout) Boat	C/E Redband trout/hour (Hours/trout) Bank	Estimated Effort (E) Boat (Hours)	Estimated Effort (E) Bank (Hours)
2009	659	3550	.117 (8.5)	.032 (31.25)	31,853	15,438
2010	608	3418	.144 (6.9)	.024 (41.6)	23,849	16,534

Table 11. Catch rates of redband trout per hour by bank fisherman in Klamath Lake from March 18-September 27, 2009 and March 8 - September 18, 2010.

Month	Angler Hours Sampled 2009	Redband Trout/Hour 2009	Angler Hours Sampled 2010	Redband Trout/Hour 2010	Sucker/Hour 2010
March	806.5	.019	1017.0	.026	.000
April	1608.0	.037	1307.5	.022	.000
May	1052.8	.035	1030.8	.030	.001
June	217.2	.031	404.9	.018	.000
July	10.0	.128	1.9	.000	.000
August	29.1	.081	6.7	.000	.000
Sept	7.5	.000	3.0	.000	.000

Other Fish Catch

An estimated 353 yellow perch were released and 331 were harvested in July-September. Peak of the yellow perch fishery occurs in August (Table 12). All yellow perch were caught by boat anglers.

A total of 42 suckers were estimated released. Most suckers captured were by boat anglers in July (Table 12). Bank angler catch of suckers occurred in May. No brown trout were reported captured in Upper Klamath Lake.

Table 12. Monthly catch rates of redband trout, yellow perch and suckers per hour by boat fisherman in Klamath Lake from March 18-September 27, 2009 and March 8 - September 18, 2010.

Month	Angler Hours Sampled 2009	Redband Trout/Hr 2009	Yellow Perch 2009	Sucker Caught 2009	Angler Hours Sampled 2010	Redband Trout Caught 2010	YEP Caught 2010	Suckers Caught 2010
Mar	577.3	.042	.000	.000	267.2	.030	.000	.000
April	1404.0	.038	.000	.000	1439.0	.019	.000	.000
May	954.8	.093	.000	.000	454.8	.109	.000	.000
June	541.1	.164	.000	.000	1183.9	.195	.000	.000
July	843.6	.221	.024	.016	630.1	.210	.002	.006
August	1201.6	.150	2.095	.000	585.0	.214	.227	.003
Sept	551.0	.113	5.086	.000	242.5	.297	.031	.000

Gear Use and Two Rod Validation

The preferred method of angling in Upper Klamath Lake was using bait (Table 14). All angler gear types released most redband trout captured (Table 15). Most fish caught and subsequently released were by lure fisherman but all three gear types had similar numbers of released fish (Bait, lures, flies, Table 16).

A total of 1350 Upper Klamath Lake bank anglers were interviewed and 180 (13%) were using two rods. A total of 1067 boat anglers were interviewed and only 53 were using two rods (5%) (Appendix A)

Table 13. Gear use by redband trout anglers in Upper Klamath Lake from March 18-September 27, 2009 and March 8 - September 18, 2010.

Gear	Percent Anglers 2009	Percent Anglers 2010
Bait	36.8%	47.6%
Flies	11.0%	13.4%
Lures	45.6%	32.5%
Combo	6.6%	6.6%

Table 14. Redband trout catch by gear type in Upper Klamath Lake from March 18-September 27, 2009 and March 8 - September 18, 2010.

Gear	Percent Kept 2009	Percent Released 2009	Percent Kept 2010	Percent Released 2010
Bait	34.5%	65.5%	29.3%	70.7%
Flies	0.2%	99.8%	10.0%	90.0%
Lures	24.7%	75.3%	22.4%	77.6%
Combo	9.6%	90.4%	18.5%	81.5%

Table 15. Overall percent of redband trout released by gear type in Upper Klamath Lake from March 18-September 27, 2009 and March 8 - September 18, 2010.

Gear	Percent Released 2009	Percent Released 2010
Bait	40.5%	29.9%
Flies	14.6%	28.6%
Lures	37.7%	32.4%
Combo	7.2%	9.1%

Summary of Upper Klamath and Agency Lake Fishery

Overall estimated catch of redband trout in the entire fishery was 6447 and 6421 in 2009 and 2010, respectively. Catch rates were also similar in the two years. In 2009 overall catch rate was 0.11 redband trout/hour. Similarly, in 2010 overall catch rate of the entire fishery was 0.10 redband trout/hour. These catch rates meet the management objective developed in 1981 of 0.06 fish per hour or greater. However, bank angling success was much lower than boat anglers. Further, the very high catch rate in the summer fishery in Pelican Bay and Agency Lake near the mouth of the Wood River increases the overall catch rates. Estimates of total fishing removal of the entire fishery were 1582 redband trout in 2010 and 1772 in 2009 (March-September both years).

A minimum estimate (March-September) of angler effort in Upper Klamath and Agency Lakes was calculated as 49,695 hours with an estimated 15,316 angler trips in 2010 (Table 18). More effort occurred in 2009 as angler effort was calculated as 57,769 hours and 17,291 angler trips (Table 18). Highest catch occurred in June of 2009 and 2010. The highest amount of angler effort was not correlated with highest catch (Table 14). Months of highest redband trout harvest were different than the months with the highest number of redband trout released (Table 17). The Herald and News holds a Trophy Trout Derby every April on Upper Klamath Lake that typically attracts nearly 400 participants per year.

In both years boat anglers had higher catch per unit effort, effort and catch than bank anglers. In Upper Klamath and Agency Lake lures were the dominant gear type used. Fly, lure and bait fisherman from Upper Klamath Lake released more redband trout than harvested. Bait fisherman from Agency Lake kept more redband trout than released.

Table 17. Estimated catch by month (harvested and released) of redband trout by bank and boat with all gear types in Upper Klamath and Agency Lakes from March 18 – September 27, 2009 and March 8 - September 18, 2010.

Month	Harvest 2010	Harvest 2009	Released 2010	Released 2009
January	No estimate	No estimate	No estimate	No estimate
February	No estimate	No estimate	No estimate	No estimate
March	No estimate	No estimate	No estimate	No estimate
March	73	92	120	146
April	87	200	270	291
May	143	361	599	1132
June	289	105	1410	1493
July	67	97	1485	1321
August	24	64	1129	764
Sept	46	24	679	357
October	No estimate	No estimate	No estimate	No estimate
November	No estimate	No estimate	No estimate	No estimate
December	No estimate	No estimate	No estimate	No estimate
Totals	729	943	5692	5504

Table 18. Monthly estimated angler effort (hours) and number of angler trips by month in Upper Klamath and Agency Lakes in March 18 – September 27, 2009 and March 8 - September 18, 2010 (note: this estimate does not include the angler effort from October through February)

Month	Hours Effort (hrs) 2010	Hours Effort (hrs) 2009	Angler Trips 2010	Angler Trips 2009
March	7113	8028	2089	3082
April	10,760	13,258	3991	3759
May	8922	14,926	3013	4174
June	10,082	7902	2862	2504
July	7091	6131	1779	1696
August	3680	5205	997	1503
Sept	2049	2318	584	572
Total	49,695	57,769	15,316	17,291

Length Frequency of Redband Trout

The dominant size class of released redband trout in 2009 and 2010 in Agency Lake and Upper Klamath Lake was 500-549 mm (20-22") (Figure 6-7, 10). The estimates of length of released redband trout are reported by anglers. Anglers are positively biased towards estimating sizes of released redband trout. The age class of three year old at 300-449 mm (12-18 inches) is being released at a much higher rate than being harvested (Figure 6-10).

The length–frequency data in 2009 and 2010 shows that anglers are typically choosing to harvest older and larger redband trout in Upper Klamath and Agency Lakes (Figure 6-10). The dominant size class of redband trout harvested was from 550-599 mm (22-24") (Figure 8-9). A significant number of age 6-8 or older redband trout greater than 620 mm (25 inches) were harvested (Figure 8-9). Average length of redband trout harvested was 544 mm (21.4 inches). The largest redband trout sampled by creel staff in 2010 was 762 mm (30 inches) and captured at Eagle Ridge using lures on June 24. Average length of redband trout released was 517 mm (20.36 inches). The largest redband trout reported released was 889 mm caught on November 2, 2010 at Eagle Ridge from the bank using bait. District staff observed the picture of the fish and the estimate is likely accurate. Length frequency of both harvested and released redband trout show a diverse age structure (Figure 6-10). However, the lower abundance of redband trout under 500 mm is unusual but appear to be the case in most recent creels conducted on Upper Klamath Lake. The lack of smaller redband trout in the creel might be related to the larger type gear used for trophy trout. Most of the redband trout captured less than 500 mm (20 inches) were captured in the Pelican Bay area or in Agency Lake near the mouth of the Wood River.

Redband trout were captured by USGS in 2009 and 2010 while pit tagging suckers in Upper Klamath Lake and Williamson River. A small sample size of captured redband by USGS occurs in 2010 (Figure 11). Capture of redband trout by USGS by trammel net and weir from February-April in 2009 show that length frequency was similar to those estimated by anglers in the 2009 statistical creel (Figure 12).

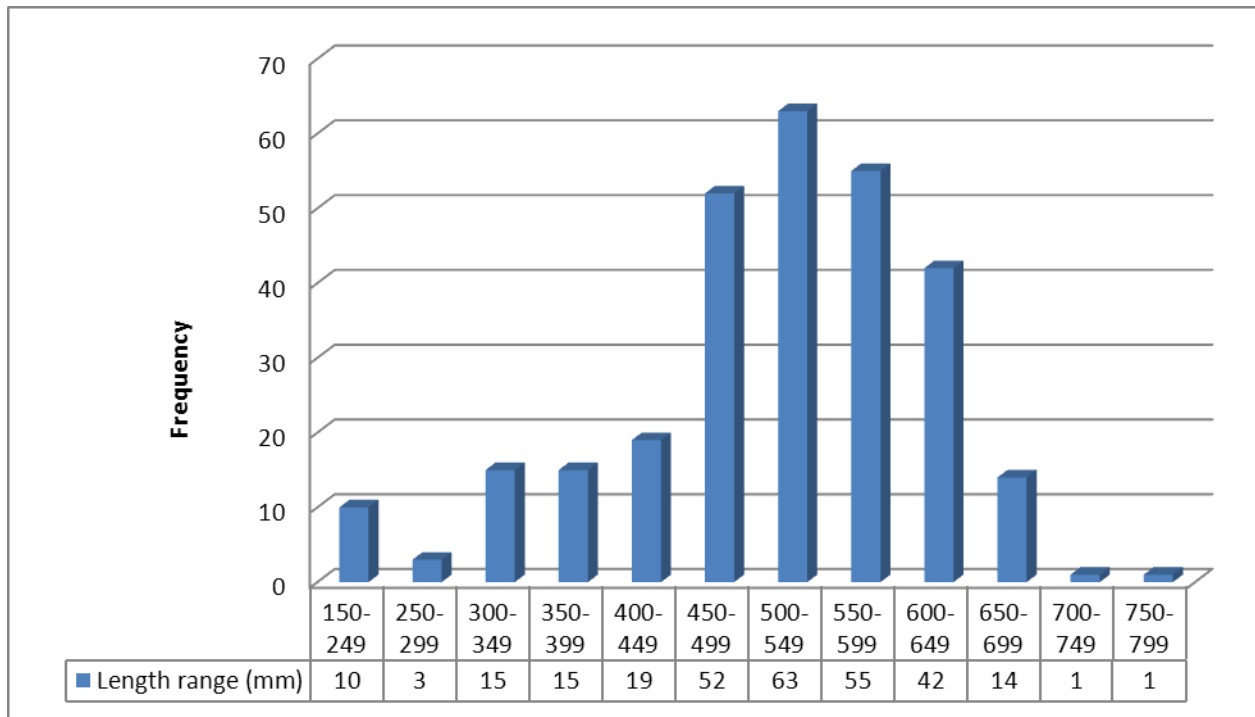


Figure 6. Angler estimated length of released redband trout in 2009 during the statistical creel in Agency Lake.

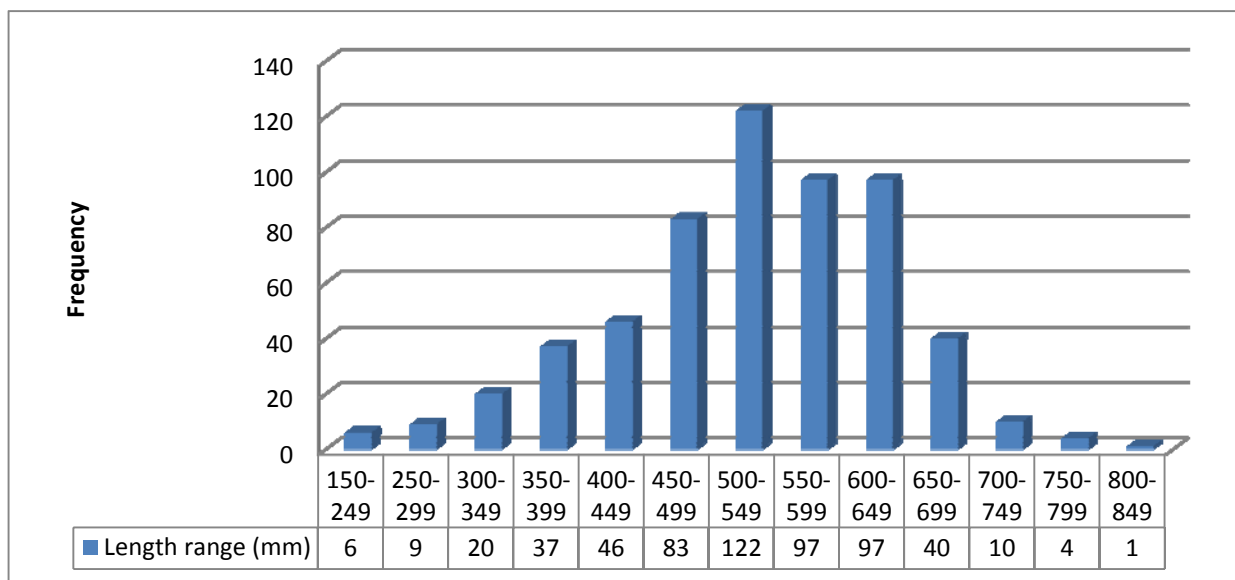


Figure 7. Angler estimated length of redband trout released in Upper Klamath and Agency Lakes in the statistical creel survey in 2009.

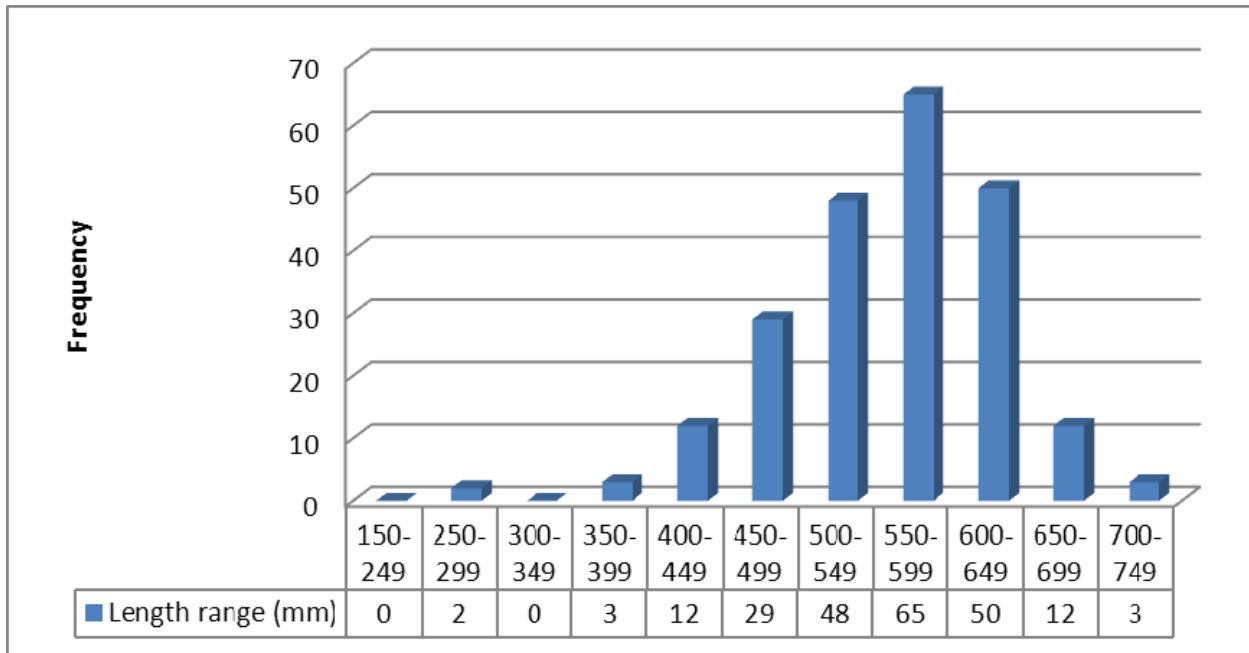


Figure 8. Length frequency (Fork Length) of redband trout harvested in the 2009 statistical creel in Upper Klamath and Agency Lakes (note: Creel surveyors measured redband trout)

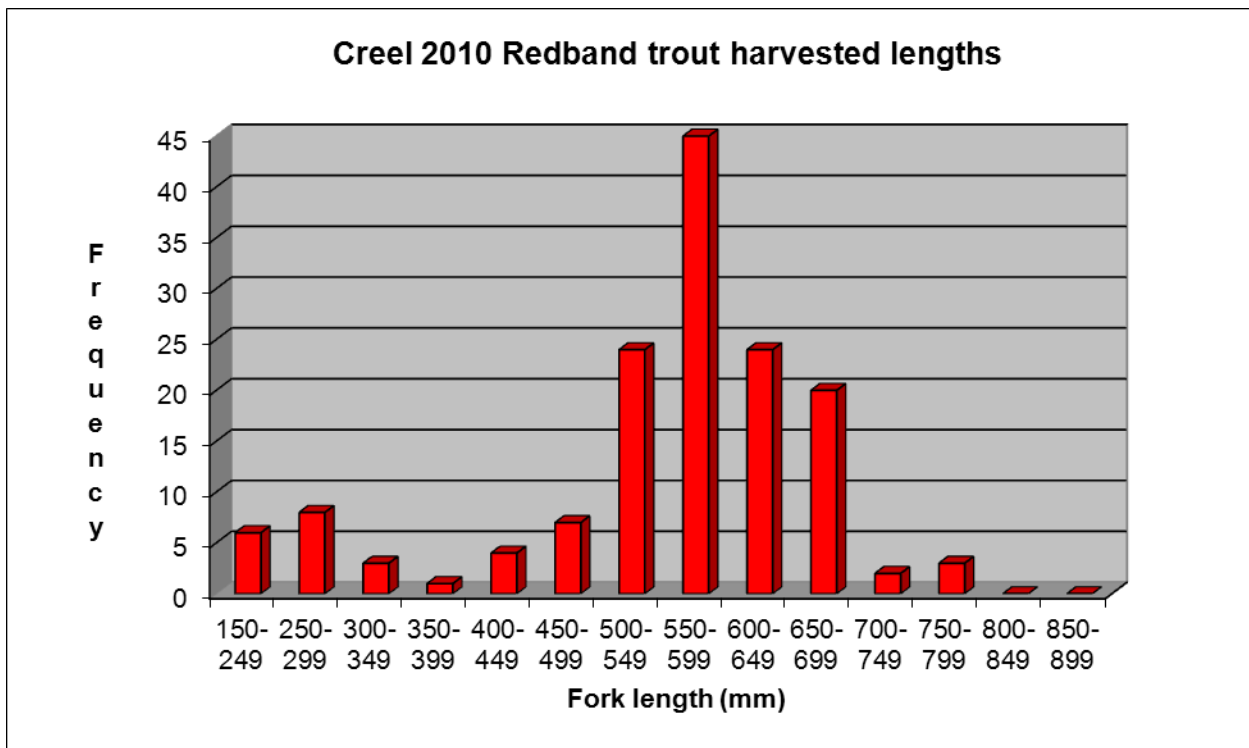


Figure 9. Length frequency of redband trout harvested during a statistical creel on Upper Klamath and Agency Lakes in 2010 (note: harvested redband trout were measured by ODFW creel staff)

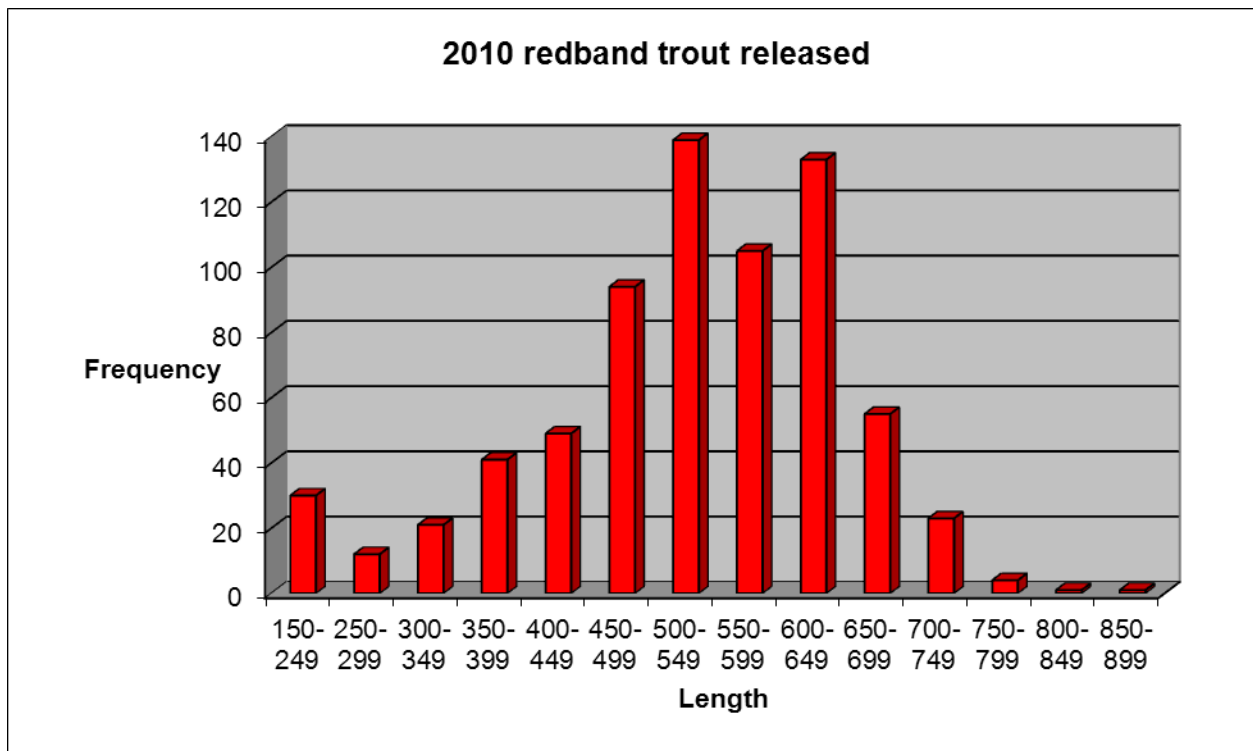


Figure 10. Angler estimated lengths of redband trout released during the Klamath and Agency Lake statistical creel in 2010.

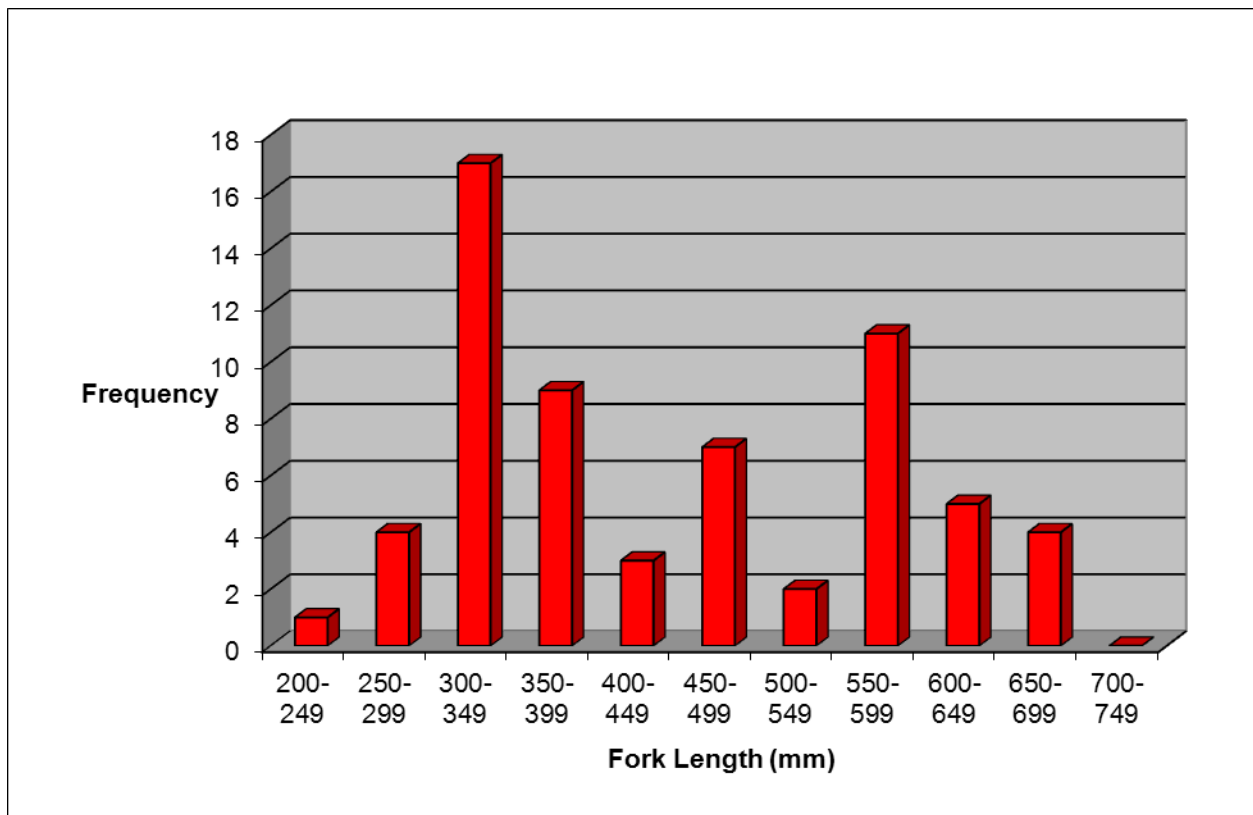


Figure 12. Length frequency of redband trout captured by trammel net and weir in Upper Klamath Lake and Williamson River from February-April 2010.

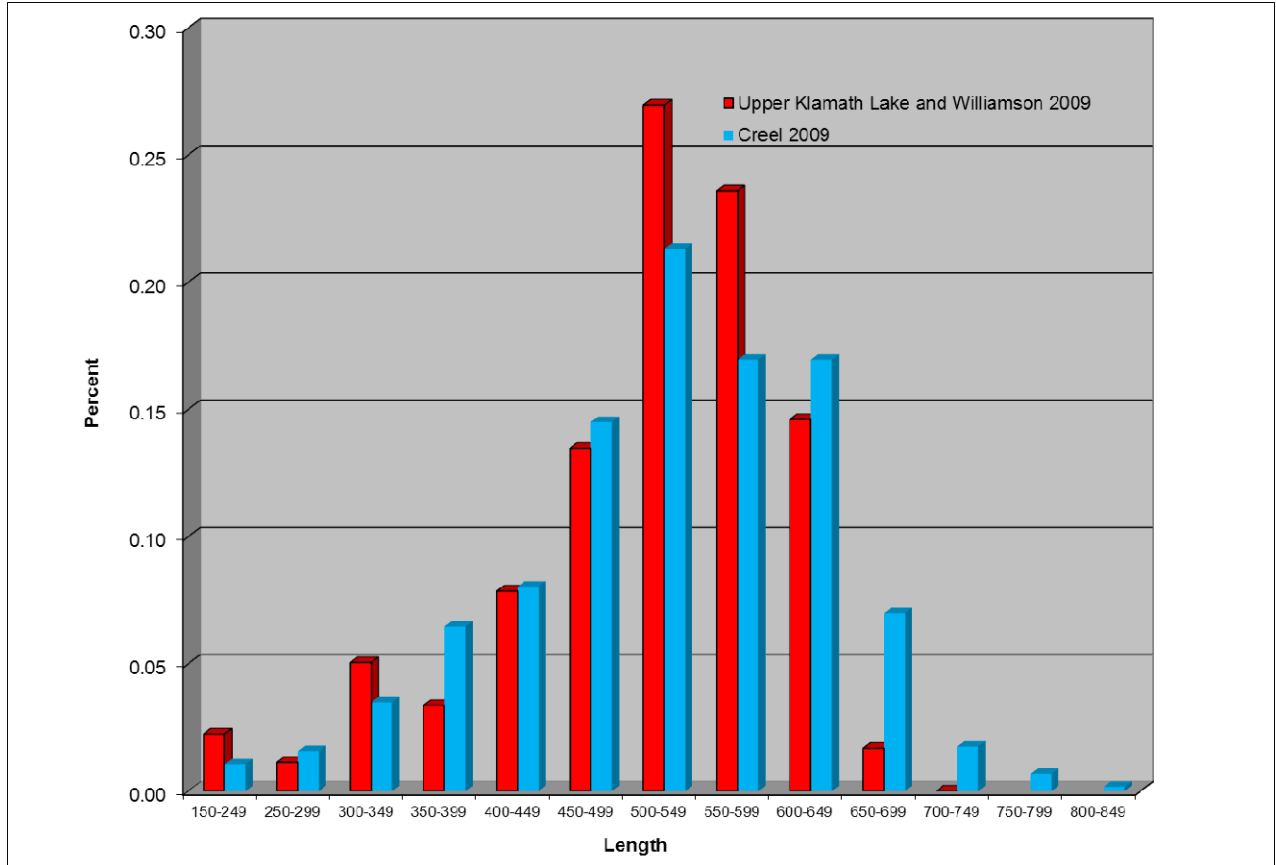
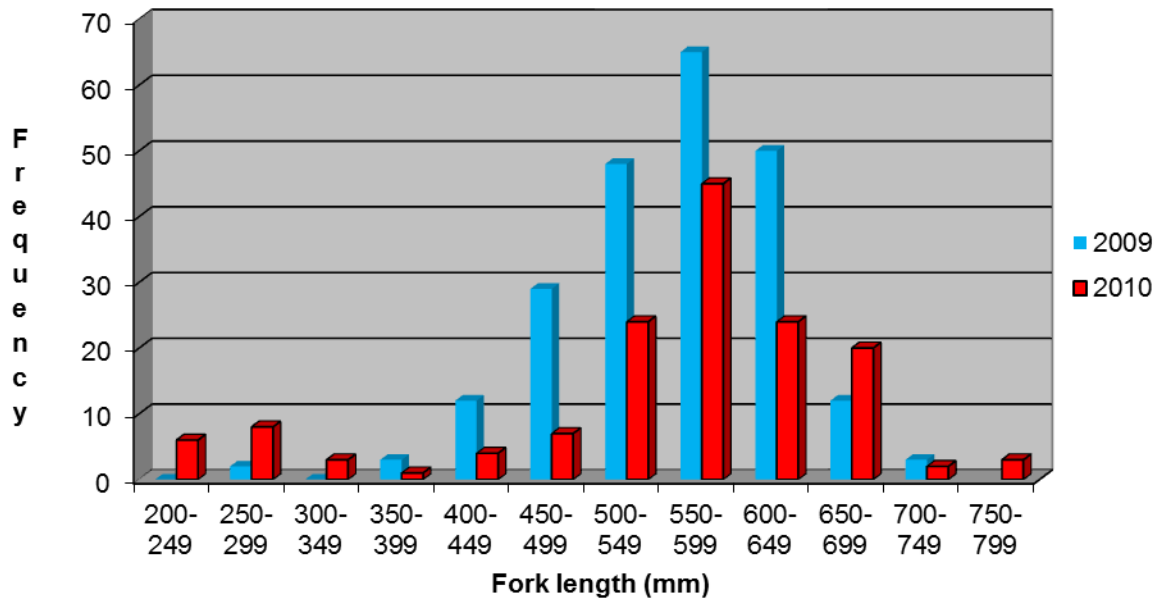


Figure 13. Percent of lengths of redband trout captured by trammel net and weir in Upper Klamath Lake and Williamson River from February-April 2009 compared to length estimates by anglers in the statistical creel in Upper Klamath and Agency Lakes in 2009.



Discussion

The redband trout estimated harvest and effort information is considered to be a minimum estimate as this creel only covered six months out of the year. The months of November - March can have significant angler effort during days of nice weather. Significant harvest and effort occurred in 2009 and 2010 in both November and February which were not included in these analyses (Appendix B). November has shown to have both high catch rate and harvest (Appendix B). Since most anglers are bank anglers using bait from November into March harvest is likely greater.

Pressure counts were not conducted in certain areas along Upper Klamath and Agency Lakes. This included Crystal, Recreation, Harriman, Odessa, Short, Fourmile, Thomason Creeks and newly flooded area at the Williamson River Delta. Further, areas around the houses at Lakeshore Drive, California Avenue, Cove Point on Upper Klamath Lake, houses along Modoc Point Road along Agency Lake and the entire Williamson River delta were a weakness of this study as well as the houses around Rocky Point. If anglers were fishing from their homes in these areas they were likely not enumerated during pressure count or interviewed. For example only eight bank angler parties were interviewed in all of Upper Klamath Lake from July through September 2010 which includes Odessa Creek. No harvest of redband trout from bank anglers was estimated from Upper Klamath or Agency Lakes from July-September.

Furthermore due to rough lake conditions due to windy weather pressure counts were often not conducted especially to Agency Lake. Bank anglers were also not enumerated on the pressure counts during peak bank angler effort on Eagle Ridge from April 14-29, 2009.

Agency Lake had significantly less harvest in 2010. The reduction in harvest in 2010 might be attributed to lower lake levels and increased turbidity at Henzel Park. The amount of effort in both lakes was higher in 2009. This was likely due to better climatic conditions in 2009 and possibly reduced turbidity. However, both years experienced high turbidity well into late May. In 2009 and 2010 the lake was low and turbid for the beginning of trout season and the high turbidity continued well into May. Weather in both years was also unsettled which likely caused reduced effort and catch. This is one reason for the low catch rates from the shore in Agency and Upper Klamath Lakes. The decreased amount of effort in 2010 was surprising considering the two rod validation became available in 2010. However, few anglers (9%) were using two rods but this might be due to samplers forgetting to ask the question.

All yellow perch were estimated caught by boat anglers which might show a weakness in the creel fishery since some yellow perch are caught from the dock at Rocky Point Resort.

The 2009 and 2010 creel only observed one party attempting to exceed the bag limit. The amount of illegal overharvest is unknown but could significantly increase the harvest rate observed as part of the statistical creel. Numerous complaints are received each year of anglers harvesting more than one redband trout. The most common complaint from the public is anglers continuing to angle after harvesting a trout.

Two of the most common errors associated with roving creel surveys are avidity bias and length of stay bias (Jones and Pollock 2012). The opposite of avidity bias might be particularly concerning as anglers who lived in houses along Agency Lake, Upper Klamath Lake and

Williamson River very rarely get interviewed due to moorage at their house. These anglers likely have higher effort and catch and harvest rates than the anglers launching or fishing at public property or public boat ramp. Anglers were rarely interviewed from their boat while fishing.

The length of stay bias has the potential for most bias due to the one trout limit on the lakes. This might also skew the data towards more catch and release from shore as those anglers spend more time angling and also have a higher likely hood of being interviewed more than once per day. The creel documented if the interview was a repeat interview which might address this concern but has not been summarized.

In 2010 overall catch rate in Upper Klamath and Agency Lakes was 0.1 redband trout per hour. Agency Lake was likely an outlier as catch rates were nearly double at 0.2 redband trout per hour. The catch per unit effort for bank anglers was very low. The one redband trout limit in Upper Klamath Lake might skew the data towards lower bank angler catch rates as anglers who kept their redband trout and left have a lower likelihood of being interviewed whereas an angler who continues to angle all day can be interviewed several times. District staff was able to obtain Larry Koertje's catch information on Upper Klamath Lake from 2000-2009 (Appendix D). Larry practices catch and release using bait from shore. His catch rate was significantly higher than the public. This might also show a bias in our statistical creel as anglers fishing alone and harvested a redband trout were less likely to be interviewed. Further, our four creel surveyors had difficulty sampling harvested redband trout as they observed few.

Another weakness of this creel survey is that most catch was not observed by the creel surveyor and was reported by the angler. Anglers might have lied about their catch as many anglers knew about the public angling regulation proposal to change regulations to catch and release. Few harvested redband trout were sampled by the creel surveyors. Prestige bias (Jones and Pollock 2012) was considered as lengths of redband trout were likely overestimated which is often the case in measurements reported by anglers. However, in 2009 length frequency was similar to the catch of redband trout made by USGS by trammel net and at the Williamson River weir.

A surprising result was most redband trout released in Agency Lake were captured from flyfisherman (Appendix Table 14) in 2009. On weekends in July and August 100% of all released redband trout were caught by flyfisherman. There appears to be a bias towards interviewing flyfisherman on Agency Lake as many anglers have been observed trolling lures and releasing fish during this time.

Results of the statistical creel has four primary management implications:

- 1) Very high catch rates in the summer
- 2) Catch and release using worms as bait while still fishing in Pelican Bay and surrounding area
- 3) Hooking mortality of trophy sized redband trout using spoons with treble hooks
- 4) Review of public Sport Fish Regulation proposals and how to effectively monitor the population to attain adequate escapement to maintain fishery.

The very high catch rate in the summer in Agency Lake where water temperatures are 24-30° C on the surface is a concern due to significant stress and mortality. Further studies and evaluations are needed to determine the mortality of fish released during stressful water temperatures. Protective angling regulations should be considered similar to the closure on the Klamath River from June 15-October 1. Reducing the fishing season or limiting harvest are other options as

June and July receive the most amount of angler effort in Agency Lake. Census spawning surveys should be implemented to determine relative abundance trends in escapement to ensure adequate survival in the fishery.

Catch and release using worms for bait during summer in the Pelican Bay and Harriman/Recreation/Crystal Creeks can have cause significant acute and chronic mortality. Future monitoring should investigate the mortality and effort associated with using live bait and releasing redband trout. The catch rate in this area can be quite high in the summer as redband trout are concentrated near spring areas in large numbers. ODFW should continue to monitor relative abundance of spawning redband trout in Crystal Creek at Crystal Springs.

Hooking mortality of redband trout using spoons can be high if fish improperly handled and hooks pulled out while damaging gills or tongue resulting in hemorrhaging. Mortality of redband trout might be significant using cleo spoons with treble hooks. Nuhfer and Alexander (1992) found that trophy brook trout hooked on cleo spoons was 8.3% and significantly higher than the same spoon using single hooks. This study showed no mortality on brook trout using Rapala lures with two treble hooks. Mortality of brook trout within 48h that were bleeding profusely also increased with increasing water temperature (Nuhfer and Alexander 1992). Most of the fish captured in Agency Lake and subsequently released are captured during times of very warm water temperatures particularly on the surface where the fish is released. Redband trout are much larger than the brook trout in this study and experience has shown that small spoons mimicking minnows can often be taken deeply into the gill arch area. ODFW should educate Upper Klamath Lake anglers on this fact and encourage the use of single, barbless hooks or cutting the line and leaving the hook in the fish. A regulation change to single, barbless hooks might also be considered if survival is improved and spawning escapement is low. Michigan's trophy trout lakes restrict lures to single pointed hooks.

Reviewing the numerous conservation based angling regulation proposals on Agency Lake will take further study to determine if total fishery removal affects conservation of the numerous redband trout populations. In the 2008 and 2012 public angling regulation process three angling regulation proposals were submitted for Agency Lake. Two regulation proposals were to change to catch and release with no bait allowed and one angling regulation proposed changing to catch and release, no bait allowed but only open from fourth Saturday in April to October 31. Redband trout spawning escapement and relative abundance should continue to be monitored in Agency Lake tributaries to ensure that redband trout populations don't continue to decline such as Sevenmile, Fourmile, Annie and Sun Creeks. However, some populations such as the Wood River, Fort Creek, Crooked Creek (Agency Creek and Ranch Creek) are recently showing very strong spawning escapement. In years of inclement weather in the spring, low lake levels thus increased turbidity reduce harvest as experienced in 2010.

Appendix A. Summary Tables of statistical creel in Upper Klamath and Agency Lakes in 2009 and 2010

2010 Statistical Creel

Table 1. Monthly estimated catch and estimated effort in Agency Lake by bank anglers from March 8-September 8, 2010

Month	Day Type	Num Days in Strata	Num Days in Samp	Num Parties Samp	Num Ang Samp	Num 2 Rod Samp	Ang Hours Samp	Est Ang Hours	Est Ang Trips	Samp Rate	RB Trout Kept	RB Trout Rel	Brown Trout Kept	Brown Trout Rel	YEP Kept	YEP Rel	Suck Rel
March	W/day	23	10	9	11	0	43.5	267	127	.163	0	0	0	0	0	0	0
March	W/end	8	5	12	16	2	55.1	170	81	.324	3	3	0	0	0	0	0
April	W/day	22	7	11	16	1	51.5	277	166	.186	0	0	0	0	0	0	0
April	W/end	8	8	10	15	0	35.5	247	148	.144	0	0	0	0	0	0	0
May	W/day	20	8	13	15	1	29.6	176	131	.168	0	0	0	0	0	0	0
May	W/end	11	10	16	19	0	43.4	165	123	.263	4	11	0	0	0	0	0
June	W/day	22	9	2	3	0	4.0	92	92	.043	0	0	0	0	0	0	0
June	W/end	8	8	5	9	0	17.4	46	26	.376	0	0	0	0	0	0	0
July	W/day	21	10	0	0	0	0.0	6	6	.000	--	--	--	--	--	--	--
July	W/end	10	8	1	1	0	0.5	23	13	.021	0	0	0	0	0	0	0
August	W/day	22	9	0	0	0	0.0	0	0	--	--	--	--	--	--	--	--
August	W/end	9	9	0	0	0	0.0	20	11	.000	--	--	--	--	--	--	--
Sept	W/day	21	5	0	0	0	0.0	0	0	--	--	--	--	--	--	--	--
Sept	W/end	9	5	1	1	0	0.5	66	37	.008	0	0	0	0	0	0	0
total bank		214	111	80	106	4	281.0	1554	962		7	14	0	0	0	0	0

Table 2. Monthly estimated catch and estimated effort in Agency Lake by boat anglers and a summary of all catch in Agency (total) from March 8 -September 8, 2010.

Month	Day Type	Num Days in Strata	Num Days in Samp	Num Parties Samp	Num Ang Samp	Num 2 Rod Samp	Ang Hours Samp	Est Ang Hours	Est Ang Trips	Samp Rate	RB Trout Kept	RB Trout Rel	Brown Trout Kept	Brown Trout Rel	YEP Kept	YEP Rel	Suck Rel
March	W/day	23	10	0	0	0	0.0	0	0	--	--	--	--	--	--	--	--
March	W/end	8	5	2	4	0	24.0	170	51	.141	0	7	0	0	0	0	0
April	W/day	22	7	4	4	0	17.0	334	113	.051	0	138	0	0	0	0	0
April	W/end	8	8	7	14	0	39.6	237	91	.167	0	18	0	0	0	0	0
May	W/day	20	8	11	18	0	78.5	587	109	.134	7	112	0	0	0	0	0
May	W/end	11	10	22	47	1	207.8	743	180	.280	8	115	0	0	0	0	0
June	W/day	22	9	18	41	0	180.4	1587	359	.114	35	352	0	0	0	0	0
June	W/end	8	8	28	62	3	278.7	929	203	.300	10	123	3	0	0	0	0
July	W/day	21	10	10	23	1	96.1	1462	323	.066	15	457	0	0	0	0	0
July	W/end	10	8	25	52	4	236.2	678	153	.348	17	135	0	0	0	43	0
August	W/day	22	9	6	11	2	45.0	357	97	.126	16	365	0	0	0	0	0
August	W/end	9	9	7	14	1	60.5	332	83	.182	0	181	0	0	66	110	0
Sept	W/day	21	5	0	0	0	0.0	212	58	.000	4	159	0	0	24	40	0
Sept	W/end	9	5	0	0	0	0.0	131	33	.000	2	98	0	0	15	25	0
total boat		214	111	140	290	12	1263.7	7758	1853		114	2260	3	0	105	218	0
total				220	396	16	1544.7	9312	2814		121	2274	3	0	105	218	0

Table 3. Estimated catch and effort by bank anglers in Upper Klamath Lake from March 8-September 18, 2010

Month	Day Type	Num Days in Strata	Num Days in Samp	Num Parties Samp	Num Ang Samp	Num 2 Rod Samp	Ang Hours Samp	Est Ang Hours	Est Ang Trips	Samp Rate	RB Trout Kept	RB Trout Rel	Brown Trout Kept	Brown Trout Rel	YEP Kept	YEP Rel	Suck Rel
March	W/day	23	10	99	152	20	500.0	2333	699	.214	19	65	0	0	0	0	0
March	W/end	8	5	96	174	33	517.0	2437	731	.212	24	19	0	0	0	0	0
April	W/day	22	7	97	151	27	449.0	3833	1890	.117	60	26	0	0	0	0	0
April	W/end	8	8	132	255	37	858.5	1788	647	.480	8	31	0	0	0	0	0
May	W/day	20	8	99	150	29	440.4	2042	892	.216	23	5	0	0	0	0	5
May	W/end	11	10	118	217	24	590.5	1809	644	.326	34	52	0	0	0	0	0
June	W/day	22	9	43	76	4	165.4	835	318	.198	5	5	0	0	0	0	0
June	W/end	8	8	60	116	6	239.6	677	295	.354	3	14	0	0	0	0	0
July	W/day	21	10	3	5	0	1.5	415	158	.004	0	0	0	0	0	0	0
July	W/end	10	8	1	2	0	0.4	81	35	.005	0	0	0	0	0	0	0
August	W/day	22	9	0	0	0	0.0	53	23	.000	--	--	--	--	--	--	--
August	W/end	9	9	3	7	0	6.7	146	64	.045	0	0	0	0	0	0	0
Sept	W/day	21	5	1	2	1	3.0	59	25	.051	0	0	0	0	0	0	0
Sept	W/end	9	5	0	0	0	0.0	24	11	.000	--	--	--	--	--	--	--
total bank		184	101	751	1305	180	3771.8	16534	6431		176	217	0	0	0	0	5

Table 4. Estimated catch and effort by boat anglers and a summary of all catch (total) in Upper Klamath Lake from March 8 –September 18, 2010.

Month	Day Type	Num Days in Strata	Num Days in Samp	Num Parties Samp	Num Ang Samp	Num 2 Rod Samp	Ang Hours Samp	Est Ang Hours	Est Ang Trips	Samp Rate	RB Trout Kept	RB Trout Rel	Brown Trout Kept	Brown Trout Rel	YEP Kept	YEP Rel	Suck Rel
March	W/day	23	10	16	26	3	100.0	592	142	.169	6	12	0	0	0	0	0
March	W/end	8	5	12	19	5	167.2	1143	256	.146	21	14	0	0	0	0	0
April	W/day	22	7	20	37	4	151.8	2261	634	.067	15	45	0	0	0	0	0
April	W/end	8	8	88	214	6	1287.2	1783	301	.722	4	12	0	0	0	0	0
May	W/day	20	8	26	45	3	158.0	1712	472	.092	33	184	0	0	0	0	0
May	W/end	11	10	41	83	5	296.8	1689	462	.176	34	120	0	0	0	0	0
June	W/day	22	9	48	104	5	360.9	3638	1011	.099	131	565	0	0	0	0	0
June	W/end	8	8	83	179	11	823.0	2278	557	.361	105	351	0	0	0	0	0
July	W/day	21	10	53	93	4	413.6	2947	684	.140	28	620	0	0	0	0	28
July	W/end	10	8	32	60	1	216.5	1478	403	.147	7	273	0	0	0	7	0
August	W/day	22	9	22	45	1	197.3	1689	432	.117	0	402	0	0	188	103	9
August	W/end	9	9	45	100	5	387.7	1082	297	.358	8	181	0	0	95	243	0
Sept	W/day	21	5	16	26	0	85.5	925	281	.092	32	184	0	0	0	0	0
Sept	W/end	9	5	24	36	0	157.0	632	138	.248	8	238	0	0	48	0	0
total boat		214	111	526	1067	53	4802.4	23849	6071		432	3201	0	0	331	353	37
total				1277	2372	233	8574.1	40382	12502		608	3418	0	0	331	353	42

Table 5. Sampled catch and effort by bank anglers in Upper Klamath Lake from March 8 –September 18, 2010.

Month	Day Type	Num Days in Strata	Num Days in Samp	Num Parties Samp	Num Ang Samp	Num 2 Rod Samp	Ang Hours Samp	RB Trout Kept	RB Trout Rel	Brown Trout Kept	Brown Trout Rel	YEP Kept	YEP Rel	Suck Rel
March	W/day	23	10	99	152	20	500.0	4	14	0	0	0	0	0
March	W/end	8	5	96	174	33	517.0	5	4	0	0	0	0	0
April	W/day	22	7	97	151	27	449.0	7	3	0	0	0	0	0
April	W/end	8	8	132	255	37	858.5	4	15	0	0	0	0	0
May	W/day	20	8	99	150	29	440.4	5	1	0	0	0	0	1
May	W/end	11	10	118	217	24	590.5	11	17	0	0	0	0	0
June	W/day	22	9	43	76	4	165.4	1	1	0	0	0	0	0
June	W/end	8	8	60	116	6	239.6	1	5	0	0	0	0	0
July	W/day	21	10	3	5	0	1.5	0	0	0	0	0	0	0
July	W/end	10	8	1	2	0	0.4	0	0	0	0	0	0	0
August	W/day	22	9	0	0	0	0.0	--	--	--	--	--	--	--
August	W/end	9	9	3	7	0	6.7	0	0	0	0	0	0	0
Sept	W/day	21	5	1	2	1	3.0	0	0	0	0	0	0	0
Sept	W/end	9	5	0	0	0	0.0	--	--	--	--	--	--	--
total bank		184	101	751	1305	180	3771.8	38	60	0	0	0	0	1

Table 6. Sampled catch and effort by boat anglers and a summary of all (total) in Upper Klamath Lake from March 8 –September 18, 2010.

Month	Day Type	Num Days in Strata	Num Days in Samp	Num Parties Samp	Num Ang Samp	Num 2 Rod Samp	Ang Hours Samp	RB Trout Kept	RB Trout Rel	Brown Trout Kept	Brown Trout Rel	YEP Kept	YEP Rel	Suck Rel
March	W/day	23	10	16	26	3	100.0	0	0	0	0	0	0	0
March	W/end	8	5	12	19	5	167.2	0	0	0	0	0	0	0
April	W/day	22	7	20	37	4	151.8	1	2	0	0	0	0	0
April	W/end	8	8	88	214	6	1287.2	3	2	0	0	0	0	0
May	W/day	20	8	26	45	3	158.0	1	3	0	0	0	0	0
May	W/end	11	10	41	83	5	296.8	3	9	0	0	0	0	0
June	W/day	22	9	48	104	5	360.9	3	17	0	0	0	0	0
June	W/end	8	8	83	179	11	823.0	6	25	0	0	0	0	0
July	W/day	21	10	53	93	4	413.6	13	56	0	0	0	0	0
July	W/end	10	8	32	60	1	216.5	38	127	0	0	0	0	0
August	W/day	22	9	22	45	1	197.3	4	87	0	0	0	0	4
August	W/end	9	9	45	100	5	387.7	1	40	0	0	0	1	0
Sept	W/day	21	5	16	26	0	85.5	0	47	0	0	22	12	1
Sept	W/end	9	5	24	36	0	157.0	3	65	0	0	34	87	0
total boat		214	111	526	1067	53	4802.4	3	17	0	0	0	0	0
total				1277	2372	233	8574.1	2	59	0	0	12	0	0

Table 7. Sampled catch and effort by bank anglers in Agency Lake from March 8 – September 18, 2010.

Month	Day Type	Num Days in Strata	Num Days in Samp	Num Parties Samp	Num Ang Samp	Num 2 Rod Samp	Ang Hours Samp	RB Trout Kept	RB Trout Rel	Brown Trout Kept	Brown Trout Rel	YEP Kept	YEP Rel	Suck Rel
March	W/day	23	10	9	11	0	43.5	0	0	0	0	0	0	0
March	W/end	8	5	12	16	2	55.1	1	1	0	0	0	0	0
April	W/day	22	7	11	16	1	51.5	0	0	0	0	0	0	0
April	W/end	8	8	10	15	0	35.5	0	0	0	0	0	0	0
May	W/day	20	8	13	15	1	29.6	0	0	0	0	0	0	0
May	W/end	11	10	16	19	0	43.4	1	3	0	0	0	0	0
June	W/day	22	9	2	3	0	4.0	0	0	0	0	0	0	0
June	W/end	8	8	5	9	0	17.4	0	0	0	0	0	0	0
July	W/day	21	10	0	0	0	0.0	--	--	--	--	--	--	--
July	W/end	10	8	1	1	0	0.5	0	0	0	0	0	0	0
August	W/day	22	9	0	0	0	0.0	--	--	--	--	--	--	--
August	W/end	9	9	0	0	0	0.0	--	--	--	--	--	--	--
Sept	W/day	21	5	0	0	0	0.0	--	--	--	--	--	--	--
Sept	W/end	9	5	1	1	0	0.5	0	0	0	0	0	0	0
total bank		214	111	80	106	4	281.0	2	4	0	0	0	0	0

Table 8. Sampled catch and effort by boat anglers and a summary of all (total) in Agency Lake from March 8 –September 18, 2010.

Month	Day Type	Num Days in Strata	Num Days in Samp	Num Parties Samp	Num Ang Samp	Num 2 Rod Samp	Ang Hours Samp	RB Trout Kept	RB Trout Rel	Brown Trout Kept	Brown Trout Rel	YEP Kept	YEP Rel	Suck Rel
March	W/day	23	10	0	0	0	0.0	--	--	--	--	--	--	--
March	W/end	8	5	2	4	0	24.0	0	1	0	0	0	0	0
April	W/day	22	7	4	4	0	17.0	0	7	0	0	0	0	0
April	W/end	8	8	7	14	0	39.6	0	3	0	0	0	0	0
May	W/day	20	8	11	18	0	78.5	1	15	0	0	0	0	0
May	W/end	11	10	22	47	1	207.8	2	29	0	0	0	0	0
June	W/day	22	9	18	41	0	180.4	4	40	0	0	0	0	0
June	W/end	8	8	28	62	3	278.7	3	37	1	0	0	0	0
July	W/day	21	10	10	23	1	96.1	1	30	0	0	0	0	0
July	W/end	10	8	25	52	4	236.2	6	47	0	0	0	15	0
August	W/day	22	9	6	11	2	45.0	2	46	0	0	0	0	0
August	W/end	9	9	7	14	1	60.5	0	33	0	0	12	20	0
Sept	W/day	21	5	0	0	0	0.0	--	--	--	--	--	--	--
Sept	W/end	9	5	0	0	0	0.0	--	--	--	--	--	--	--
total boat		214	111	140	290	12	1263.7	19	288	1	0	12	35	0
total				220	396	16	1544.7	21	292	1	0	12	35	0

2009 Statistical Creel

Table 9. Monthly estimated catch and estimated effort by bank anglers in Upper Klamath Lake from March 18-September 27, 2009.

Month	Day Type	Num Days in Strata	Num Days in Samp	Num Parties Samp	Num Ang Samp	Ang Hours Samp	Est Ang Hours	Est Ang Trips	Samp Rate	RB Trout Kept	RB Trout Rel	Brown Trout Kept	Brown Trout Rel	YEP Kept	YEP Rel	Suck Rel	LMB Kept	LMB Rel
Mar 18-31	W/day	10	7	128	257	539.3	3432	1765	.157	38	38	0	0	0	0	0	0	0
Mar 18-31	W/end	4	2	40	91	267.3	1109	399	.241	0	8	0	0	0	0	0	0	0
April	W/day	22	10	153	227	531.6	3083	1120	.172	46	75	0	0	0	0	0	0	0
April	W/end	8	8	209	417	1076.4	2180	602	.494	51	24	0	0	0	0	0	0	0
May	W/day	20	9	92	144	390.7	1715	483	.228	35	22	0	0	0	0	0	0	0
May	W/end	11	10	167	288	662.2	1911	590	.347	38	32	0	0	0	0	0	0	0
June	W/day	22	11	42	66	116.4	925	592	.126	16	8	0	0	0	0	0	0	0
June	W/end	8	8	42	68	100.9	617	395	.163	12	12	0	0	0	0	0	0	0
July	W/day	22	8	1	2	4.0	21	16	.187	0	0	0	0	0	0	0	0	0
July	W/end	9	6	1	2	6.0	72	54	.084	0	12	0	0	0	0	0	0	0
August	W/day	21	9	4	6	7.8	264	200	.030	0	0	0	0	0	0	0	0	0
August	W/end	10	10	4	7	21.3	73	55	.292	3	24	0	0	0	0	0	0	0
Sept	W/day	21	8	1	2	1.5	13	10	.112	0	0	0	0	0	0	0	0	0
Sept	W/end	9	6	1	4	6.0	23	17	.260	0	0	0	0	0	0	0	0	0
total bank		167	98	883	1575	3731.1	15438	6300		239	255	0	0	0	0	5	0	0

Table 10. Monthly estimated catch and estimated effort by boat anglers and a summary of all catch (total) in Upper Klamath Lake from March 18-September 27, 2009.

Month	Day Type	Num Days in Strata	Num Days in Samp	Num Parties Samp	Num Ang Samp	Ang Hours Samp	Est Ang Hours	Est Ang Trips	Samp Rate	RB Trout Kept	RB Trout Rel	Brown Trout Kept	Brown Trout Rel	YEP Kept	YEP Rel	Suck Rel	LMB Kept	LMB Rel
Mar 18-31	W/day	10	7	35	64	245.2	1077	266	.228	9	40	0	0	0	0	0	0	0
Mar 18-31	W/end	4	2	26	66	332.1	1441	287	.230	17	39	0	0	0	0	0	0	0
April	W/day	22	10	38	73	289.0	3188	805	.091	33	132	0	0	0	0	0	0	0
April	W/end	8	8	102	246	1115.0	3207	651	.348	37	37	0	0	0	0	0	0	0
May	W/day	20	9	35	59	247.5	2706	609	.091	44	197	0	0	0	0	0	0	0
May	W/end	11	10	78	170	707.3	4331	1052	.163	80	337	0	0	0	0	0	0	0
June	W/day	22	11	33	67	293.6	3251	761	.090	44	576	0	0	0	0	0	0	0
June	W/end	8	8	32	68	247.5	1112	310	.223	9	85	0	0	0	0	0	0	0
July	W/day	22	8	49	85	295.2	2223	619	.133	30	580	0	0	0	0	45	0	0
July	W/end	9	6	86	155	548.4	2718	801	.202	50	431	0	0	20	99	35	0	0
August	W/day	21	9	58	113	434.4	2591	653	.168	24	394	0	0	2207	4069	0	0	0
August	W/end	10	10	109	219	767.2	1824	499	.421	19	224	0	0	1084	1891	0	0	0
Sept	W/day	21	8	32	55	269.5	1623	370	.166	18	199	0	0	1747	6572	0	0	0
Sept	W/end	9	6	34	77	281.5	561	155	.502	6	24	0	0	451	2343	0	0	0
total boat		197	112	747	1517	6073.3	31853	7837		420	3295	0	0	5509	14974	80	0	0
total				1630	3092	9804.4	47292	14137		659	3550	0	0	5509	14974	85	0	0

Table 11. Monthly estimated catch and estimated effort in Agency Lake by bank anglers from March 18-September 27, 2009

Month	Day Type	Num Days in Strata	Num Days in Samp	Num Parties Samp	Num Ang Samp	Ang Hours Samp	Est Ang Hours	Est Ang Trips	Samp Rate	RB Trout Kept	RB Trout Rel	Brown Trout Kept	Brown Trout Rel	YEP Kept	YEP Rel	Suck Rel	LMB Kept	LMB Rel
Mar 18-31	W/day	10	7	12	24	73.5	467	215	.157	13	6	0	0	0	0	0	0	0
Mar 18-31	W/end	4	2	9	11	19.9	154	82	.129	0	0	0	0	0	0	0	0	0
April	W/day	22	10	46	55	133.0	538	247	.247	16	4	0	0	0	0	0	0	0
April	W/end	8	8	36	63	190.3	249	132	.763	3	4	0	0	0	0	0	0	0
May	W/day	20	9	26	35	55.2	589	489	.094	21	32	0	0	0	0	0	0	0
May	W/end	11	10	43	64	157.4	426	193	.369	16	3	0	0	0	0	0	0	0
June	W/day	22	11	3	6	13.7	63	52	.217	0	0	0	0	0	0	0	0	0
June	W/end	8	8	1	2	9.0	43	19	.210	0	0	0	0	0	0	0	0	0
July	W/day	22	8	0	0	0.0	0	0	--	--	--	--	--	--	--	--	--	--
July	W/end	9	6	0	0	0.0	0	0	--	--	--	--	--	--	--	--	--	--
August	W/day	21	9	0	0	0.0	0	0	--	--	--	--	--	--	--	--	--	--
August	W/end	10	10	0	0	0.0	0	0	--	--	--	--	--	--	--	--	--	--
Sept	W/day	21	8	0	0	0.0	0	0	--	--	--	--	--	--	--	--	--	--
Sept	W/end	9	6	0	0	0.0	0	0	--	--	--	--	--	--	--	--	--	--
total bank		197	112	176	260	651.9	2530	1429		69	49	0	0	0	0	0	0	0

Table 12. Monthly estimated catch and estimated effort in Agency Lake by boat anglers and a summary of all catch in Agency (total) from March 18 -September 27, 2009.

Month	Day Type	Num Days in Strata	Num Days in Samp	Num Parties Samp	Num Ang Samp	Ang Hours Samp	Est Ang Hours	Est Ang Trips	Samp Rate	RB Trout Kept	RB Trout Rel	Brown Trout Kept	Brown Trout Rel	YEP Kept	YEP Rel	Suck Rel	LMB Kept	LMB Rel
Mar 18-31	W/day	10	7	5	7	24.0	311	60	.077	13	13	0	0	0	0	0	0	0
Mar 18-31	W/end	4	2	0	0	0.0	37	9	.000	2	2	0	0	0	0	0	0	0
April	W/day	22	10	12	21	94.5	426	77	.222	9	9	5	0	0	0	0	0	0
April	W/end	8	8	43	88	250.3	387	125	.647	5	6	2	0	0	0	0	2	0
May	W/day	20	9	22	47	198.0	1279	265	.155	6	194	0	6	0	0	0	0	0
May	W/end	11	10	59	139	537.3	1969	494	.273	121	315	0	4	0	0	0	0	0
June	W/day	22	11	53	111	593.0	1385	260	.428	14	673	0	0	0	0	0	2	0
June	W/end	8	8	49	98	433.8	506	114	.858	10	139	0	0	0	0	0	0	0
July	W/day	22	8	25	39	95.6	786	147	.122	8	222	0	0	0	0	0	0	0
July	W/end	9	6	15	26	69.5	312	58	.223	9	76	0	0	0	0	0	0	0
August	W/day	21	9	7	11	37.0	228	48	.162	18	55	0	0	0	0	0	0	0
August	W/end	10	10	14	30	103.7	224	47	.463	0	67	0	0	39	11	0	0	0
Sept	W/day	21	8	1	1	2.9	97	20	.030	0	134	0	0	0	0	0	0	0
Sept	W/end	9	6	0	0	0.0	0	0	--	0	0	0	0	0	0	0	0	0
total boat		197	112	305	618	2439.6	7947	1724		215	1905	7	10	39	11	0	4	0
total				481	878	3091.5	10477	3153		284	1954	7	10	39	11	0	4	0

Table 13. Sampled catch and effort by bank anglers in Upper Klamath Lake from March 18 –September 27, 2009.

Month	Day Type	Num Days in Strata	Num Days in Samp	Num Parties Samp	Num Ang Samp	Ang Hours Samp	RB Trout Kept	RB Trout Rel	Brown Trout Kept	Brown Trout Rel	YEP Kept	YEP Rel	Suck Rel	LMB Kept	LMB Rel
Mar 18-31	W/day	10	7	128	257	539.3	6	6	0	0	0	0	0	0	0
Mar 18-31	W/end	4	2	40	91	267.3	0	2	0	0	0	0	0	0	0
April	W/day	22	10	153	227	531.6	8	13	0	0	0	0	0	0	0
April	W/end	8	8	209	417	1076.4	25	12	0	0	0	0	0	0	0
May	W/day	20	9	92	144	390.7	8	5	0	0	0	0	0	0	0
May	W/end	11	10	167	288	662.2	13	11	0	0	0	0	0	0	0
June	W/day	22	11	42	66	116.4	2	1	0	0	0	0	0	0	0
June	W/end	8	8	42	68	100.9	2	2	0	0	0	0	0	0	0
July	W/day	22	8	1	2	4.0	0	0	0	0	0	0	0	0	0
July	W/end	9	6	1	2	6.0	0	1	0	0	0	0	0	0	0
August	W/day	21	9	4	6	7.8	0	0	0	0	0	0	0	0	0
August	W/end	10	10	4	7	21.3	1	7	0	0	0	0	0	0	0
Sept	W/day	21	8	1	2	1.5	0	0	0	0	0	0	0	0	0
Sept	W/end	9	6	1	4	6.0	0	0	0	0	0	0	0	0	0
total bank		167	98	883	1575	3731.1	65	60	0	0	0	0	1	0	0

Table 14. Sampled catch and effort by boat anglers and all methods (total) in Upper Klamath Lake from March 18 –September 27, 2009.

Month	Day Type	Num Days in Strata	Num Days in Samp	Num Parties Samp	Num Ang Samp	Ang Hours Samp	RB Trout Kept	RB Trout Rel	Brown Trout Kept	Brown Trout Rel	YEP Kept	YEP Rel	Suck Rel	LMB Kept	LMB Rel
Mar 18-31	W/day	10	7	35	64	245.2	2	9	0	0	0	0	0	0	0
Mar 18-31	W/end	4	2	26	66	332.1	4	9	0	0	0	0	0	0	0
April	W/day	22	10	38	73	289.0	3	12	0	0	0	0	0	0	0
April	W/end	8	8	102	246	1115.0	13	13	0	0	0	0	0	0	0
May	W/day	20	9	35	59	247.5	4	18	0	0	0	0	0	0	0
May	W/end	11	10	78	170	707.3	13	55	0	0	0	0	0	0	0
June	W/day	22	11	33	67	293.6	4	52	0	0	0	0	0	0	0
June	W/end	8	8	32	68	247.5	2	19	0	0	0	0	0	0	0
July	W/day	22	8	49	85	295.2	4	77	0	0	0	0	6	0	0
July	W/end	9	6	86	155	548.4	10	87	0	0	4	20	7	0	0
August	W/day	21	9	58	113	434.4	4	66	0	0	370	682	0	0	0
August	W/end	10	10	109	219	767.2	8	94	0	0	456	795	0	0	0
Sept	W/day	21	8	32	55	269.5	3	33	0	0	290	1091	0	0	0
Sept	W/end	9	6	34	77	281.5	3	12	0	0	226	1175	0	0	0
total boat		197	112	747	1517	6073.3	77	556	0	0	1346	3763	5	0	0
total				1630	3092	9804.4	142	616	0	0	1346	3763	6	0	0

Table 15. Sampled catch and effort by bank anglers in Agency Lake from March 18 – September 27, 2009

Month	Day Type	Num Days in Strata	Num Days in Samp	Num Parties Samp	Num Ang Samp	Ang Hours Samp	RB Trout Kept	RB Trout Rel	Brown Trout Kept	Brown Trout Rel	YEP Kept	YEP Rel	Suck Rel	LMB Kept	LMB Rel
Mar 18-31	W/day	10	7	12	24	73.5	2	1	0	0	0	0	0	0	0
Mar 18-31	W/end	4	2	9	11	19.9	0	0	0	0	0	0	0	0	0
April	W/day	22	10	46	55	133.0	4	1	0	0	0	0	0	0	0
April	W/end	8	8	36	63	190.3	2	3	0	0	0	0	0	0	0
May	W/day	20	9	26	35	55.2	2	3	0	0	0	0	0	0	0
May	W/end	11	10	43	64	157.4	6	1	0	0	0	0	0	0	0
June	W/day	22	11	3	6	13.7	0	0	0	0	0	0	0	0	0
June	W/end	8	8	1	2	9.0	0	0	0	0	0	0	0	0	0
July	W/day	22	8	0	0	0.0	--	--	--	--	--	--	--	--	--
July	W/end	9	6	0	0	0.0	--	--	--	--	--	--	--	--	--
August	W/day	21	9	0	0	0.0	--	--	--	--	--	--	--	--	--
August	W/end	10	10	0	0	0.0	--	--	--	--	--	--	--	--	--
Sept	W/day	21	8	0	0	0.0	--	--	--	--	--	--	--	--	--
Sept	W/end	9	6	0	0	0.0	--	--	--	--	--	--	--	--	--
total bank		197	112	176	260	651.9	16	9	0	0	0	0	0	0	0

Table 16. Sampled catch and effort by boat angler and all methods (total) in Agency Lake from March 18 –September 27, 2009

Month	Day Type	Num Days in Strata	Num Days in Samp	Num Parties Samp	Num Ang Samp	Ang Hours Samp	RB Trout Kept	RB Trout Rel	Brown Trout Kept	Brown Trout Rel	YEP Kept	YEP Rel	Suck Rel	LMB Kept	LMB Rel
Mar 18-31	W/day	10	7	5	7	24.0	1	1	0	0	0	0	0	0	0
Mar 18-31	W/end	4	2	0	0	0.0	--	--	--	--	--	--	--	--	--
April	W/day	22	10	12	21	94.5	2	2	1	0	0	0	0	0	0
April	W/end	8	8	43	88	250.3	3	4	1	0	0	0	0	1	0
May	W/day	20	9	22	47	198.0	1	30	0	1	0	0	0	0	0
May	W/end	11	10	59	139	537.3	33	86	0	1	0	0	0	0	0
June	W/day	22	11	53	111	593.0	6	288	0	0	0	0	0	1	0
June	W/end	8	8	49	98	433.8	9	119	0	0	0	0	0	0	0
July	W/day	22	8	25	39	95.6	1	27	0	0	0	0	0	0	0
July	W/end	9	6	15	26	69.5	2	17	0	0	0	0	0	0	0
August	W/day	21	9	7	11	37.0	3	9	0	0	0	0	0	0	0
August	W/end	10	10	14	30	103.7	0	31	0	0	18	5	0	0	0
Sept	W/day	21	8	1	1	2.9	0	4	0	0	0	0	0	0	0
Sept	W/end	9	6	0	0	0.0	--	--	--	--	--	--	--	--	--
total boat		197	112	305	618	2439.6	61	618	2	2	18	5	0	2	0
total				481	878	3091.5	77	627	2	2	18	5	0	2	0

Appendix B. Results of non-statistical creel surveys conducted during November and February 2009 and 2010.

Date	area	Trip type	parties	anglers	tworod	Ang hours	RB kept	RB rel	RB Kept catchrate	RB Rel catchrate	Pressure est	RB kept est	RB rel est
2/4/2009	UKL	bank	7	15	0	23.9	0	1	.000	.042	143	0	6
2/18/2009	UKL	bank	2	7	0	25	0	0	.000	.000	57	0	0
2/20/2009	UKL	bank	5	10	0	29.2	0	2	.000	.068	102	0	7
2/24/2009	UKL	bank	NA	NA	NA	NA	NA	NA	.000	.068	71	0	5
11/2/2009	UKL	bank	9	14	0	45.5	2	6	.044	.132	85	4	11
11/3/2009	UKL	bank	2	2	0	2.75	0	0	.000	.000	12	0	0
11/4/2009	UKL	bank	1	2	0	3	0	0	.000	.000	12	0	0
11/10/2009	UKL	bank	12	17	0	32.8	1	0	.030	.000	82	3	0
11/18/2009	UKL	bank	13	18	0	29.2	2	1	.068	.034	126	9	4
11/30/2009	UKL	bank	5	9	0	13.3	0	0	.000	.000	50	0	0
2/9/2010	UKL	bank	12	15	4	51.5	3	0	.058	.000	91	5	0
2/4/2009	UKL	boat	NA	NA	NA	NA	NA	NA	NA	NA	18	NA	NA
2/18/2009	UKL	boat	NA	NA	NA	NA	NA	NA	NA	NA	28	NA	NA
2/20/2009	UKL	boat	2	3	0	4	0	0	.000	.000	19	0	0
2/24/2009	UKL	boat	NA	NA	NA	NA	NA	NA	NA	NA	10	NA	NA
11/2/2009	UKL	boat	NA	NA	NA	NA	NA	NA	NA	NA	27	NA	NA
11/3/2009	UKL	boat	1	1	0	1	0	0	.000	.000	9	0	0
11/4/2009	UKL	boat	NA	NA	NA	NA	NA	NA	NA	NA	9	NA	NA
11/10/2009	UKL	boat	NA	NA	NA	NA	NA	NA	NA	NA	9	NA	NA
2/18/2009	Agency	bank	2	2	0	3.5	1	1	.286	.286	13	4	4
2/20/2009	Agency	bank	6	9	0	23.5	1	1	.043	.043	32	1	1
2/24/2009	Agency	bank	2	3	0	11.5	0	0	.000	.000	26	0	0
11/18/2009	Agency	bank	2	2	0	7.5	0	0	.000	.000	11	0	0
11/23/2009	Agency	bank	4	4	0	7.1	0	0	.000	.000	23	0	0
2/20/2009	Agency	boat	1	2	0	2	0	0	.000	.000	13	0	0

Appendix C. All creel summaries from Upper Klamath and Agency Lakes from 1952-2010. The years of 1964, 1968, 1970 and 1971 included warmwater anglers. 2005 were creel books handed out to expert anglers and guides. 2009 and 2010 were a statistical creel from March-September. (Note: Observed data not estimates)

Year	Catch Rate Trout/ Hour	Percent redband > 500mm (20 inches)	Total Redband Trout landed	Total anglers	Total hours fished
1952	0.14	37	251	287	1766
1953	0.19	26	879	701	4617
1954	0.07	37	106	415	1560
1955	0.09	38	76	184	806
1956	0.08	17	64	186	766
1957	0.09	35	118	294	1186
1958	0.09	15	104	333	1094
1959	0.11	30	352	648	3190
1960	0.12	38	118	336	965
1961	0.19	40	48	71	248
1962	0.17	16	51	70	298
1963	0.13	10	64	96	429
1964	0.26	6	849	599	3246
1965	0.37	8	127	143	346
1966	0.2	19	215	314	1122
1967	0.06	26	41	259	650
1968	0.1	19	334	751	3310
1969	0.17	16	219	358	1264
1970	0.14	19	156	310	1070
1971	0.11	15	134	327	1250
1972	0.16	19	157	310	980
1973	0.06	55	36	269	606
1974	0.02	0	1	33	48
1975	0.09	47	76	264	856
1976	0.05	47	30	193	541
1977	0.04	70	27	219	634
1978	0.05	49	105	763	1919
1979	0.06	52	114	641	1890
1980	0.06	56	139	849	2192
1981	0.07	51	68	301	982
1982	0.07	30	293	1423	4167
1983	0.03	61	42	606	1227
1984	0.08	49	184	846	2251
1985	0.13	41	347	816	2734
1986	0.05	57	206	974	2120
1987	0.07	51	119	466	1603
1988	0.06	100	58	310	896
1989	0.13	53	40	137	304
1995	0.03		41	317	1281.75
2005	0.24	59	112	5	466.5
2009	.11	80 H (65 C _R)	1462	3976	12,895
2010	.10	80 H(66 C _R)	1048	2761	10,118

Appendix D. Catch statistics by Larry Koertje in Upper Klamath Lake using bait but practicing catch and release from the years 2000-2009.

Year	Number of days fished	Effort (hrs)	Number of strikes	Strikes per hour	fish landed	Fish per day	Fish per hour	Hours per fish
2000	21	170.5	140	0.82	31	1.47	0.18	5.50
2001	25	199	162	0.81	32	1.28	0.16	6.22
2002	64	449	384	0.85	62	0.96	0.14	7.24
2003	38	234	141	0.6	36	0.95	0.15	6.50
2004	42	367	188	0.5	35	0.83	0.10	10.49
2005	24	188	186	1.01	28	1.16	0.15	6.71
2006	33	207	265	1.28	45	1.36	0.22	4.60
2007	29	238	141	0.59	28	0.93	0.12	8.50
2008	27	222	183	0.82	23	0.85	0.10	9.65
2009	43	316	253	0.8	47	1.09	0.15	6.72

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