State of California
The Resources Agency
California Department of Fish & Wildlife
North Central Region

Thermalito Afterbay

2013 Creel Survey and Sport Fish Evaluation Study

(Hansen, H., 2013)

Prepared by D. Scott Newton

Scientific Aid

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Introduction

In 2007, 4800 yearling Feather River steelhead (*Oncorhynchus mykiss*) were stocked in the Thermalito Afterbay to assess the potential of establishing a recreational cold water fishery in the reservoir. The results were positive as the yearling steelhead grew rapidly and provided great angling opportunities in the following year (California Department of Water Resources: Final Report Fish Species Composition and Juvenile Bass Recruitment, 2008). With the increased availability of hatchery steelhead the California Department of Fish and Wildlife (CDFW) was able to stock Thermalito Afterbay again in 2012 with 5,000 yearling Feather River steelhead. In 2013 10,300 Feather River steelhead weighing a total of 2575 pounds were released into the Afterbay. The steelhead stocked in the Thermalito Afterbay are managed as inland fish therefore no steelhead tag is required to target them and the daily limit allows up to 5 fish to be retained. Left ventral fins were clipped to identify the Thermalito Afterbay stock. As the fishery develops, analyses to assess the changes are prudent. Any effects due to this change in management on anglers, fishing techniques, and fish would not be well understood otherwise.

In 2013CDFW conducted a creel survey on the Thermalito Afterbay in an effort collect data relevant to the new fishery. The main purpose of the survey was to evaluate ongoing recreational steelhead trout stocking. Additionally the data will also be used to assess the overall angling experience for the water. Creel surveys were done primarily at the two boat ramps that access the lake. Together, the surveys resulted in 170 anglers interviewed and data collected on 164 fish.

Thermalito Afterbay is a multi-use reservoir located in Butte County about 20 miles south of Chico, CA and 70 miles north of Sacramento. It is part of the Oroville-Thermalito

complex, which is operated by the State of California Department of Water Resources. The Afterbay was formed upon completion of the Thermalito Afterbay Dam in 1969 (California State, 2009). The dam defines the west and south ends of the reservoir and at 42,000 feet, is the longest dam in the California State Water Project system (California State, 2009). At maximum operating capacity the water surface sits at 136.5 feet above sea level and covers 4,300 acres (California State, 2009). The Afterbay is a shallow reservoir with a maximum depth of approximately 20 feet (California Department of Water Resources: Final report characterization of cold water pool availability, 2004). Total shore line at maximum operating capacity is 26 miles and the maximum capacity is 57,040 acre-feet (California State, 2009).

The Afterbay receives its water from Lake Oroville which is fed by the confluence of the North, Middle and South Forks as well as the West Branch of the Feather River (Oroville wildlife area, 2009). Thermalito Afterbay functions in several ways to support the Thermalito diversion dam power plant while also providing a variety of recreational possibilities. The Afterbay is also used to regulate downstream flows and as a warming basin for water use by rice farmers to the east of the Oroville- Thermalito complex (California Department of Water Resources: Final report characterization of cold water pool availability, 2004). Recreational uses include boating, swimming, waterfowl hunting and fishing (Thomas, K., 2013). Fishing at Thermalito Afterbay is allowed year around. The reservoir has two boat ramps and along with some popular shoreline areas, making for easy fishing access. The two ramps are the Monument Hill Ramp and the Wilbur road Ramp, located at the north end of the reservoir. Both are paved single lane ramps with bathroom facilities. The Monument Hill ramp also has picnic tables and a beach area that varies in size dependent on water levels.

Planting History and Species Composition

Beyond steelhead, there are numerous fish species populating the reservoir (California Department of Water Resources: Final Report Fish Species Composition and Juvenile Bass Recruitment, 2004). Historic stocking involved brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*). These species were still documented in electofishing surveys from 2002 (California Department of Water Resources: *Final report characterization of cold water pool availability, 2004*). Black bass species present are largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), and spotted bass (*Micropterus punctulatus*) (California Department of Water Resources: *Final report characterization of cold water pool availability,* 2004). Other sport fish include black crappie (*Pomoxis nigromaculatus*), white crappie (*Pomoxis annularis*), bluegill (*Lepomis macrochirus*), green sunfish (*Lepomis cyanellus*), redear sunfish (*Lepomis microlophus*), tule perch (*Heterocarpus traski*), catfish (*Ameiurus sp. and Ictalurus spp.*), and common carp (*Cyprinus carpio*) (The resources agency, 2004). Non-gamefish populating the reservoir include hardhead (*Mylopharodon conocephalus*), golden shiner (*Notemigonus crysoleucas*), hitch (*Lavinia exilicauda*), Sacramento sucker (*Catostomus occidentalis*), sculpin (*Cottus sp.*) and wakasagi (*Hypomesus nipponensis*). Smaller numbers of other sport fish are sometimes present in the Lake Oroville complex such as coho salmon (*Oncorhynchus kisutch*) which have made their way into the Thermalito Afterbay from Lake Oroville.

Methods:

In order to assess the success of the new stocking program angler surveys were conducted to determine average growth and condition, catch rates, angler use, harvest, and preferences. To

further assess catch and harvest rates and the approximate number of days between stocking and harvest Afterbay steelhead were marked with Floy® tags.

Angler surveys were conducted based on availability of staff to perform the surveys. For this survey 21 days (17 weekdays and 4 weekends) were selected in 2013 from early March through mid-November. The numbers of days in which the creel occurred varied from month to month and survey start times were randomly stratified into either AM or PM periods. When anglers had fish in possession and were willing to allow data collection, survey takers determined species, total length (mm), and hatchery markings. A standard series of questions was asked to determine angling effort, catch rate, and size and species of fish released. In addition, each angler was asked a series of between one and three "yes or no" questions to determine angler satisfaction. Each angler was asked, "Are you satisfied with your angling experience today?" Anglers that caught fish were also asked "Are you satisfied with the size of the fish?" and "Are you satisfied with the number of fish?" Results were compiled to calculate percent of anglers satisfied with these criteria.

The tagging study was conducted using methods described by (Guy, C., Blankenship, H., & Nielsen. L., 1996). Methods consisted of placing $10 dollar reward Floy® T-bar Anchor tags on 499 steelhead prior to the 2012 plant and non-reward tags on 500 steelhead for the 2013 plant. Printed on each tag was a Fish and Game return mailing address. Signs were also placed at several locations around the reservoir to alert anglers about the presence of the tagged fish and how to return the tag. Upon receipt of the returned tag, anglers were sent a letter confirming the receipt of the tag along with information regarding the tagged fish.

Results

Surveyed parties totaled 170 anglers that combined for a total angling effort of 528.0 hours fishing on Thermalito Afterbay and 164 fish reported caught (kept or released). This equates to 3.1 hours fished per angler and a catch per unit effort (CPUE) of 0.31 fish per hour for the year. Data from 2012 showed an overall CPUE of 0.39. Attempts were made whenever possible during interviews to determine target fish and catch to species. While steelhead anglers were specific about targeting steelhead trout, bass anglers were less specific. Black bass (genus *Micropterus*) which includes largemouth, smallmouth and spotted bass will be used in much of the angler data as opposed to specific bass species. This is due to 91% of bass anglers targeting "Bass" and not a particular species of black bass.

Collected data allowed CPUE to be analyzed for black bass and steelhead (Appendix 1). The 2013 catch per unit effort (CPUE) per month for anglers targeting black bass ranged from 0.0 to 0.82 fish per hour. The 2013 CPUE for anglers targeting steelhead ranged from 0.0 to 0.42 fish per hour. April and May resulted in the highest catch rates for steelhead and October was the highest rate for black bass anglers. Surveyed anglers that stated they were targeting a specific game fish only caught their target fish, there was no incidental take for the survey year.

Bait was the most used gear type by Thermalito Afterbay fisherman at 45% of all gear used. Bait was closely followed by lures at 38% of total fisherman (using only one type of gear for that day). Fifteen percent of anglers used both lures and bait during a single fishing day and 2% of anglers used flies (Figure 1).

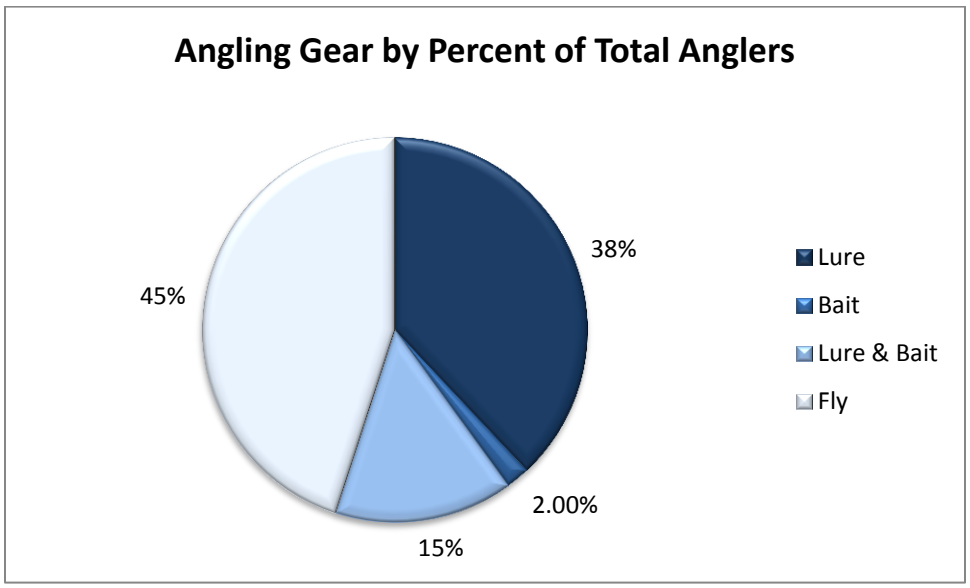

Figure 1. Gear Use per Total Anglers at Thermalito Afterbay (2013)

Survey responses and fish identification by CDFW staff resulted in two classifications for caught fish: black bass, and steelhead trout. Catch statistics for black bass were used in lieu of individual species because most bass anglers stated that they were targeting "bass". Seventy-two fish were identified as largemouth bass with 65 released. Those identified only as black bass accounted for 19 caught and released fish. Average length for kept black bass was 473mm (Table 1). The average length in 2012 was 370 mm. The CPUE for black bass anglers was 0.53 compared to 0.39 in 2012.

A total of 71 steelhead trout were reported caught with 24 released by anglers. The average length of kept steelhead trout was 438mm (Table 1). This compares to 358mm in 2012. The 2013 CPUE for steelhead angers was 0.24 and 0.40 for 2012.

Although not accounted for in the anger survey data, 23 Floy® tags have been returned to the CDFG since 2012. Two of these tags were from 2013 steelhead and 21 from the 2012 steelhead plant.

Table 1. Catch Statistics per Angler Targeted Fish, Thermalito Afterbay (2013)

Steelhead Trout Kept	47
Steelhead Trout Released	24
Avg. Length Kept	438mm
Steelhead Trout Targeted Hours	297
Steelhead Trout CPUE	**0.24**
Black Bass Kept	8
Black Bass Released	85
Avg. Length Kept	473mm
Black Bass Targeted Hours	178
Black Bass Targeted CPUE	**0.53**

To better understand what angling gear is most conducive to a successful angling experience on the Thermalito Afterbay, CPUEs were compared per target fish by angling gear (Table 3). Bass anglers almost exclusively used lures. No other gear was successful but anglers using lures had an annual CPUE of 0.54. Steelhead anglers used a variety of gear and had most success (CPUE of 0.83) with fly fishing but this is a very limited sample size. Bait fishing was the least productive for steelhead at 0.17 fish per hour while those using only lures or lures and bait were similarly successful at 0.28 and 0.30 fish per hour respectively.

Table 2. Catch Rates per Species by Angling Gear for Thermalito Afterbay (2013)

Target Fish	Gear	Hours Fished	Fish Caught	CPUE
Steelhead	**Lure**	32	9	0.28
	Fly	14.5	12	0.83
	Bait	197	34	0.17
	Bait/Lure	49.5	15	0.30
Bass	**Lure**	171	93	0.53
	Bait	1	0	0
	Bait/Lure	6	0	0

Forty-seven retained steelhead trout were measured for total lengths (Figure 2). Steelhead trout lengths ranged from 388mm to 605 mm. A total of seven bass were retained. All were identified as largemouth bass. The size range for these fish was 429mm- 550mm. All retained bass except for the 429mm fish were caught by one party of boating anglers.

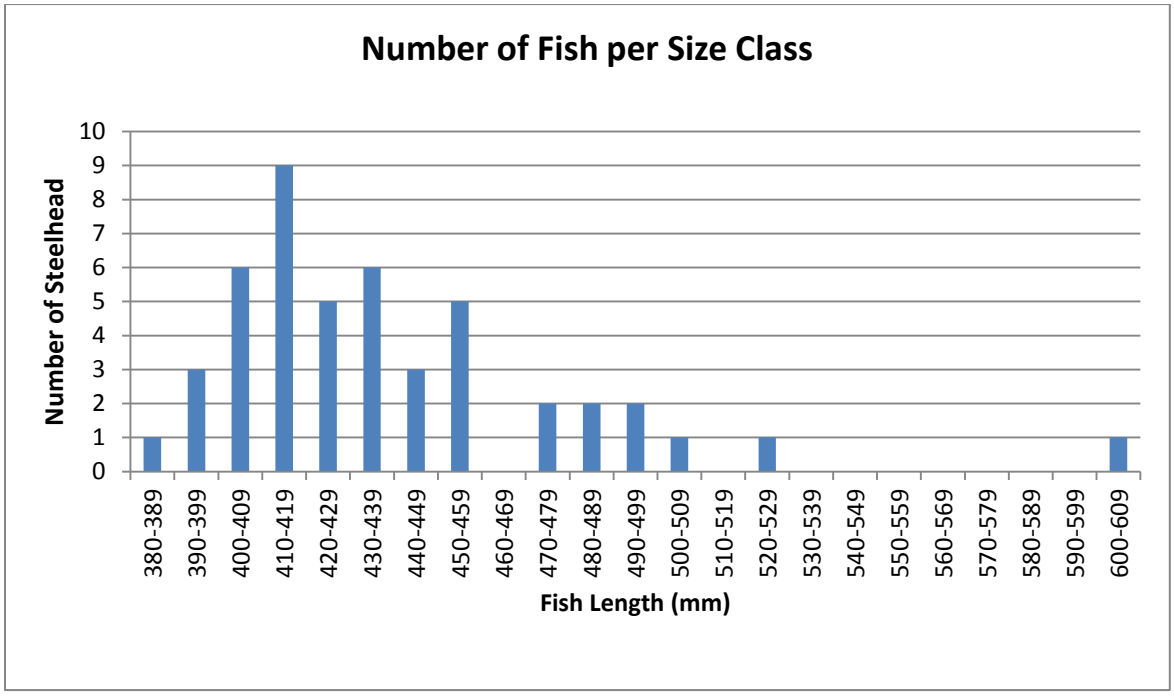

Figure 2. Number of Retained Steelhead per Size Class Thermalito Afterbay (2013)

Although Thermalito Afterbay has approximately 26 miles of shoreline, much of it is not accessible to shore angling. The 8 mile long dam bounding the west and southwestern shores is off limits to the public and the most of the eastern shoreline is defined by very gradually sloping topography. Creel surveys encountered shore based anglers at three spots more suited to successful angling (Figure 3). Point "A" was the most popular shore angling location for Steelhead fishing. Anglers parked and fished along the south side of the inflow canal at the Wilbur road boat launch. Point "B" was the second most popular shore based angling site. Fisherman fished along a roughly 100 yard section south of the highway 162 bridge. Points "A" and "B" take advantage of steep gradients created by roadside rip-rap. Point "C" is located at the Monument Hill boat ramp and utilizes a small beach area with a gentle gradient creating a shallow, sandy bottomed fishing area.

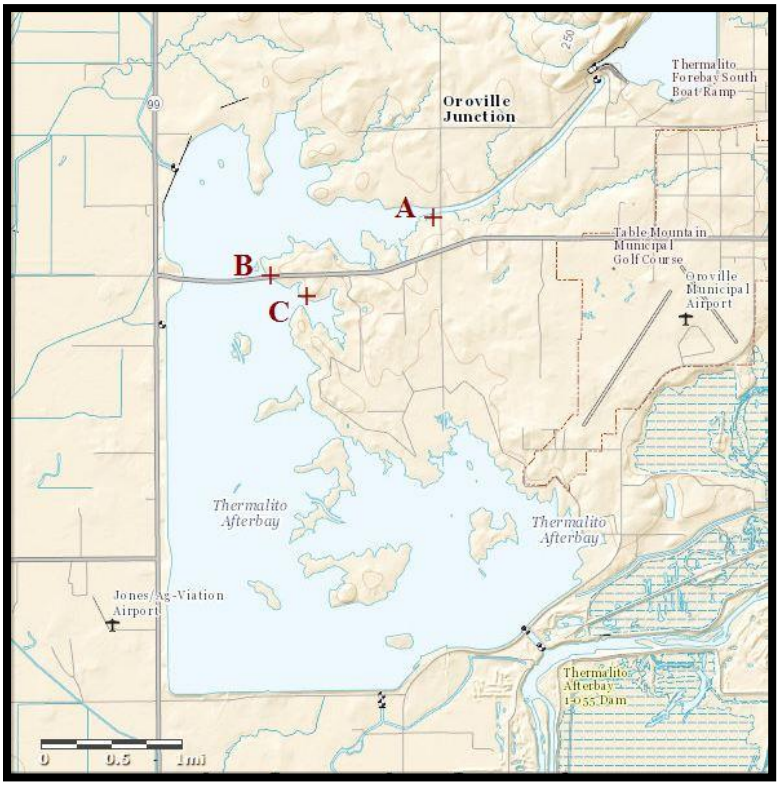

Figure 3. Thermalito Afterbay Shore-based Angler Locations (2013 Creel Survey)

Survey clerks moved to several locations in search of anglers. These locations were chosen as areas most likely to result in encounters with anglers. This resulted in data collection from a mix of shore and boat based anglers. Nearly 80% of all anglers specified that they were targeting either steelhead trout or black bass. The data collected on catch rates and hours fished enabled a CPUE comparison of the different target species by angling method (Table 3). Boat based anglers had higher catch rates for both black bass and steelhead trout. When comparing anglers, the majority (36%) were shore based fisherman targeting steelhead trout.

Table 3. CPUE for Various Angling Methods and Target Species, Thermalito Afterbay (2013)

Target Species	Method	Number of Anglers*	Total Hours Fished	Fish Caught	CPUE
Steelhead	Boat	17%	116.0	38	0.33
	Shore	36.%	179.7	33	0.18
Black Bass	Boat	22%	164.9	93	0.56
	Shore	4%	13.5	0	0

∗ 21% of Anglers were classified under “Target species” as “Any” or “Unknown.”

Considering angler satisfaction questions, 78% of anglers that were asked, “Are you satisfied with your overall fishing experience?” responded “Yes”. For respondents with kept fish, 79% responded “Yes” to the question “Are you satisfied with the numbers of fish?” For the question, “Are you satisfied with the size of the fish?” 87% were satisfied (Table 4). These numbers were higher than in 2012. Thermalito Afterbay creel responses in 2012 resulted in fisherman stating they were “satisfied” with their overall angling experience 73% of the time. Satisfaction with the numbers of fish was 36% and satisfaction with fish size was 76%.

Table 4. Thermalito Afterbay Percent of Positive Responses to Survey Questions (2013)

	Yes	No	Percent Satisfied
Overall Fishing Experience	124	32	78%
Satisfaction with Numbers of Fish	41	11	79%
Satisfaction with Fish Size	45	7	87%

A further analysis of angler satisfaction by steelhead fisherman, bass fisherman and those who did not specify a target fish shows variability between the categories (Table 5). Steelhead anglers represented the highest percentage of all fishermen that were satisfied for all three questions. Black bass anglers had the second highest rates of satisfaction. Those that did not specify a target species had the lowest satisfaction percentage at 58%.

Table 5. Thermalito Afterbay Angler Survey Question Responses by Target Species (2013)

Steelhead Trout	**Yes**	**No**	**Percent Satisfied**
Overall Fishing Experience	**77**	**10**	**89%**
Satisfaction with Numbers of Fish	**29**	**1**	**97%**
Satisfaction with Fish Size	**28**	**2**	**93%**
Black Bass			
Overall Fishing Experience	**32**	**11**	**74%**
Satisfaction with Numbers of Fish	**12**	**9**	**57%**
Satisfaction with Fish Size	**17**	**5**	**77%**
Unspecified Fish			
Overall Fishing Experience	**15**	**11**	**58%**
Satisfaction with Numbers of Fish	**0**	**1**	**0%**
Satisfaction with Fish Size	**0**	**0**	**NA**

Angler origins were accessed to determine distances traveled to fish the Afterbay. By comparing home zip codes for fisherman year over year, a determination can be made on the perceived quality of a fishery over time. For 2013, the majority of anglers visited the reservoir from Butte and Sutter counties (61 anglers) with the main cities of origin being Chico and Oroville (Figure 1). Distances traveled by fisherman were compared to 2012 data (Table 1). Angler origins were also categorized in 25 mile driving distances from zip code locations to the Thermalito Afterbay. In 2012, 3.0% of anglers traveled over 50 miles to fish, compared to 13% in 2013. Data for anglers targeting steelhead trout showed that 15% of them traveled over 50 miles to fish.

Angler Origin by California Counties

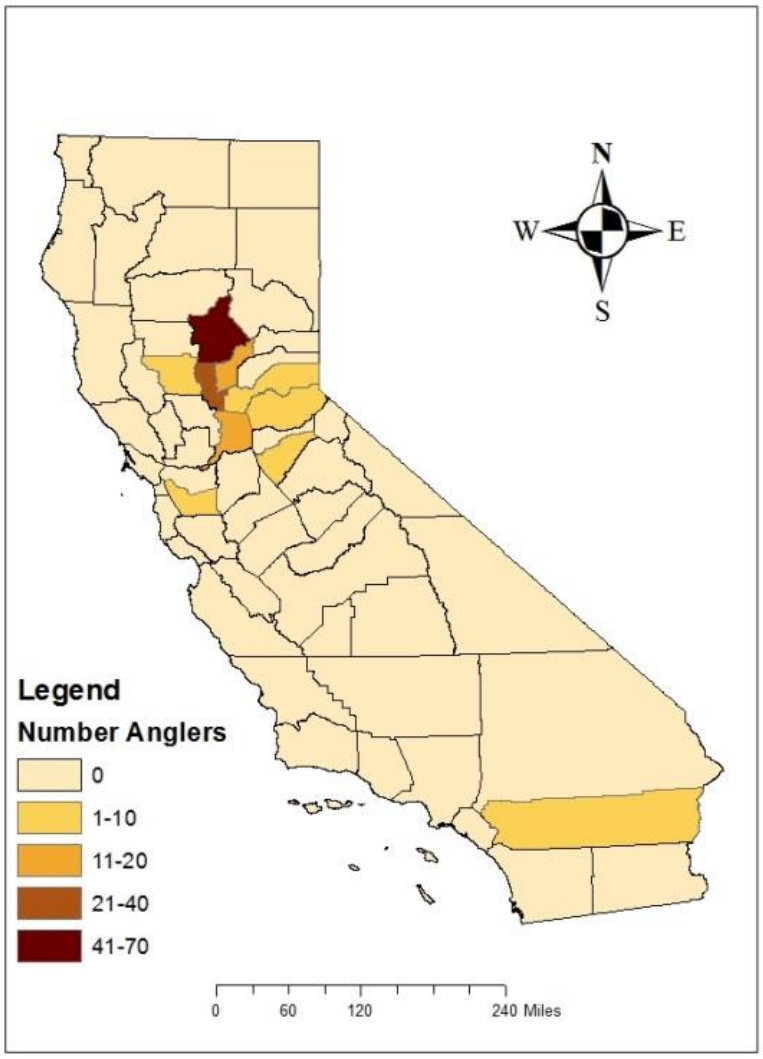

Figure 4. Angler Origin by California County, Thermalito (2013)

Table 6. Angler Origin for Thermalito Afterbay (2012-2013)

Miles Traveled	2012 (All Anglers)	2013 (All Anglers)	2013 (Steelhead Anglers)
0-24	69%	56%	58%
25-49	28%	31%	27%
50-74	1.5%	8%	10%
75-99	1.5%	1%	1%
100+	0%	4%	4%

Discussion:

The steelhead trout stocking program for Thermalito Afterbay began to show very good results in its second year. Comparisons to much of the 2012 fish and catch data.are not reliable due to the small number of fish in that survey (4 total) however the other angler survey questions are comparable. The 2013 0.24 annual CPUE is a drop from 2012's 0.40 CPUE but this is most likely due to the 2012 sample size being so small. Much of the 2013 data is able to stand alone in assessing the fishery.

The 2013 creel survey data resulted in high steelhead angler satisfaction for all three questions. Enthusiasm for the introduced game fish can be seen not only in the 89% satisfaction with overall fishing experiences but particularly in the satisfaction with numbers of steelhead (97%) even as the CPUE for steelhead anglers was 0.24 fish per hour for the year. Notably, a small number of fly fishermen represented the highest CPUE for steelhead by gear. The catch per hour of 0.83 was much higher than the next most successful gear used, lures at 0.28. The sample size was small with three anglers interviewed. Two of these anglers fished in early spring and combined for 6 fish each in 6 hours. The third fished in November and caught no fish in 2 hours. With such a small sample, determination of reasons for the success these anglers enjoyed is impossible. The least effective steelhead gear (bait at 0.17), was also the most popular used for a

total of 59% of all steelhead angler hours. Presently, this minimizes angling pressure but gear use may begin to change as anglers learn what works for steelhead on the reservoir. From the catch rates per gear type it appears the CPUE for steelhead salmon could be higher with more knowledgeable angling practices. The ability to track trends as the steelhead fishery becomes more well-known is important to understand success of the fishery.

The 2013 data also showed an increase in the percent of visitors traveling to Thermalito Afterbay from over 50 miles away. This may mean the stocking program is beginning to encourage angler spending typical of those traveling longer distances to fish. As word of the steelhead fishing at Thermalito Afterbay spreads, it is likely that average distances traveled by anglers to the reservoir will increase. The more data the CDFW can collect, the more precise we can be in our understanding of changes such as this occurring to the fishery; therefore continued evaluation of the Thermalito Afterbay is recommended. Creel surveys, using experienced scientific staff should continue to be the primary means of collection of angler preferences and use for the reservoir. To expand data collection on the Afterbay, it is recommended that angler survey boxes (ASBs) be considered for both launch ramps and the Wilbur road bridge adjacent to popular shore fishing on the inflow canal. The concentration of anglers at these locations, along with the potential to collect more data makes ASB use a viable enhancement for studying the black bass angling and the emerging steelhead fishery.

Due to low numbers of retained bass species and the small number of bass anglers encountered, creel surveys on Thermalito Afterbay is not an effective method for monitoring black bass size changes over time. If more information is desired on bass populations, electrofishing surveys may be the best option. The data collected in 2012 and 2013 illustrates the issues with small sample sizes of retained bass. The 2013 fish were, on average, 80% larger than

the year prior. It is notable that all but one of the bass from 2013 were retained by a single angling party. This creates a bias and the data on retained bass cannot be used to assess fish populations, size structure, or angler success.

Overall, the introduction of steelhead salmon has been a benefit to the fishery. A final recommendation would be to continue the practice of stocking steelhead over the annual allotment whenever possible. The fish viewed by creel census takers were consistently thick, healthy, and well fed. Competition for resources does not seem to be an issue. Further, several anglers reported catching fish such as the +600mm fish measured in 2013 (Figure 3). The more fish stocked, the higher the numbers of holdovers there will likely be for anglers to engage. A few anglers already know they can catch large steelhead on the Afterbay but pictures of large fish from there may be the quickest way to grow angling use through this new and unique opportunity.

Appendix 1. CPUE per Species for the Thermalito Afterbay from Available Dates (2013)

Month	Target Species	Time Fished (Hrs.)	Number of Anglers	Total Fish Caught	Monthly CPUE
March	Steelhead	36.5	14	14	0.38
	Black Bass	81.75	18	40	0.49
April	Steelhead	14.4	6	6	0.42
	Black Bass	2.5	2	0	0
May	Steelhead	0	0	0	0
	Black Bass	35	4	17	0.49
October	Steelhead	142.5	39	33	0.23
	Black Bass	41.5	12	34	0.82
November	Steelhead	102.6	30	17	0.17
	Black Bass	24.3	6	0	0

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