State of California

California Department of Fish and Wildlife

North Central Region

Rollins Reservoir, Nevada County

2015 Angler Survey Box Analysis

Rollins Reservoir (NID 2014)

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Introduction

Rollins Reservoir (Rollins) is located in Nevada County, on the Bear River, at an elevation 2,171 feet above mean sea level, just off Highway 174 near Colfax, CA. Rollins is managed by the Nevada Irrigation District (NID) for hydroelectric power, agricultural use, and recreational activities. Rollins was created in 1965 with a maximum storage capacity of 65,988 acre-feet and has a surface area of approximately 825 acres with nearly 26 miles of shoreline (NID 2016). At full capacity, maximum depth is upward of 280 feet (Shaffer 2005).

Rollins is a diverse fishery, boasting populations of brown trout (*Salmo trutta*), rainbow trout (*Oncorhynchus mykiss*), smallmouth bass (*Micropterus dolomieu*), largemouth bass (*Micropterus salmoides*), spotted bass, (*Micropterus punctulatus*), black crappie (*Pomoxis nigromaculatus*), bluegill (*Lepomis macrochirus*), redear sunfish (*Lepomis microlophus*), common carp (*Cyprinus carpio*), channel catfish (*Ictalurus punctatus*), brown bullhead (*Ameiurus nebulosus),* and Sacramento pikeminnow (*Ptychocheilus grandis)*.

Table 1 lists the previous five years of fish plants at Rollins conducted by the California Department of Fish and Wildlife (Department). The lake is planted primarily with catchable-sized rainbow trout and is managed as a "put and take" rainbow trout fishery. See Appendix I for a complete list of fish planted by the Department at Rollins since 2001.

Table 1. Department Planting Events at Rollins Reservoir, 2010 to 2015

Year	Species	Pounds or Number of Fish	Size
2015	Rainbow trout	3,200	Catchable
2014	Rainbow trout	3,250	Catchable
2014	Rainbow trout	28,600	Fingerling
2013	Rainbow trout	5,600	Catchable
2012	Rainbow trout	6,000	Catchable
2011	Rainbow trout	5,000	Catchable
2010	Brown trout	2,000	Catchable
2010	Rainbow trout	4,000	Catchable

In an attempt to assess the fishery and associated angler satisfaction at Rollins, a total of five Angler Survey Boxes (ASBs) were installed at boat ramps, and at other high-use access points, in September 2014. ASBs were installed at the boat ramps at Greenhorn Campground, Peninsular Family Camping,

and Long Ravine Campground. Two ASBs were installed at Orchard Springs Campground, one at the boat ramp, and one near trails used by shore anglers. Figure 1 is a map of Rollins Reservoir with the campground locations marked for reference.

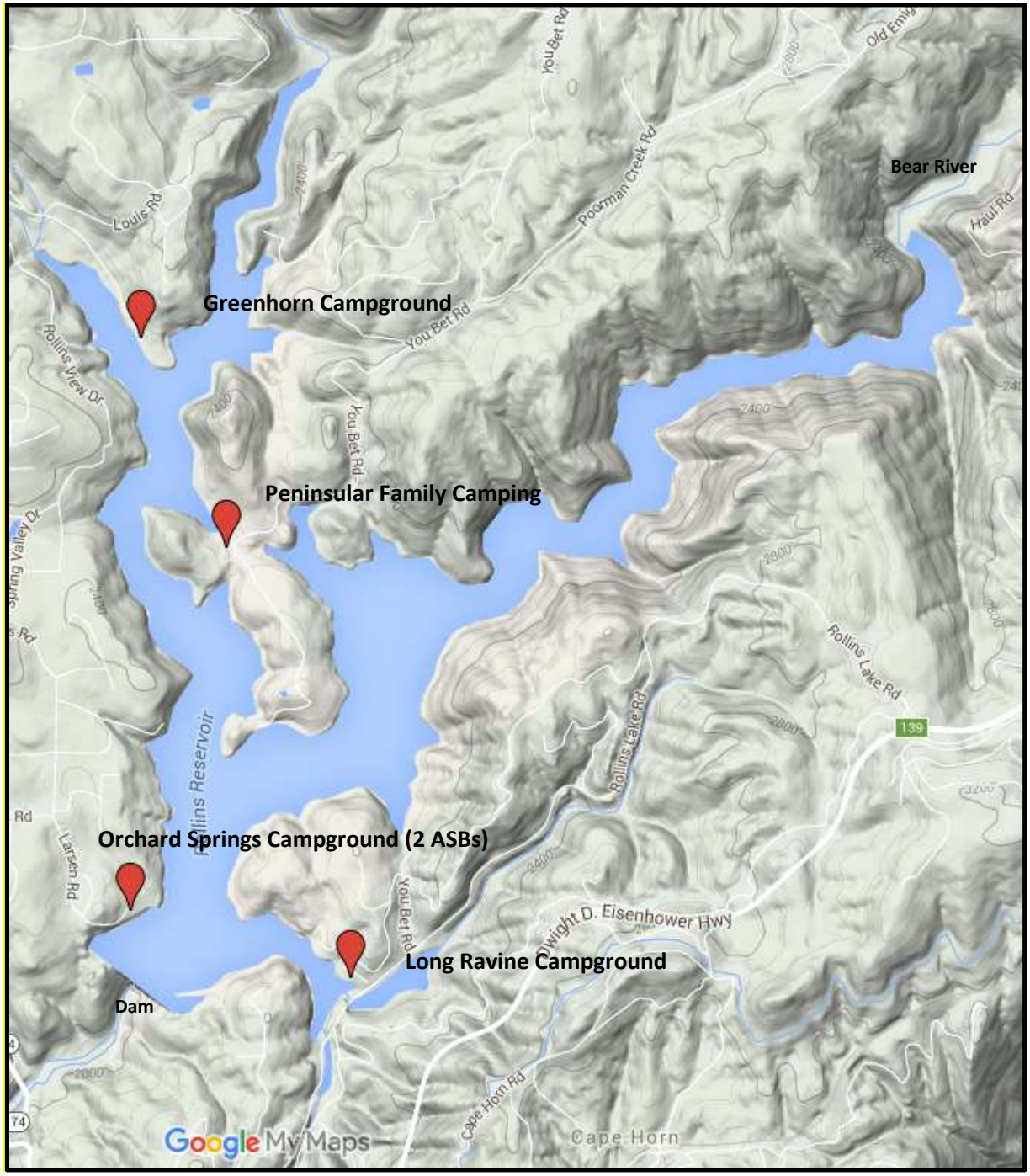

Figure 1. Map of Rollins Reservoir illustrating the location of four campgrounds with boat ramps where the Department installed Angler Survey Boxes (ASBs). One ASB was installed at each campground, with the exception of Orchard Springs Campground where two boxes were installed, for a total of five ASBs.

Methods

At each ASB installation is a sign requesting anglers fill out a volunteer survey form regarding their catch, effort, and satisfaction. The angler survey form includes questions regarding hours fished, type of gear and method used, and the number of fish landed. In addition, successful anglers can report the size and species of fish landed and whether they kept or released their catch. Lastly, the survey includes three questions regarding the angler's satisfaction with: 1) overall angling experience; 2) size of fish; and 3) number of fish. Answers are recorded on a scale of -2 to 2, with "2" representing most satisfied and "-2" representing least satisfied. The back of the survey form is reserved for any additional comments. See Appendix II for a copy of the 2015 survey form.

Results

Three survey forms from 2014 were included in the dataset; two from November and one from December. These were added to November 2015 and December 2015, respectively, for a total of 84 anglers who completed survey questionnaires in 2015 (Table 2). The 84 anglers landed 569 fish while totaling 417.5 hours of fishing, which resulted in 6.8 fish per angler and an average of 5.0 hours of fishing per angler. Overall, the anglers responding to the ASB form in 2015 averaged a catch per hour of 1.4 fish. A creel survey in 2013 (Hickey 2014) reported 333 anglers totaling 812.7 hours of fishing while catching 344 fish, resulting in a catch per hour of 0.42 fish.

Table 2. 2015 Catch Statistics and Angler Effort for Rollins

Number of Anglers	84
Number of Fish Caught	569
Total Hours Fished	417.5
Hours Fished per Angler	5.0
Fish per Angler	**6.8**
Catch per Hour	**1.4**

Of the 84 anglers responding to the survey, 59 anglers (70%) landed at least one fish and 25 anglers (30%) reported catching zero fish (Figure 2). The 10 most successful anglers landed a total of 291 fish (51% of the total catch), averaging 29.1 fish per angler. The highest number of fish an angler landed during one trip was 40; achieved by two anglers in spring of 2015.

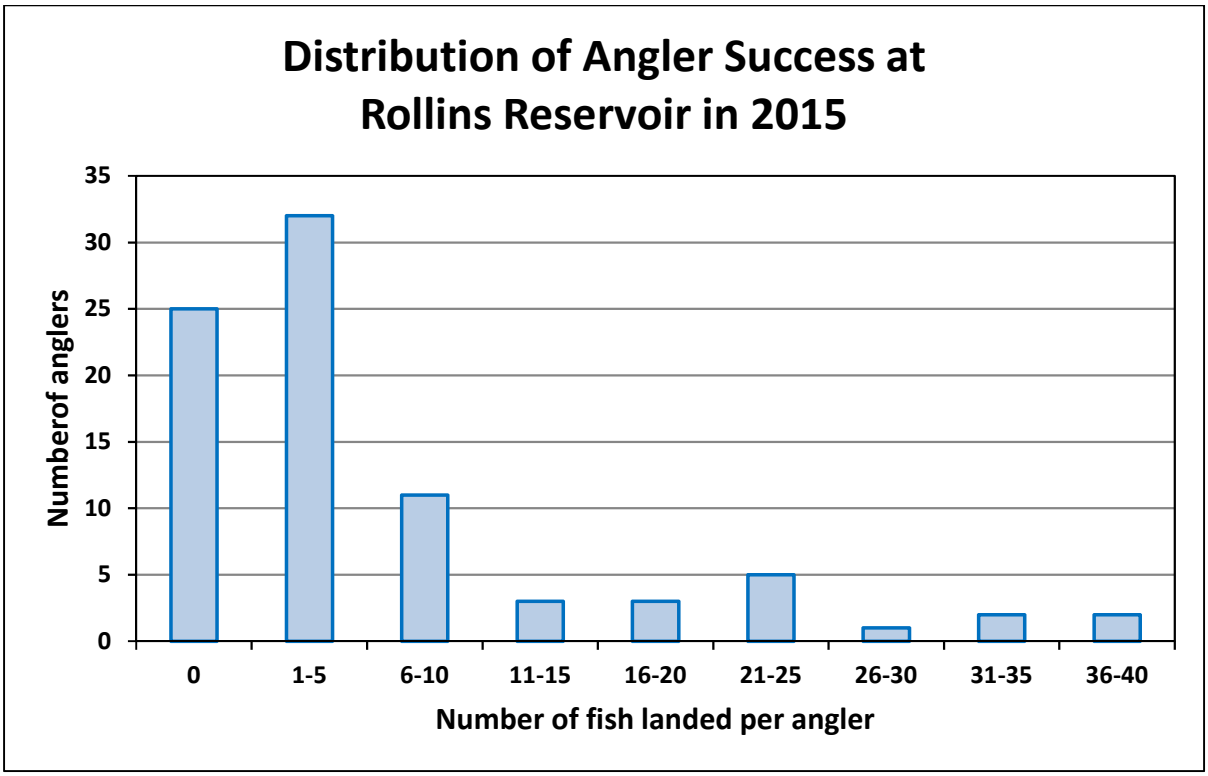

Figure 2. Distribution of angler success at Rollins Reservoir in 2015 measured as number of reported fish landed per angler.

The species composition of fish landed is shown in Table 3. Most respondents did not specify the black bass species landed. As a result, the category "black bass species" potentially covers all three black bass

Table 3. Composition of Species Landed and Harvested at Rollins Reservoir in 2015

Species	Number of Fish	Kept	Released	Percent of Total Catch
Black bass species	262	33	229	46.0
Unknown species	120	28	92	21.1
Rainbow trout	113	79	34	19.9
Spotted bass	33	5	28	5.8
Brown trout	23	8	15	4.0
Bluegill	12	2	10	2.1
Catfish Species	6	2	4	1.1
Total	**569**	**157**	**412**	**100**

species found in the lake. When summing the percentages of "black bass species" and "spotted bass", bass make up 51.8% of the total catch. Unknown species make up 21.1%, rainbow trout 19.9%, brown trout 4%, bluegill 2.1%, and catfish 1.1%. The 2013 creel survey show that bass made up 73% of the total

catch and rainbow trout eight percent of the total catch. In total, 32% of anglers landed warm water species, 30% landed cold water species, 20% landed a mix of cold and warm water species, and 18% did not specify their catch.

Table 3 also includes numbers of kept or released fish by species. The total harvest in 2015 was 157 fish or 27.5% of the total catch. Although rainbow trout only made up 19.9% of the total catch, more than 50% of the total harvest was rainbow trout. Of the rainbow trout landed, 79 (69.9%) were kept.

Figure 3 displays the length distribution of fish landed. The modal size class for all black bass and rainbow trout was 10 to 11.9 inches with 40 (59%) of the rainbow trout landed and 89 (30%) of the bass landed being in this size class. In contrast, the modal class for brown trout was less than 6 inches, with 13 of the 22 (59%) brown trout landed being in that size class. The remaining nine brown trout landed in 2015 showed a random size distribution with the three biggest individuals reported as 24 to 25.9 inch size class.

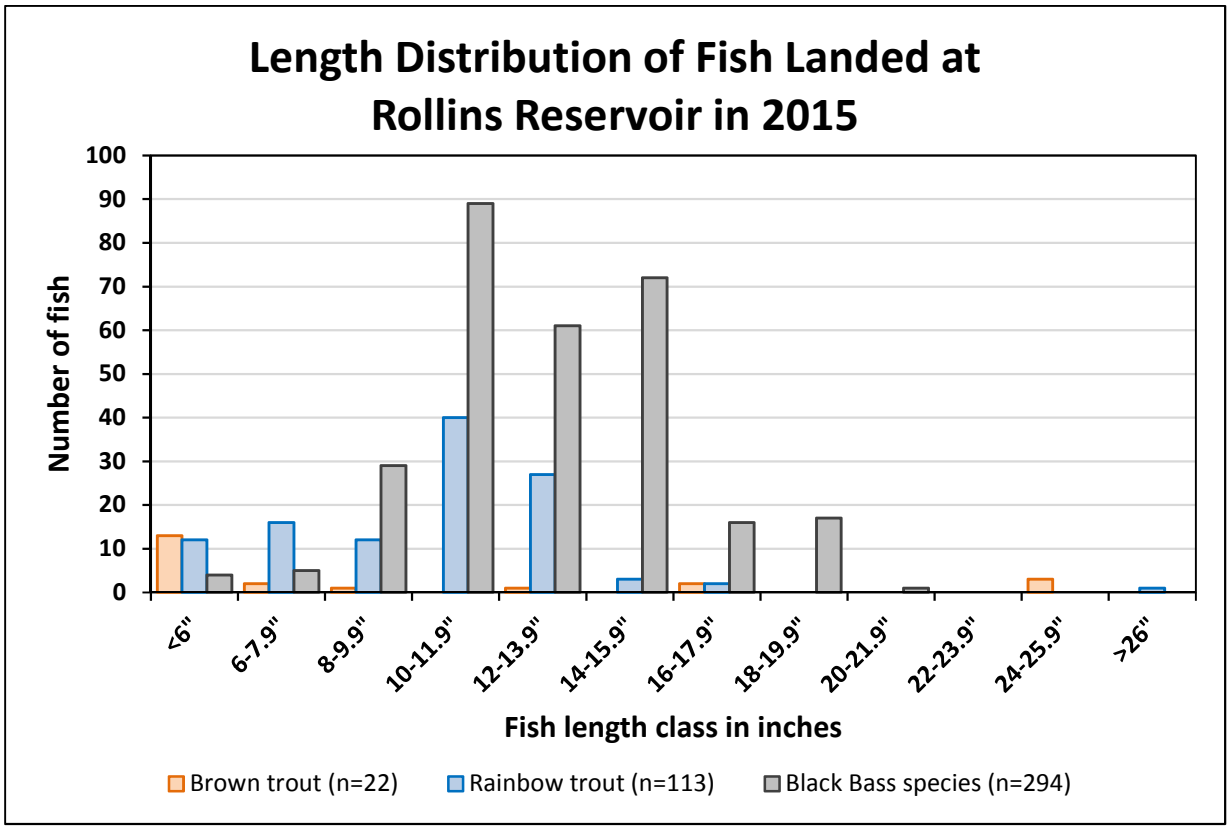

Figure 3. Length distribution in inches of reported fish at Rollins Reservoir in 2015.

During the reporting period, February through May had the highest number of anglers at Rollins Reservoir. While the months of March, April, and May had the highest catch rate (Table 4). A total of 37 anglers spent 198.5 hours fishing during these months, landing more than two fish per hour. A total of 432 fish were landed in March through April, which amounts to 76% of the total catch in 2015. The average number of anglers was higher from January to June, with an average of 10 anglers per month, than from July to December, with an average of three anglers per month.

Table 4. Angler Catch and Effort per Month for Rollins Reservoir in 2015

Month	Number of Anglers	Hours Fished	Number of Fish	Catch/Hour
January	8	30.5	19	0.6
February	10	58	5	0.1
March	14	72	165	2.3
April	13	72.5	153	2.1
May	10	54	114	2.1
June	9	37	40	1.1
July	2	9	4	0.4
August	4	18	14	0.8
September	3	14	7	0.5
October	2	9	25	2.8
November	5	21	12	0.6
December	4	22.5	11	0.5

Lures were the preferred type of gear among anglers fishing on Rollins (Table 5). Forty-eight anglers (57%) used lures while fishing and these anglers were also the most efficient at catching fish, landing 1.87 fish per hour. Warm water species accounted for 80% of the total catch for anglers fishing with

Table 5. Gear Used, Catch per Hour and Harvest at Rollins Reservoir in 2015

Method	Number of Anglers	Percent of Anglers	Fish Landed	Hours Fished	Catch per Hour
Lure	48	57	455	242.75	1.87
Bait	18	21	63	66.75	0.94
Bait and Lure	13	15	31	79.50	0.39
Fly	1	1	11	7.50	1.47
DNA	4	5	9	21	0.43

lures. Bait was the second most popular gear type used and the 18 anglers (21.4%) fishing with bait landed on average 0.94 fish per hour. Cold water species (rainbow trout and brown trout) made up 82%

of the catch for anglers using bait. The 15% of anglers using both lure and bait averaged 0.39 fish per hour. Only one angler reported using flies and this one angler landed 1.47 fish per hour. Four anglers did not answer (DNA) which method they used.

The average hours fished for anglers using both lures and bait was 6.1, while anglers using lures, on average, fished 5.1 hours, and anglers fishing with bait fished 3.7 hours, on average. Anglers using lures kept a total of 101 fish or 22% of their catch. Anglers using bait kept a total of 34 fish or 54% of their catch.

A total of 75 anglers answered the survey questions related to their overall satisfaction with the fishing experience at Rollins in 2015 (Table 6). On average, the Overall Angler Satisfaction (OAS) was positive, with a value of 0.29. Sixty-eight anglers expressed an average satisfaction of 0.26 with the size of the fish they landed. The satisfaction with the number of fish landed was also positive for the 73 respondents, with an average satisfaction value of 0.30. These results correspond with the creel surveys from 2004 (Serup 2016) and 2013, which also showed that a majority of the anglers at Rollins had a positive fishing experience.

Table 6. Angler Satisfaction at Rollins Reservoir in 2015

Overall Satisfaction (n=75)	Size of Fish (n=68)	Number of Fish (n=73)
0.29	0.26	0.30

Max. Positive satisfaction 2, min. negative satisfaction -2.

Table 7 shows OAS related to the number of fish landed per angler. The level of satisfaction increases with the number of fish landed. Anglers reporting a zero catch had an average OAS of -1.62 and anglers reporting a catch of more than 10 fish per trip had the highest average OAS value at 1.67.

Table 7. Overall Angler Satisfaction (OAS) Compared to Catch

Number of Fish Landed	Number of Anglers	Average OAS
0	21	-1.62
1-5	29	0.55
6-10	10	1.50
>10	15	1.67

Table 8 differentiates satisfaction in relation to gear used and species landed. Anglers using both bait and lure reported dissatisfaction with their overall fishing experience, the size of fish, and the number fish. Anglers using either lure or bait were satisfied with their overall fishing experience and with both the size and number of fish, although anglers using bait were less satisfied with the size of fish than anglers using lures. The lower half of Table 8 shows the relationship between satisfaction and type of fish landed (warm water species, cold water species, or a mix). However, the sample size is too small to conclude if species landed has an impact on satisfaction.

Table 8. Angler Satisfaction by Gear and Species Landed at Rollins Reservoir in 2015

	OAS	SOF	NOF
Bait	0.73 (n=15)	0.20 (n=15)	0.40 (n=15)
Lure	0.70 (n=44)	0.77 (n=39)	0.63 (n=43)
Bait/Lure	-1.62 (n=13)	-1.60 (n=10)	-1.45 (n=11)
Warm (n=17)	1.06	0.53	0.82
Cold (n=16)	1.00	1.06	0.44
Mix (n=11)	1.36	0.82	1.64

OAS: Overall Angling Satisfaction, SOF: Size of Fish, NOF: Number of Fish. There was only one angler using fly in 2015

Discussion

Rollins Reservoir is a productive black bass fishery with a coldwater trout component maintained by regular Department plants of catchable-sized rainbow trout. ASB data indicate a healthy bass fishery with a broad distribution of size classes landed, a catch per hour in excess of 0.5, and a positive angler satisfaction regarding size of fish, number of fish, and overall angling experience for those anglers that landed bass.

Rainbow trout are the second most common fish landed. ASB data indicate that many of the fish landed are approximately the same size as when they are planted, indicating that the “put and take” planting strategy is functioning as intended. The data also show individual rainbow trout that are not harvested have the potential to hold over, survive, and grow to trophy size. In addition, the presence of very small rainbow trout in the catch data indicate that some level of natural rainbow trout reproduction and recruitment is occurring within Rollins Reservoir.

Brown trout are occasionally landed at Rollins, including trophy-sized fish in excess of 24 inches. Catchable sized brown trout were planted in Rollins for years but that practice was halted in 2010. That some anglers landed very small juvenile brown trout suggests that natural reproduction is occurring within Rollins. It is unclear whether adult recruitment is sufficient to allow the brown trout population to persist at low densities without additional plants. In addition, it is unclear whether or not the few large brown trout landed were holdover fish from 2010 or wild fish.

Kokanee salmon were not landed or reported at Rollins during the 2015 reporting period. These data support the conclusion that there is no longer a functional Kokanee salmon fishery at Rollins, despite annual fingerling plants from 2005 to 2008.

Contrasts with 2013 Creel and Discussion of ASB Method

Compared to the creel survey in 2013, which registered 333 anglers, the 84 anglers responding to the ASB survey are very unlikely to be representative of the true number of anglers fishing on Rollins in 2015. Although the difference in angler numbers between the two years is significant, not even the angler numbers from the 2013 creel survey are a true estimate of total angler number for 2013, but simply the number of anglers interviewed over 43 survey days. . However, it is unlikely that the number of anglers fishing on Rollins have dropped dramatically over a two year period, so the explanation is probably found in the differences between creel surveys and ASB survey methods.

First, having anglers fill out the ASB form requires that anglers find the forms. Rollins has more access points than the four locations where the ASBs are placed, which means that not all anglers will find the forms. Second, there is likely a bias toward anglers fishing from boats, given that all the ASBs are placed in close proximity to a boat launch ramp. To investigate whether ASBs are actually biased toward boat anglers in Rollins, the ASB form could be modified to include a question pertaining to “Fishing technique” (boat or shore). The creel survey in 2013 found twice as many anglers fishing from shore as there were anglers fishing from boat. Third, the ASB is based on voluntary action and anglers may decide to not fill out the form. Interview-based creel surveys are not as sensitive to the aforementioned biases, given that interviewers can actively spot and approach anglers, which may explain the large difference in angler numbers between the two years.

Another difference that stood out between the two survey methods was catch per hour. The catch per hour in 2015 was 1.4 fish, compared to 0.42 fish for the creel survey done in 2013, and a catch per hour of 0.25 fish from the creel survey in 2004. That is, ASB data indicate anglers in 2015 landed almost one fish per hour more than anglers in 2013, and five times more fish per hour than in 2004. Several studies have looked at voluntary angler surveys and whether data from these can be compared to creel or electrofishing surveys (Mosindy and Duffy, 2007; Bray and Schramm, 2001; Prentice et al., 1995; and Sztramko et al., 1991). The results are inconclusive when comparing the studies, so careful consideration should be given to conclusions resulting from ASB data.

One explanation for the bias is that anglers with zero catch are less inclined to fill out the ASB form than anglers who landed fish, which would drive up the catch per hour. Another possibility is avidity bias; avid anglers who fish Rollins regularly are likely to catch more fish than a casual Rollins angler, and may have a vested interest in filling out the ASB form. The phenomenon of "avidity bias" in voluntary diary surveys is reported by Bray and Schramm (2001) in their survey of Mississippi anglers. Creel surveys, on the other hand, minimize the above mentioned reporting bias, given that all anglers that the surveyor encounters at the water will be included in the survey. One of the advantages of the ASB survey method is that it collects information on complete trips, whereas many creel surveys collect data on incomplete trips, resulting in biased catch rates (Keefe et al., 2009). A third possible explanation for the difference in catch per hour between 2013 and 2015 can be found in the relatively small sample size in 2015. Five anglers in 2015 were highly successful in March – April, catching 31% of the total catch for 2015. If those five surveys are removed from the dataset average catch per hour is reduced to 1.03. Furthermore, the 2013 creel survey had the highest number of survey days in July – September, but the ASB data from 2015 show that highest number of anglers and the highest catch per hour were in March – May.

Although it is not possible to directly compare angler satisfaction data between the creel surveys and the ASB survey (creel surveys questions are yes or no questions, whereas ASB surveys are rated from -2 to 2), it is possible to obtain a somewhat comparable measure of angler satisfaction by treating the ASB satisfaction answers like yes or no answers. Any -1 or -2 is equal to a "no" in a creel survey satisfaction question and any 1 or 2 is equal to "yes". Zeros are disregarded (only seven anglers were neutral). In 2015, this resulted in 62% of anglers being overall satisfied with their fishing experience. In 2004, that number was 69% (only anglers that were done fishing were included), and in 2013 it was 70%. So, regardless of the large difference in catch per hour, anglers were overall satisfied with their fishing experience.

Another difference between the 2015 ASB data and the 2004 creel data is that 46% of 2004 anglers who reported having an overall positive fishing experience did not catch anything. This is in stark contrast to the ASB data in 2015, where just two and a half percent of the anglers who reported not catching anything still reported an overall positive fishing experience.

There is a discrepancy between the distribution of anglers throughout the year at Rollins when comparing the /2015 ASB data and the 2013 creel survey data. In 2015, the first six months of the year had the highest number of anglers, with 76% of respondents fishing during this time period. The creel survey data show the exact opposite pattern, with 63% of the anglers fishing between June and August. Part of the uneven distribution of anglers found in the creel survey can be explained by the creel survey bias design; the summer months also had the highest number of survey days. This does not explain why the ASB data experiences such a significant drop in anglers over the summer. Based on the 2013 creel survey, which had the highest number of anglers per survey day in July and August, it is unlikely that Rollins is subject to a lower number of anglers during summer months. However, it is possible that the type of anglers differ throughout the year, with more avid anglers fishing in the spring and less avid anglers fishing over the summer. If there is a correlation between angler avidity and inclination to fill out the ASB form, this could explain the difference in monthly fishing pressure observed in 2015.

The species composition of fish landed in 2015 reflects the data from 2013, but there is variation in the percentages of different species landed. Disregarding the “Unknown” (species of fish) category for both data sets, anglers in 2015 landed six different species, and anglers in 2013 landed nine different species. Rainbow trout made up 20% of the total catch in 2015, compared to eight percent in 2013, black bass species made up 52% of the total catch in 2015 compared to 75% in 2013, and brown trout amounted to four percent of the total catch in 2015 compared to 0.6% in 2013. The percentage of landed fish reported as “Unknown” was only 3.8% in the creel survey, while it was 21% in 2015. It is difficult to conclude whether the three species (Sacramento pikeminnow, black crappie, and brown bullhead) that were landed in 2013 were also landed in 2015, given the high number of unknown species reported in 2015. This difference in unidentified species probably arises from anglers not filling out the ASB form in detail, but simply checking off the size and number of fish in the category “Other species,” which may be an important bias in the ASB data. Another explanation could be that creel survey crews have the opportunity to verify data on the fish that were kept, thereby lowering the number of “Unknown” species in the dataset. With ASB surveys, verification is not possible, and the data (species and length of fish) may be less accurate than for creel surveys based on interviews. A study from 2012, which

concluded that the overall ability of anglers to accurately identify fish species is low, supports this concern (Page et al., 2012).

Overall, the ASB survey method presents a relatively inexpensive way (compared to other survey methods) to gather information on fisheries characteristics for management purposes, but the data cannot necessarily be compared to that of other surveys, nor does it provide estimates of total catch or total fishing effort for a fishery.

Recommendations

- Increase the visibility of the ASB's and the amount of information written on them. The ASB's are easily overlooked, especially on days with a lot of traffic around the boat ramps and parking lots. Increasing the visibility by mounting an information board behind the ASB's will increase visibility and create a platform on which to inform anglers about the survey, what the data is used for, why it is important that all anglers fill out a form, and to present previous years data.

- Install fish ID posters to support anglers in identifying fish species.

- Another way to increase visibility of the survey forms is to have kiosk staff hand out the forms when anglers are paying to access the campgrounds. In the off-season, survey forms could be placed next to the self-service kiosks. Having kiosk staff hand out the forms also allows for calculating the response rate on forms handed out. This would require that each form contain an ID number, which then makes it possible to register how many forms are returned.

- Use the same measurement for satisfaction in ASB and other surveys so results are comparable.

- Modify the ASB form for Rollins to include a question about fishing technique to obtain data on the percentages of anglers fishing from shore or boat, respectively.

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2012	Rainbow trout	6,000	Catchable
2011	Rainbow trout	5,000	Catchable
2010	Brown trout	2,000	Catchable
2010	Rainbow trout	4,000	Catchable
2009		No Plants	
2008	Brown trout	1,350	Catchable
2008	Kokanee salmon	40,125	Fingerling
2008	Rainbow trout	6,000	Catchable
2007	Brown trout	600	Catchable
2007	Kokanee salmon	24,186	Fingerlings
2007	Rainbow trout	5,000	Catchable
2006	Brown trout	1,000	Catchable
2006	Kokanee salmon	16,400	Fingerling
2006	Rainbow trout	4,000	Catchable
2005	Brown trout	1,000	Catchable
2005	Kokanee salmon	40,005	Fingerlings
2005	Rainbow trout	4,000	Catchable
2004	Brown trout	1,000	Catchable
2004	Rainbow trout	7,000	Catchable
2004	Rainbow trout	4,000	Sub-Catchable
2003	Brown trout	2,000	Catchable
2003	Rainbow trout	8,000	Catchable
2002	Brown trout	1,500	Catchable
2002	Rainbow trout	5,000	Catchable
2002	Rainbow trout	2,350	Sub-Catchable
2001	Brown trout	2,000	Catchable
2001	Rainbow trout	5,000	Catchable

Appendix II. Department's 2015 Angler Survey Form for Rollins Reservoir

Rollins Reservoir

The California Department of Fish and Wildlife is conducting an evaluation of the fishery at Rollins Reservoir. We request your help in this evaluation by providing the following information in this survey. Please use this form for one day's fishing on Rollins Reservoir by one angler only.

Date Fished: _____ # Hours Fished: _____
mm/dd/yyyy

Primary gear type used (check one):

? Bait ? Lure ? Fly

Enter the total number of fish caught by species and size class:

Size	rainbow trout		brown trout		other	
	Kept	Released	Kept	Released	Kept	Released
Less than 6"						
6"-7.9"						
8"-9.9"						
10"-11.9"						
12"-13.9"						
14"-15.9"						
16"-17.9"						
18"-19.9"						
20-21.9"						
22"-23.9"						
24"-25.9"						
>26"						

Please indicate your level of satisfaction with the following statements regarding your fishing experience today:

	Least satisfied		Neutral		Most satisfied
Overall angling experience:	-2	-1	0	+ 1	+2
Size of fish:	-2	-1	0	+ 1	+2
Number of fish:	-2	-1	0	+ 1	+2

Please use the back of this form for any additional comments. Thank you for helping us manage and protect California's resources.

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20-21.9"						
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24"-25.9"						
>26"						

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Size of fish:	-2	-1	0	+1	+2
Number of fish:	-2	-1	0	+1	+2

Please use the back of this form for any additional comments. Thank you for helping us manage and protect California's resources.