State of California
The Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE

Antelope Lake
General Fish Survey 2011 & 2013

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TABLE OF CONTENTS

ACRONYMS

CDFW California Department of Fish and Wildlife
DWR California Department of Water Resources
SR-18 Smith-Root electrofishing boat

Fish Species

BCR Black crappie
Pomoxis nigromaculatus
BK Brook trout
Salvelinus fontinalis
BB Brown bullhead
Ameiurus nebulosus
BN Brown trout
Salmo trutta
GSH Golden shiner
Notemigonus crysoleucas
LMB Largemouth bass
Micropterus salmoides
PSD Pumpkinseed
Lepomis gibbosus
RT Rainbow trout
Oncorhynchus mykiss (4)
SKR-S Sacramento sucker
Catostomus occidentalis
SMB Smallmouth bass
Micropterus dolomieu

Measurements

mm millimeters
g grams
TL total length
CPUE catch per unit effort

I. INTRODUCTION

Antelope Lake is located in Plumas County, in the northern portion of the Plumas National Forest. Antelope Lake is a 948 surface acre reservoir created in 1964 that sits at an elevation of 5,002 feet and is part of the Feather River drainage. The dam is owned and operated by the California Department of Water Resources (DWR). It was created as part of the State Water Project to regulate Indian Creek for irrigation purposes and to enhance recreation opportunities. The recreational fishery established at Antelope Lake is comprised of a variety of stocked and self-sustaining native and non-native fish populations including rainbow trout (RT) (*Oncorhynchus mykiss*), brook trout (BK) (*Salvelinus* fontinalis), brown trout (BN) (*Salmo trutta*), brown bullhead (BB) (*Ameiurus nebulosus*), black crappie (BCR) (*Pomoxis nigromaculatus*), pumpkinseed (PSD) (*Lepomis gibbosus*), smallmouth bass (SMB) (*Micropterus dolomieu*), and largemouth bass (LMB) (*Micropterus salmoides*).

In an effort to evaluate the fishery at Antelope Lake, a general fish survey was conducted on the nights of May 19, 2011, July 26-27, 2011 and July 16-17, 2013 by California Department of Fish and Wildlife (CDFW). Prior to this, the lake was last surveyed in 2008 as part of the effort to monitor other waters nearby Lake Davis for northern pike. Results of this effort can be found in the *2008 monitoring of other waters of Plumas County* (LaCoss and Rossi 2011b) paper. Boat electrofishers were used to complete the 2011 and 2013 surveys. Fish species identified during these surveys were black crappie, brook trout, brown bullhead, brown trout, golden shiner (GSH) (*Notemigonus crysoleucas*), largemouth bass, pumpkinseed, rainbow trout, Sacramento sucker (SKR-S) (*Catostomus occidentalis*), and smallmouth bass.

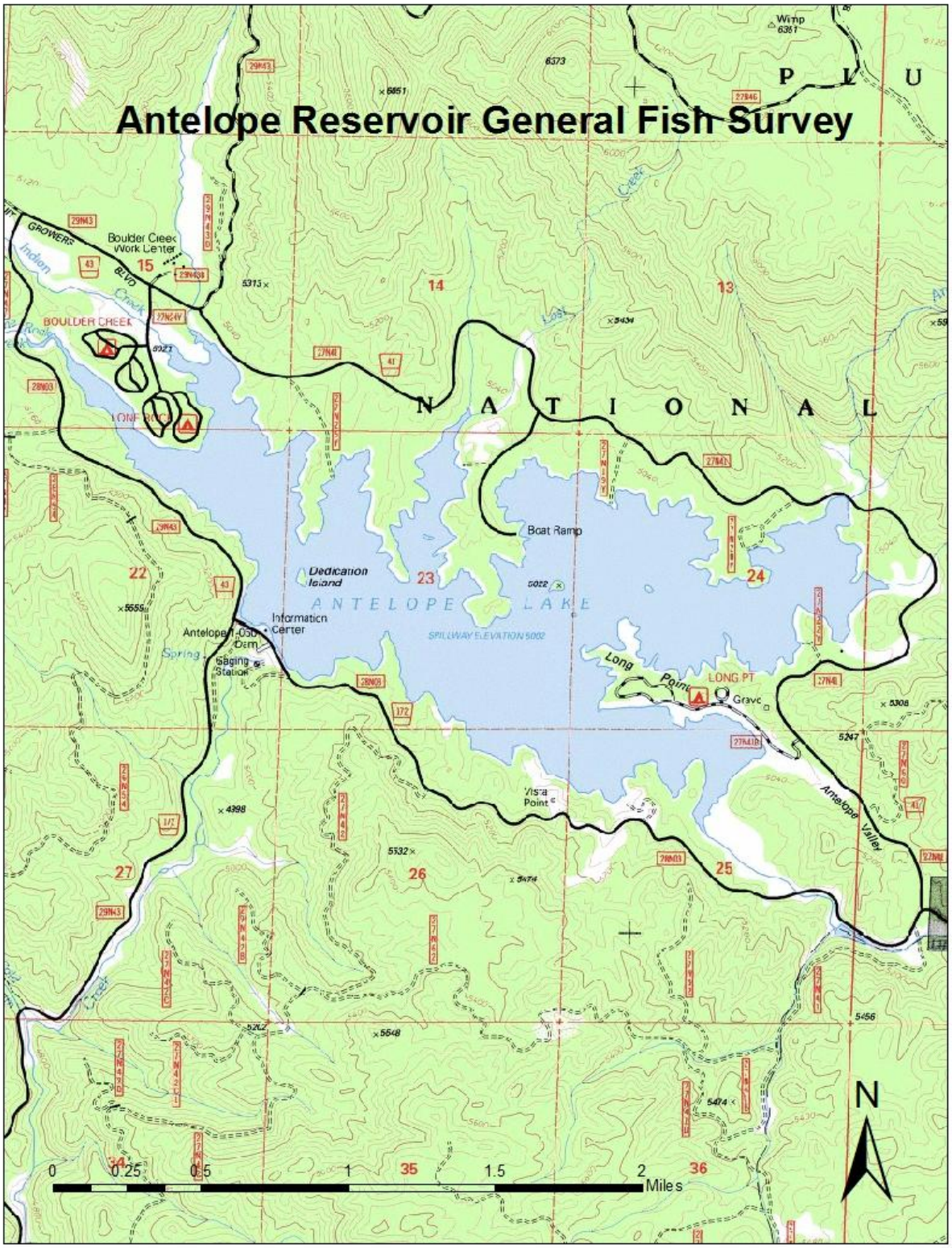
II. METHODS

Monitoring was conducted by paralleling the perimeter of the reservoir with electrofishing boats. Sampling methods included the use of three boat electrofishers at night. The lake was divided into three sections (one per boat). In 2011, each crew was instructed to sample as much of the shoreline as possible in their designated area. In 2013, each crew was instructed to sample as many transects as possible in their designated area using 600 seconds of pedal shock time per transect. The efforts varied based on distance from launch, accessibility of sampling area, weather conditions, and safety. A minimum of 30 fish per species captured during each sampling event were randomly sub-sampled and measured (total length (TL); millimeters (mm)) and weighed (grams (g)). Sampling events were defined as one monitoring period using a given area electrofished. If more than thirty fish per species per event were captured they were tallied by species. Capture rates for each method and species were calculated as catch per unit effort (CPUE), by dividing the number of fish captured by the hours sampled.

Boat Electrofisher

Three Smith-Root electrofishing boats (SR-18) were used during nighttime hours on the evenings of May 19, 2011, July 26-27, 2011 and July 16-17, 2013 to sample the shallow water around the perimeter of Antelope Lake (Figure 1). The reservoir was electrofished a total of 4.94 hours in 2011 and 2.83 hours in 2013. Boat output was generally set to 40% DC Low at 120 pulses per second or DC High at 60 pulses per second producing plus or minus 6 amperes output.

Figure 1. Antelope Lake General Fish Survey.



III. RESULTS

Antelope Lake 2011

Antelope Lake was sampled by boat electrofisher with a total of nine sampling events. Water temperature was approximately 72 degrees Fahrenheit. A total of 4.94 hours of electrofishing occurred during these sampling events, resulting in the capture of a total of 909 fish, of which 723 were measured. The effort resulted in a CPUE of 184.01 fish per hour. Nine species of fish were captured: black crappie, brook trout, brown bullhead, golden shiner, largemouth bass, pumpkinseed, rainbow trout, Sacramento sucker, and smallmouth bass (Table 1). Length frequency for fish measured during electrofishing events is displayed in a length frequency histogram in Figures 2 and 3. Species composition is displayed in Figure 4.

Table 1. 2011 summary of fish captured in Antelope Lake using boat electrofishing.

Species	Number Captured	TL Range	TL Mean	Percent of Capture	CPUE
Black crappie	41	275-393	357	4.51%	8.30
Brook trout	4	230-250	244	0.44%	0.81
Brown bullhead	42	33-160	91	4.62%	8.50
Golden shiner	54	75-220	126	5.94%	10.93
Largemouth bass	253	66-545	226	27.83%	51.21
Pumpkinseed	255	55-188	114	28.05%	51.62
Rainbow trout	43	82-440	294	4.73%	8.70
Sacramento sucker	76	155-561	374	8.36%	15.38
Smallmouth bass	141	70-310	184	15.51%	28.54
Total	909	-	-	~100%	184.01

Figure 2. 2011 length-frequency histogram of Antelope Lake centrarchids captured using boat electrofishing.

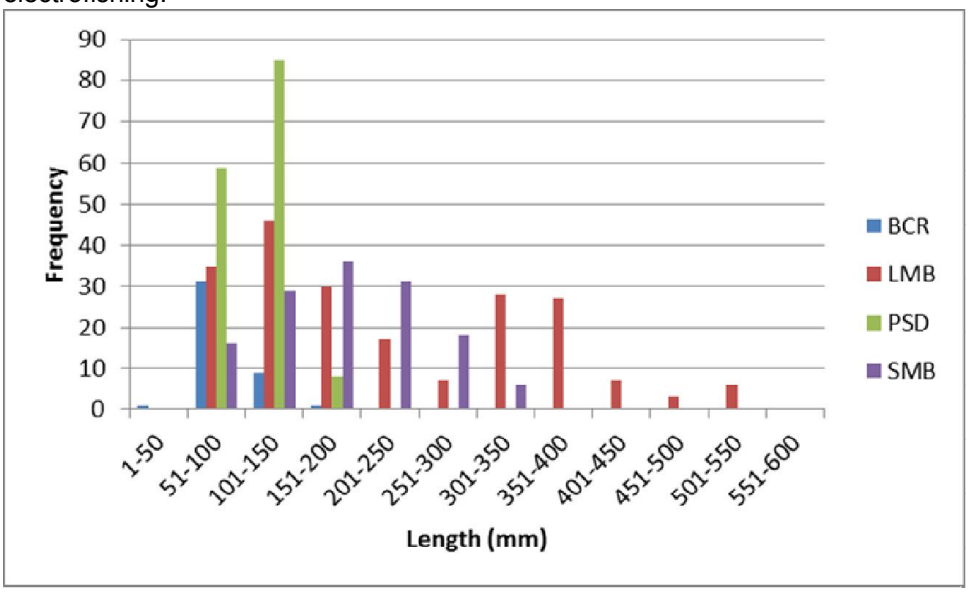


Figure 3. 2011 length-frequency histogram of Antelope Lake non-centrarchids captured using boat electrofishing.

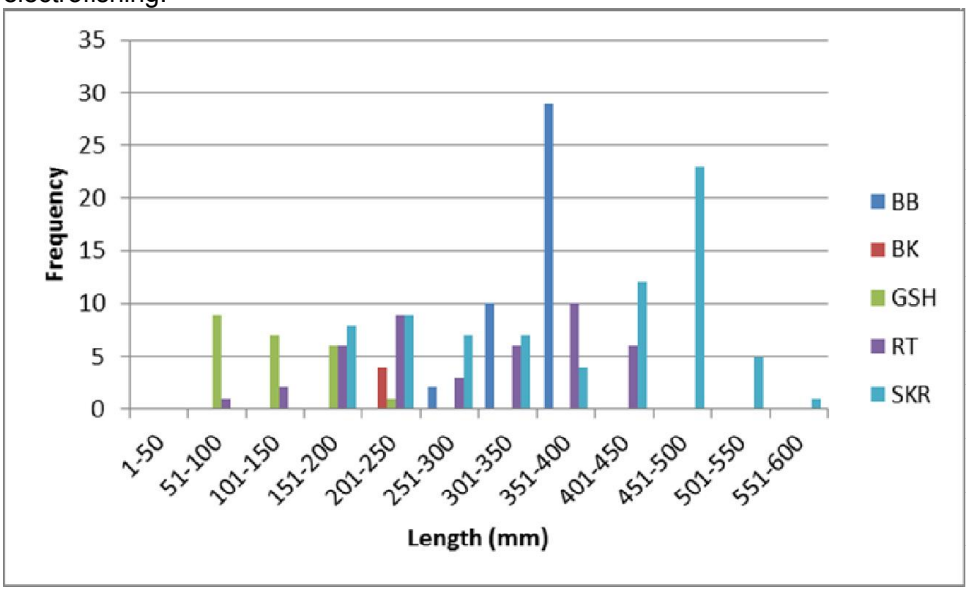
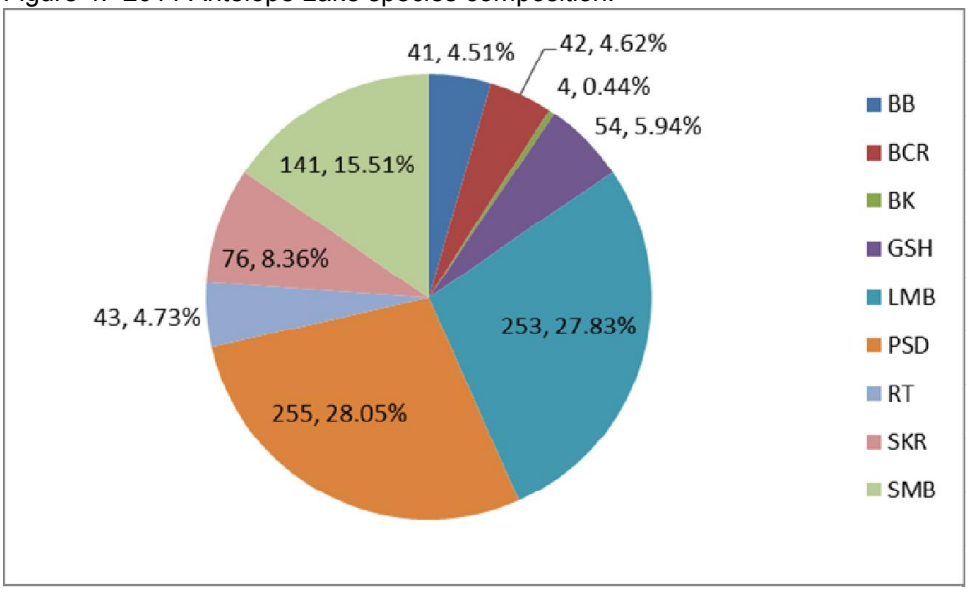


Figure 4. 2011 Antelope Lake species composition.



Antelope Lake 2013

Antelope Lake was sampled by boat electrofisher with a total of 14 sampling events. Water temperatures ranged from 71-74 degrees Fahrenheit. A total of 2.83 hours of electrofishing occurred during these sampling events, resulting in the capture of a total of 966 fish, of which 690 were measured. The effort resulted in a CPUE of 341.34 fish per hour. Nine species of fish were captured: black crappie, brown bullhead, brown trout, golden shiner, largemouth bass, pumpkinseed, rainbow trout, Sacramento sucker, and smallmouth bass (Table 2). Length frequency for fish measured during electrofishing events is displayed in a length frequency histogram in Figures 5 and 6. Species composition is displayed in Figure 7.

Table 2. 2013 summary of fish captured in Antelope Lake using boat electrofishing.

Species	Number Captured	TL Range	TL Mean	Percent of Capture	CPUE
Black crappie	22	98-395	263	2.28%	7.77
Brown bullhead	29	25-230	88	3.00%	10.25
Brown trout	1	284	284	0.10%	0.35
Golden shiner	190	23-131	73	19.67%	67.14
Largemouth bass	181	28-580	197	18.74%	63.96
Pumpkinseed	319	55-195	145	33.02%	112.72
Rainbow trout	12	296-445	373	1.24%	4.24
Sacramento sucker	29	153-543	373	3.00%	10.25
Smallmouth bass	183	38-316	166	18.94%	64.66
Total	966	-	-	~100%	341.34

Figure 5. 2013 length-frequency histogram of Antelope Lake centrarchids captured using boat electrofishing.

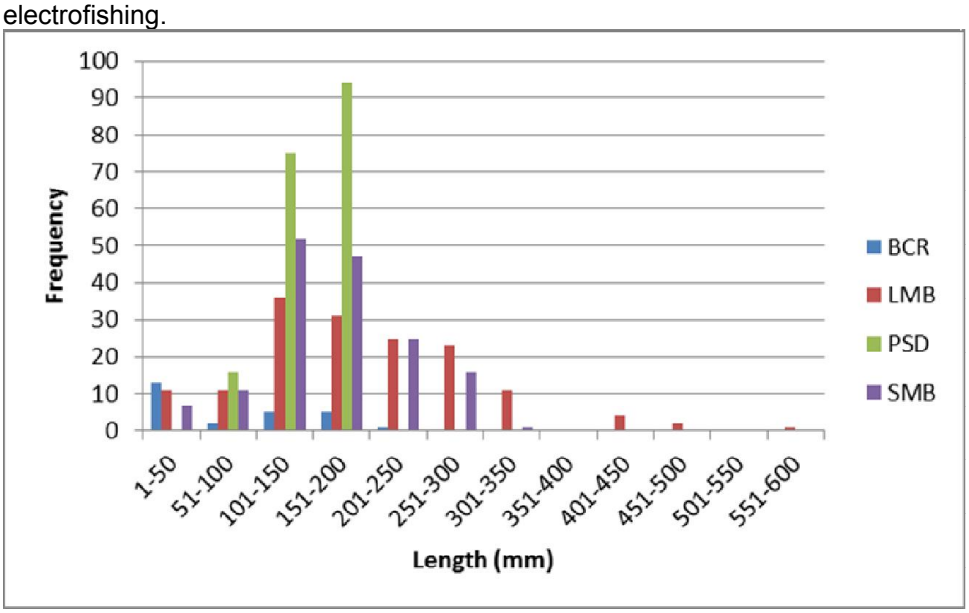


Figure 6. 2013 length-frequency histogram of Antelope Lake non-centrarchids captured using boat electrofishing.

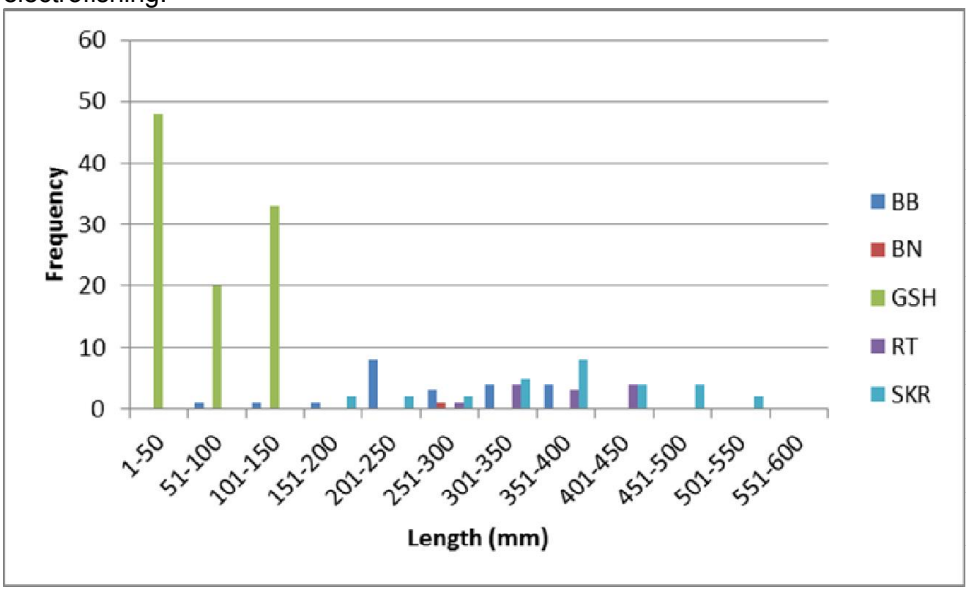
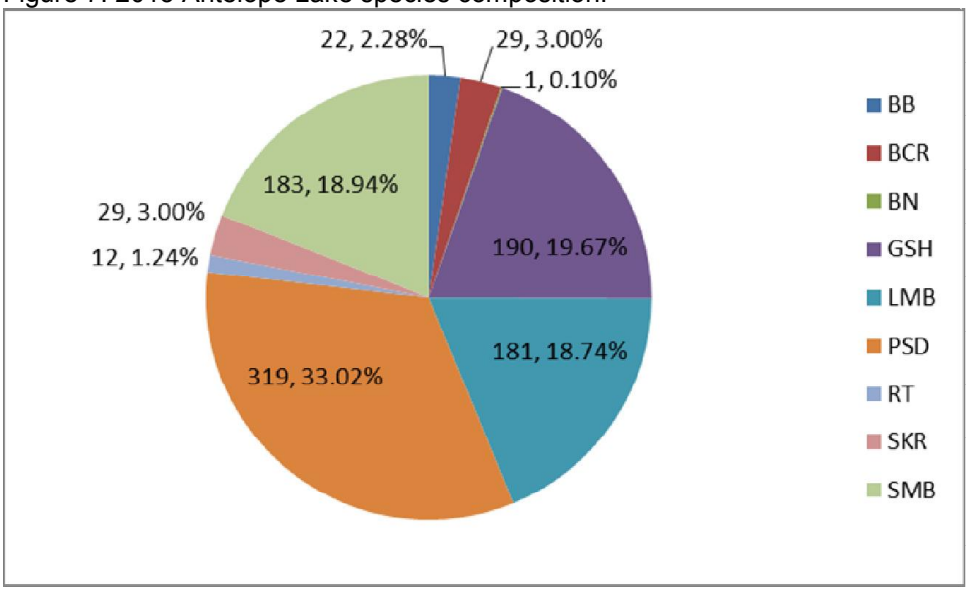


Figure 7. 2013 Antelope Lake species composition.



Black Crappie

Forty-one BCR were collected in 2011 ranging from 275-393 mm; mean TL 357 mm (third year to fourth year and above age classes) (Table 1). Twenty-two were collected in 2013 ranging from 98-395 mm; mean TL 263 mm (second year to fourth year and above age classes) (Table 2). BCR results indicated a decline in population both by species composition and CPUE results from 2008 to 2013. They went from 8.4 percent of the catch in 2008, to 4.51 percent in 2011, to 2.28 percent in 2013. CPUE results showed 13.2 BCR per hour in 2008, 8.30 BCR per hour in 2011, and 7.77 BCR per hour in 2013 (Tables 1, 2, & 3; Figures 4, 7, & 9)

Brook trout

Four BK were collected in 2011 ranging from 230-250 mm; mean TL = 244 mm (Table 1). Length range data indicates that the BK sampled are in the third year age class (230-250 mm). No brook trout were collected in 2013.

Brown bullhead

Forty-two BB were collected ranging from 33-160 mm; mean TL = 91 mm (Table 1). Length range data indicates that the BB sampled are in the young of the year to third year (140-200 mm) age classes. Twenty-nine BB were collected in 2013 ranging from 25-230 mm; 25-230 mm; mean TL = 88 mm (Table 2). Length range data indicates that the BB sampled are in the young of the year to fourth year age class (190-280 mm) (Moyle 2002). BB catch results did not indicate any significant changes from 2008 to 2013 (Tables 1, 2, & 3).

Brown trout

No BN were collected in 2011. One BN was collected in 2013 measuring 284 mm (Table 2). Length data indicates that the BN sampled is in the third (130-360 mm) year age class (Moyle 2002).

Golden shiner

Fifty-four GSH were collected in 2011 ranging from 75-220 mm; mean TL= 126 mm (Table 1). Length range data indicates that the GSH sampled are in the second year to seventh year and above age classes. One hundred and ninety GSH were collected in 2013 ranging from 23-131 mm; mean TL= 73 mm (Table 2). Length range data indicates that the GSH sampled are young of the year to fifth year age class. GSH results indicate an increase in population both by species composition and CPUE from 2008 to 2013 (Tables 1, 2, & 3; Figures 4, 7, & 9).

Largemouth bass

Two hundred and fifty-three LMB were collected in 2011 ranging from 66-545 mm; mean TL = 226 mm (Table 1). One hundred and eighty-one LMB were collected in 2013 ranging from 28-580 mm; mean TL = 197 mm (Table 2). Length range data from both 2011 and 2013 shows the LMB sampled are in the young of the year to fourth year and above age classes. Identifying individual age classes by growth rate in LMB is difficult due to the variability of genetic background, food availability, competition, temperature, and other limnological factors (Moyle 2002). LMB catch results did not indicate any trends toward population increase or decrease from 2008 to 2013 (Tables 1, 2, & 3).

Pumpkinseed

Two hundred and fifty-five PSD were collected in 2011 ranging from 55-188 mm; mean TL = 114 mm (Table 1). Three hundred and nineteen PSD were collected in 2013 from 55-195 mm; mean TL = 145 mm (Table 2). Length range data from both 2011 and 2013 indicates that the PSD sampled are in the second year to fourth year and older age classes. Species composition results indicate an increase in the PSD population from 2008 to 2013. They went from 17.7 percent of the catch in 2008, to 28.05 percent in 2011, to 33.02 percent in 2013. This is further confirmed by the CPUE results which showed 27.7 PSD per hour in 2008, 51.21 PSD per hour in 2011, and 112.72 PSD per hour in 2013 (Tables 1, 2, & 3; Figures 4, 7, & 9).

Rainbow trout

Forty-three RT were collected in 2011 ranging from 82-440 mm; mean TL = 294 mm (Table 1). Length range data shows the RT sampled are in the one year to fourth year and above age classes. Twelve RT were collected in 2013 ranging from 296-445 mm; mean TL = 373 mm (Table 2). Length range data shows the RT sampled are in the second year to fourth year and above age classes.

Sacramento sucker

Seventy-six SKR-S were collected in 2011 ranging from 155-561 mm; mean TL = 374 mm (Table 1). Length range data shows the SKR-S sampled are in the young of the year and above age classes (Moyle 2002). Twenty-nine SKR-S were collected in 2013 ranging from 153-543 mm; mean TL = 373 mm (Table 2). Length range data from both 2011 and 2013 shows the SKR-S sampled are in the one year and above age classes. Identifying individual age classes by growth rate in SKR-S is difficult due to variability. SKR-S less than 47 mm (standard length) are likely to be under a year old, while many suckers over 400 mm are older than ten years (Moyle 2002). SKR-S catch results indicate an increase in population from 2008 to 2011, followed by a decrease from 2011 to 2013. No trend information can be surmised from this data set (Tables 1, 2, & 3).

Smallmouth bass

One hundred and forty-one SMB were collected in 2011 ranging from 70-310 mm; mean TL = 184 mm (Table 1). One hundred and eighty-three SMB were collected in 2013 ranging from 38-316 mm; mean TL = 166 mm (Table 2). Length range data shows the SMB sampled are in the young of the year to four year age classes. The majority of SMB collected were in the one year of age class (60-180 mm), the second year age class (140-270 mm), and the third year age class (190-270 mm) (Figure 3 & 5) (Moyle 2002). SMB CPUE results indicate a mild decrease in population from 2008 to 2011, followed by a significant increase from 2011 to 2013 (Tables 1, 2, & 3).

Table 3. 2008 Summary of fish captured in Antelope Reservoir using boat mounted electrofishing (LaCoss and Rossi 2011b).

Species	Number Captured	Number Measured	TL Range (mm)	Mean TL (mm)	Percent of Capture (%)	CPUE (fish per hour)
Black crappie	29	29	31-245	115	8.4	13.2
Brown bullhead	17	15	332-386	361	4.9	7.7
Golden shiner	9	8	31-41	37	2.6	4.1
Largemouth bass	144	73	49-492	229	41.9	65.5
Pumpkinseed	61	58	54-178	137	17.7	27.7
Rainbow trout	4	4	156-472	247	1.2	1.8
Sacramento sucker	4	4	365-471	400	1.2	1.8
Black bass species	76	55	92-479	236	22.1	34.5
Total	344	246	-	-	~100	156.4

Figure 8. 2008 Length frequency histogram of Antelope Lake centrarchids captured using boat mounted electrofishing (LaCoss and Rossi 2011b).

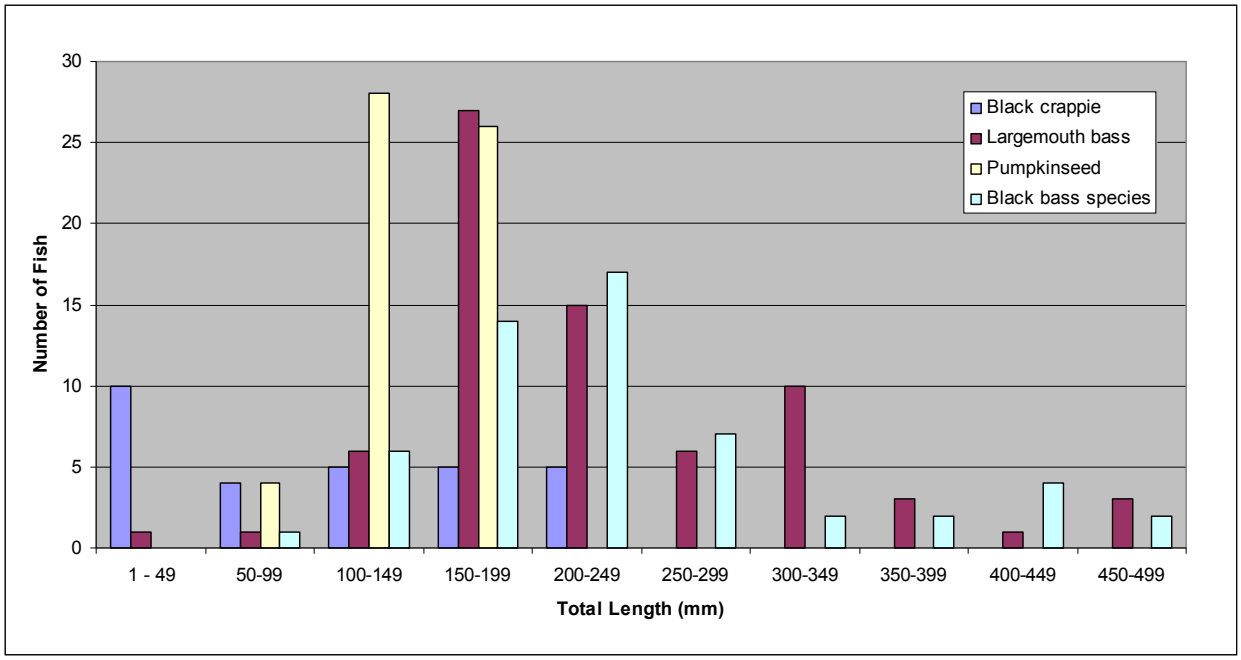
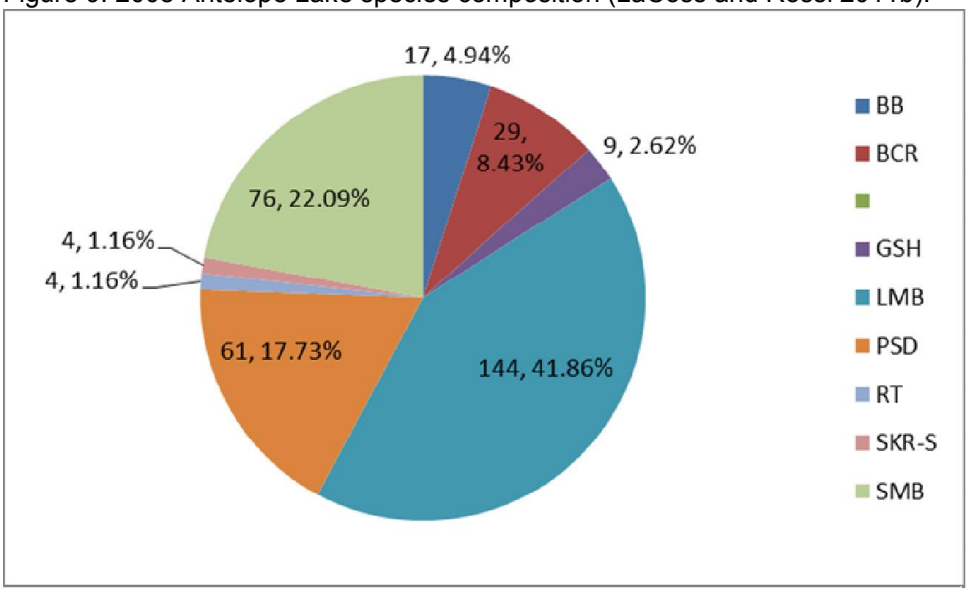


Figure 9. 2008 Antelope Lake species composition (LaCoss and Rossi 2011b).



IV. DISCUSSION

Antelope Lake boat electrofishing surveys indicate that the predominate species are centrarchids (Figures 4, 7, & 9). However, this result is not representative of the entire lake since electrofishing boats are better suited for sampling the littoral zone where bass and other warmwater species are generally more prevalent. Electrofishing boats are not designed to sample the limnetic zone where cold water pelagic species predominate. Coldwater species are mostly incidental catches, thus most of the deeper water remains unsampled. Possible options for sampling coldwater species include angling surveys, creel surveys, angler survey boxes, gill nets, or electrofishing during colder times of the year when coldwater species are more likely to find the shallow water tolerable.

A Recreational Use Survey conducted by DWR in 2009 indicated that the rainbow trout catch per hour rates were relatively low and, according to their creel data, have been declining since the introduction of black bass species sometime around 1984 (DWR 2009). Their creel data also indicated a decrease in black bass mean lengths since 2002. However, these results are inconclusive since there are multiple species of black bass in the reservoir and the fish mentioned in the discussion portion were not identified by individual species.

2008 versus 2011 and 2013

Antelope Lake was surveyed in early June and late July during the 2008 sampling, in late May and late July in 2011, and mid-July during the 2013 sampling. The July sampling periods provided some consistency for the three sampling years, in regard to time of year. Two electrofishing boats were used during the 2008 survey, while three electrofishing boats were used in both 2011 and 2013. This did not seem to have an impact on catch rates or results. The overall CPUE was much greater in 2013 (2.83 hours of electrofishing at 341.34 fish per hour) than the previous sampling efforts in 2008 (2.2 hours of electrofishing at 156.4 fish per hour) and 2011 (4.94 hours of electrofishing at 184.01 fish per hour). This may have been a result of the different sampling techniques used (running the shoreline versus specific transects). In 2008, sampling involved following the shoreline to cover as much of the perimeter of the lake as possible. In 2011, the same technique was used as in 2008, except the reservoir was divided up amongst three boats. In 2013, sampling occurred in 600 seconds of pedal shock time transects at different locations chosen by each crew within their designated portion of the reservoir. This type of electrofishing allowed the crews to target specific locations and habitat that may be more conducive to fish capture. The change in electrofishing technique was made in an attempt to improve efficiency.

The most noticeable fish capture result was the spike in pumpkinseed population from 2008 to 2013. The other noticeable population increases were the golden shiner and the smallmouth bass results from 2011 to 2013. The pumpkinseed and smallmouth bass populations may have been directly affected by the increased forage base that the golden shiner provided. On another note, the black crappie did not seem to have benefitted from these population increases. Their catch results indicated a decline from 2008 to 2013. It is possible that the larger pumpkinseed and smallmouth bass populations are suppressing or out-competing the black crappie. It is also possible that the results are merely a natural population swing or the result of variances in electrofishing technique. Further evaluations are necessary to determine whether the population shifts are a concern.

V. CONCLUSION

Monitoring will be continued in subsequent years. A springtime sampling may prove to find more life stages present in shallow water as some species come in to breed. Also, other species that prefer cooler temperatures may find the shallows more tolerable in the early season. Angling surveys, creel surveys, angler survey boxes, or gill netting may help to obtain more information on the salmonid populations inhabiting the lake. A cooperative effort with DWR during future Recreational Use Surveys may prove beneficial in collecting valuable creel data. These sampling timeframes and methods will be applied to future evaluations of the Antelope Lake fishery.

VI. REFERENCES

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