State of California
The Resources Agency
Department of Fish and Game

Raymond Lake General Fish Survey
Spring 2012

By

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North Central Region

Introduction

In an effort to evaluate the fishery of Raymond Lake (Raymond), a general fish survey was conducted on July 11 - 12, 2012 by Department of Fish and Game (Department) personnel John Hanson and Ben Ewing. Since 2008, the Department has not planted any trout into Raymond Lake. The data collected from this survey will be used to monitor the status of this fishery as well as determine if the lake can be added to the plant stocking list for the Department.

Location

Raymond is a natural lake on the eastern slope of the Sierra Nevada Mountain Range (Figure 1). Raymond is located approximately 25 miles southwest of the city of Gardnerville, Nevada (Figure 2). Raymond sits at an elevation of approximately 9000 ft. above sea level. At maximum pool the lake occupies approximately 10 surface acres and provides a quality golden trout (GT) *Oncorhynchus mykiss* subspp. and Lahontan cutthroat (LCT) *Oncorhynchus clarki henshawi* fishery.

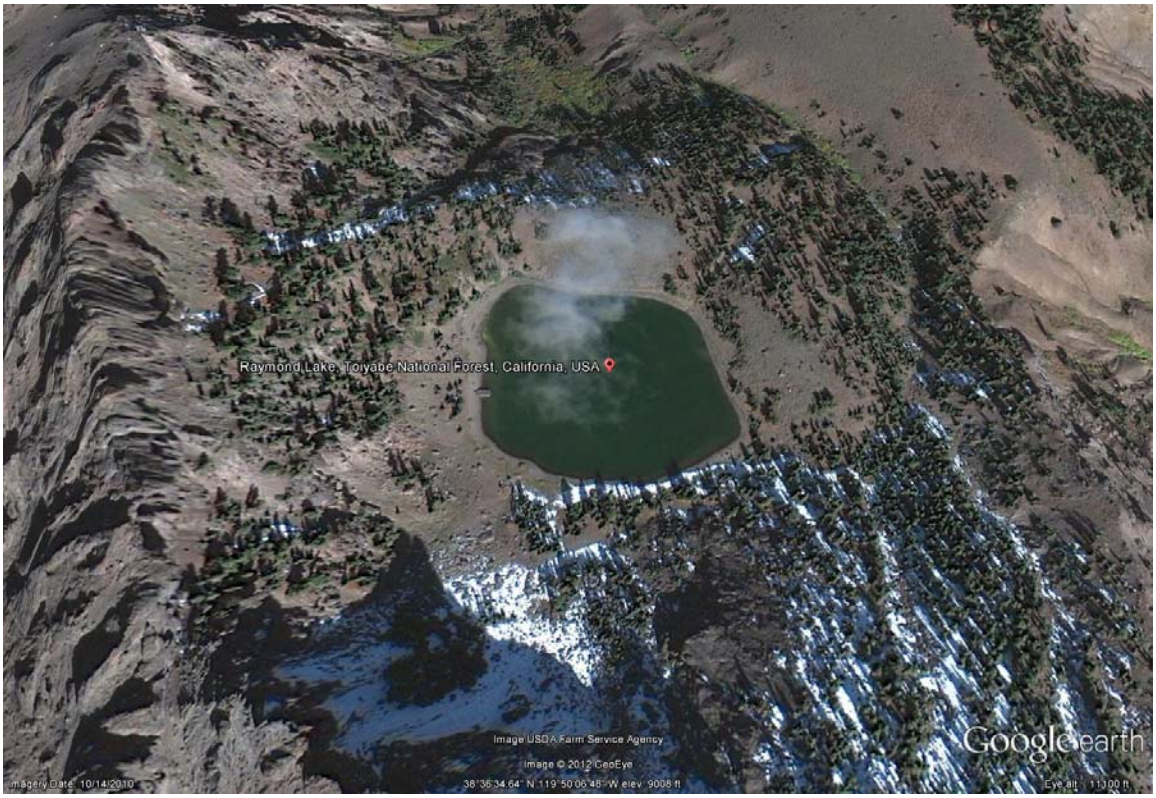


Figure 1. Raymond Lake

Figure 2. Map of Raymond Lake in relation to Gardnerville.

Methods and Materials

In estimating the population of trout in Raymond we considered the populations to be "closed". According to, Anderson and Newman, 1996; Krebs 1999; and Seber 1982; the following assumptions have to be true for the estimates to be reliable.

(a) The population is closed, so that N (the population) is constant.
(b) All animals have the same probability of being caught in the first sample
(c) Marking does not affect the catchability of an animal.
(d) The second sample is a simple random sample, i.e. each of the possible samples has an equal chance of being chosen.
(e) Animals do not lose their marks in the time between the two samples.
(f) All marks are reported on recovery in the second sample.

In a closed population it is assumed that the population size is constant without recruitment or losses. This includes fish growing into the specific size range during the sampling period. When the assumptions are not met, the estimate is not reliable and will result in large confidence intervals.

Petersen Method

The Petersen method is the simplest of the mark-recapture methods. It involves going out one time to mark individuals and then collecting individuals on a later date and checking them for marks. Using this method all the fish can be marked with the same type of mark. The recapture effort must be random with all fish having an equal chance of being collected. At Raymond, angling was used for the marks and gill nets were used for the recapture effort. The trout were released into the same area where they were collected during the initial and recapture sampling effort if they survived the gill net. The data collected from this study was:

M = Number of individuals marked in the first sample.

C = Total number of individuals captured in the second sample.

R = Number of individuals in second sample that are marked.

N = Size of the population at time of marking

From this data we can estimate the population using the formula (Krebs 1999):

$$\hat{N} = \frac{CM}{R}$$

Binomial Confidence Intervals were used for the fraction of marked animals (R/C) in this estimate. These confidence intervals are obtained from the sample and population proportion Figure 2.2 (Krebs 1999) and applying it to the number of total bass collected in the initial marking.

A total of two sampling efforts were conducted to mark and recapture trout. The marking effort took one day using two anglers with the two anglers using float tubes as well as shoreline fishing, the entire lake was sampled.

All trout in the 2012 estimate were marked with an adipose fin clip (removal) removed.

Data Analysis

The mean length and weight for each species was determined and an analysis of population indices was evaluated for them. These indices include catch per unit of effort (CPUE) weight-length relationships, relative weight (Wr), and proportional stock density (PSD) (Anderson, R.O. and R.M. Neumann 1996).

For this survey, species had to meet a minimum total length in order to calculate a known weight. Murphy and Willis (1996) emphasize that small fish should not be included if accuracy is low. Various minimum standards found in Fisheries Techniques will be used for the species collected during the survey. The relative weight index ranges for determining the condition of selected species are: 110 and above as excellent, 90-110 as good, 70-89 as average, and 69 and below as poor.

Results and Discussion

Initial Marking

Tables one and two summarize the species composition, CPUE, mean total length and weight, and length ranges for species caught by angling and gillnetting. A total of 15 fish representing two species were collected during the angling part of the survey (Table 1). Lahontan cutthroat trout comprised 73.3 percent of the total fish sampled. Golden trout followed with 26.7 percent. The total CPUE for the angler survey effort was 1.24 fish/hr.

Table 1. Species composition from Raymond Lake using angling. July 11, 2012.
Mean Total Length (TL) was measured in millimeters (mm).

	Species	Number	Percent	CPUE	Length (TL)	Length Ranges
1	Lahontan cutthroat trout	11	73.3%	0.91	355.6	254 - 419
2	Golden trout	4	26.7%	0.33	292.1	260 - 318
	Total	15				
	Angling time hours:	12.1				
	CPUE (Fish/angling hr.)	1.24				
	Water Temperature	68º F				

Golden trout

GT caught by angling ranged from 260 - 318 mm (10.2 - 12.5 in.) (Table 1). The mean total length for GT was 292.1 mm (11.5 inches). No length class figures, PSD, or relative weights were made due to the low number caught by angling. No mean weights were calculated for the angling aspect of the survey.

Lahontan cutthroat trout

Eleven LCT were caught by angling ranging from 254 - 419 mm (10 - 16.5 in.) (Table 1). Length range data shows the LCT sampled are two plus years of age (Moyle 2002). The last known plant of LCT into Raymond was in 2000 when 1500 fingerlings were planted so some of the LCT caught could be 12 years of age. Like GT, no length class figures, PSD, or relative weights were made for angler-caught LCT due to the low number caught.

Recapture effort

A total of 41 fish representing two species were collected during the gillnetting part of the survey (Table 2). Golden trout comprised 80.5 percent of the total fish sampled. Lahontan cutthroat trout followed with 19.5 percent. The total CPUE for the gillnetting survey effort was 3.4 fish/hr.

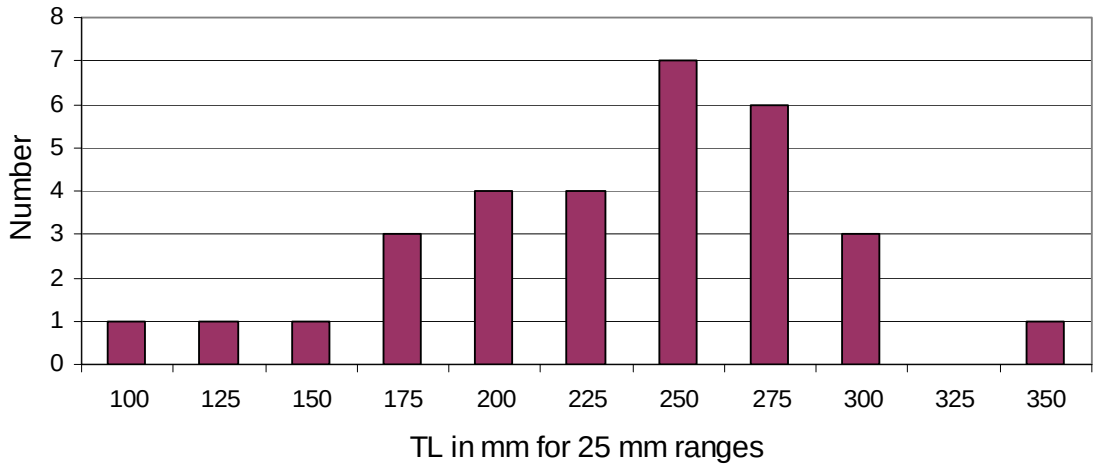
Table 2. Species composition from Raymond Lake using gillnet. July 12, 2012.
Mean Total Length (TL) was measured in millimeters (mm). Average weight was in grams (g)

	Species	Number	Percent	CPUE	(TL)	Weight	Length Ranges
1	Golden trout	33	80.5%	2.72	238.8	150.5	135 - 353
2	Lahontan cutthroat trout	8	19.5%	0.66	372.8	NA	286 - 419
	Total	41					
	Gillnet time hours:	12.2					
	CPUE (Fish/gillnetting hr)	3.4					
	Water Temperature	68º F					

Golden trout

GT caught by gillnet ranged from 135 - 353 mm (5.3 - 13.9 in.) (Table 2). The length class with greatest frequency was the 250 mm class (9.8 in.) (Figure 3). Figure 3 indicates there was a very little amount of recruitment for this year. The mean total length for GT was 238.8 mm (9.4 in.).

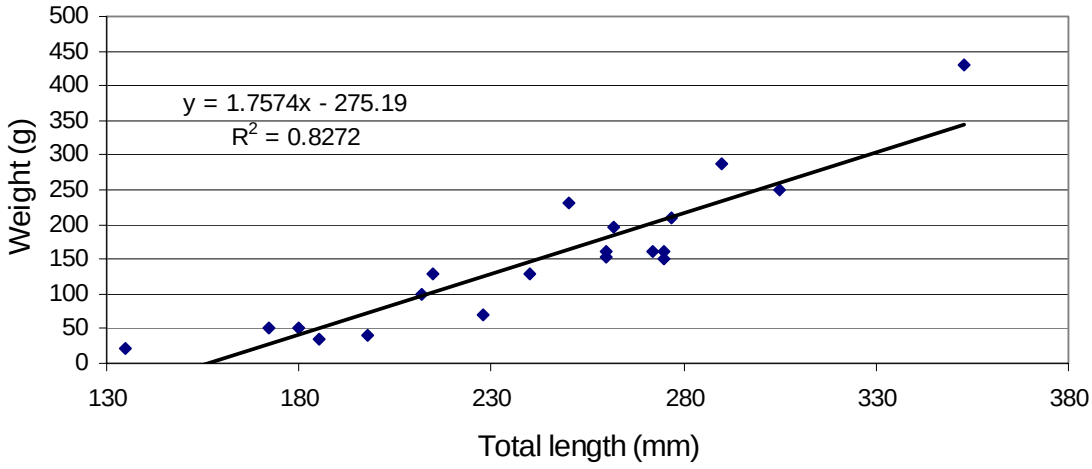
Figure 3. Length-frequency distribution for golden trout captured by gillnetting at Raymond Lake, Spring, 2012.



No PSD or Wr values for GT was calculated due to no given intercept, slope, and length categories for the species.

Using the linear regression equation present in Figure 4, a reliable estimated weight can be determined for GT 135 mm (5.3 in.) and greater in total length. These estimates are considered reliable due to the high R^2 (coefficient of determination) for this equation.

Figure 4. Total length-weight scatter plot with linear regression line for golden trout captured by gillnetting at Raymond Lake, Spring, 2012.



Lahontan cutthroat trout

Only eight LCT were collected in the gillnet ranging from 286 - 419 mm (11.3 to 16.5 in.) (Table1). The mean total length for LCT was 372.8 mm (14.7inches). No length class or length-weight correlation figures, PSD, or relative weights were made due to the low number caught by gillnetting.

Conclusions

Due to the limited number (15) of trout marked and one recapture for the population estimate, no estimate was made since it would be unreliable and would have very wide confidence intervals. Overall the lake was very productive, producing quality - sized fish (C.G. Kruse and W. A. Hubert unpublished). There was only a little recruitment seen at the time of the survey. With only one outlet to Raymond and no inlets, spawning can be difficult for LCT and GT. It is possible there is some minor recruitment occurring in the small outlet and lakeshore, but the Department feels there is not enough to sustain a healthy recreational fishery. Spawning of rainbow trout on lake shores has been observed in several lakes throughout New Zealand with most lake-shore spawning occurring where there is an absence of suitable spawning streams (Penlington 1983). With the absence of Decision species and lack of suitable habitat for them, the Department should conduct a pre-stocking evaluation to assess if Raymond can be put back on the stocking list.

References

Anderson, R. O. and R. M. Newmann. 1996. Length, weight and associated structural indices. Pages 447-482 in B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

C.G. Kruse and W. A. Hubert (unpublished).

Krebs, Charles J. 1999. Ecological methodology, 2nd edition. Addison Wesley Longman Educational Publishers, Inc., Menlo Park, CA

Moyle, P. 2002. Inland Fishes of California. University of California Press, Berkeley and Los Angeles, California. Pgs. 291.

Murphy, B. R. and D. W. Willis. 1996. Fisheries Techniques. 2nd edition. American Fisheries Society. Bethesda, Maryland. Pg. 458 and 462.

Penlington, B. P. 1983. Lake-shore spawning of rainbow trout at Lake Rotoma, New Zealand Journal of Marine and Freshwater Research, 17:4, 349-355.

Seber, G. A. F. 1982. The estimation of animal abundance and related parameters 2nd edition. The Blackburn Press, Caldwell, NJ.