State of California
The Resources Agency
Department of Fish and Wildlife

Indian Valley Reservoir General Fish Survey
Lake County
Spring, 2017

By

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North Central Region

Summary

In an effort to evaluate the fishery of Indian Valley Reservoir (Indian Valley) following a four- year drought, a general fish survey was conducted on May 10, 2017. For this survey, six random locations were selected for sampling with an electrofishing boat. Fish collected during the survey included Sacramento pikeminnow (SPM) (*Ptychocheilus grandis*), largemouth bass (LMB) (*Micropterus salmoides)*, black crappie (BCR) (*Pomoxis nigromaculatus*), Sacramento sucker (SS) (*Catostomus occidentalis)*, channel catfish (CCF) (*Ictalurus punctatus*), redear sunfish (RES) (*Lepomis microlophus*), threadfin shad (TSH) (*Dorosoma petenense*), smallmouth bass (SMB) (*Micropterus dolomieu*), and common carp (CC) (*Cyprinus carpio*). Results from the 2017 survey demonstrated that Indian Valley still had a wide diversity of fish species, but the larger-size fish were not collected in similar numbers as in the 2013 survey (Ewing 2013). This spring's data along with past and future efforts will be used to monitor the status of this fishery.

Introduction

The objectives of this survey were to:

- **Determine fish species composition and condition**
- **Determine fish age class distribution**
- **Determine possible effects of the drought on the fishery**

Indian Valley is located on the North Fork Cache Creek in Lake County, California (Figure 1). The reservoir was constructed to provide long-term irrigation storage for Yolo County and flood control for Cache Creek. The earth and rock-filled dam was completed in 1975 by the Yolo County Flood Control District (YCFCD) in cooperation with the United States Bureau of Reclamation. The reservoir is approximately six miles long and one mile wide with a drainage area of 121 square miles. At gross-storage capacity, the reservoir holds 300,600 acre-feet of water and has a surface area of 3,975 acres (DFG Files 1991). Some of the species that have been found in Indian Valley, in addition to what was found during this years' survey are California roach (*Lavinia symmetricus*), hardhead (*Mylopharodon conocephalus*), riffle sculpin (*Cottus gulosus*), bluegill (BG) (*Lepomis macrochirus*), white crappie (*Pomoxis annularis*), and kokanee salmon (*Oncorhynchus nerka*) (DFG Files 1985 and 1991).

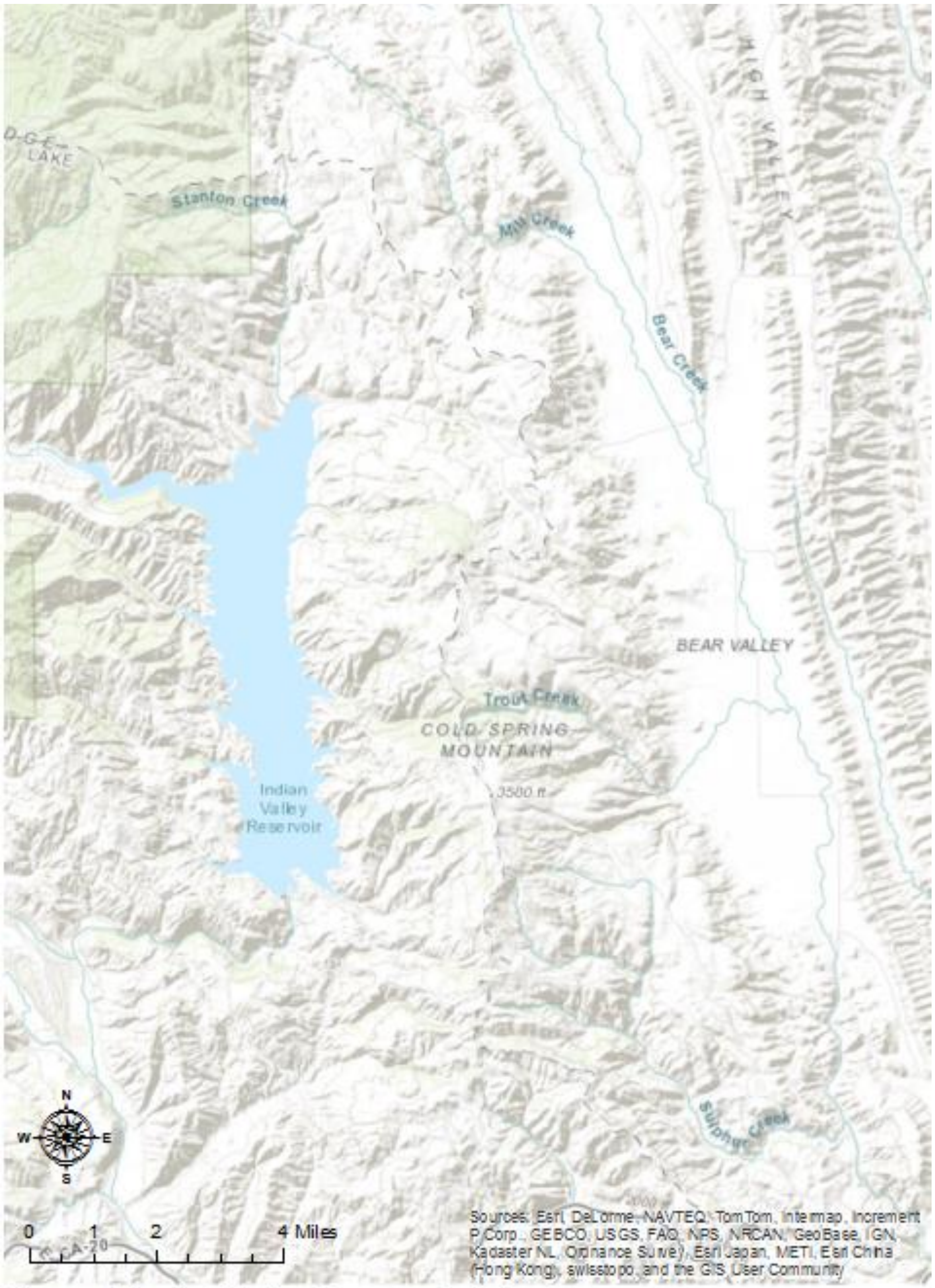

Figure 1. Indian Valley Reservoir, Lake County.

Methods and Materials

Six sites (Figure 2) were sampled for an average of 600 electrofishing seconds (10.0 minutes) each using an 18 ft. Smith-Root electrofishing boat. Sites were surveyed between the hours of 18:00 and 23:45. Pulsed DC current (8-12 amps) was used to “stun” the fish. The boat ran parallel along the shore in a continuous manner with start and stop sites marked by GPS (Global Positioning Satellite). When an electrical field was applied to the water, it was measured on a counter and this time was recorded as generator seconds for each transect. Fish under electronarcosis were netted and placed in a holding tank. An effort was made to capture all shocked fish except CC and TSH, which were noted for presence or absence in each transect. CC were not netted due to the damage they can do to nets and space they require in the holding tank. TSH were not netted due to the large numbers and relative small differences in sizes of this particular species. Small fish (< 25 mm) sometimes eluded capture as did those fish on the outer edge of the electrical field. The mean length and weight for each species was determined and an analysis of population indices were evaluated for selected species. These indices include catch per unit of effort (CPUE) weight-length relationships, relative weight (Wr), and proportional and relative stock densities (PSD) (RSD) (Anderson, R.O. and R.M. Neumann 1996). For each transect, fish were identified to species and the first 25 of each species had measurements recorded for total length (TL) in mm and weights in grams (g). Weights were determined using a digital or temperature compensating scales depending on the size of the fish. All fish after the first 25 of a species were tallied.

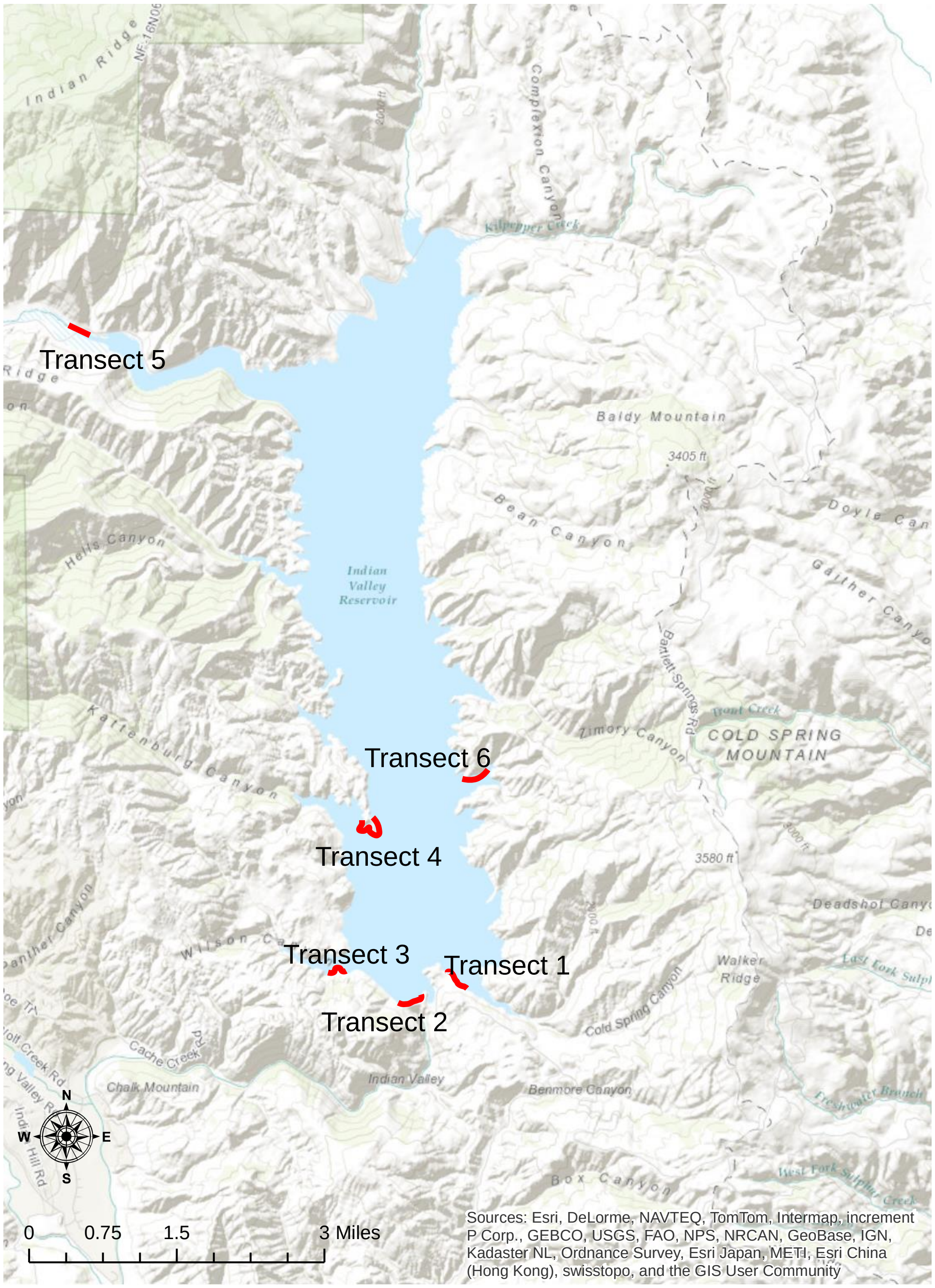

Figure 2. Electrofishing transect location for the Indian Valley Reservoir General Fish Survey conducted on May 10, 2017.

The crew consisted of two forward netters, two crewmembers working the livewell, and one boat operator.

Catch Per Unit of Effort

Catch per unit effort (CPUE) is defined as the number fish collected per minute of shocking time. The data was used to estimate (CPUE) for all species combined and for individual species.

CPUE = N/M

where:

N = total number of collected or the total number of a species and

M = number of minutes that the electric field was active in the water

Relative Weight (Wr)

Relative Weights (Wr) are used to represent the overall condition of the species in Indian Valley. A fish's length is generally the primary determinant of its weight and increases in length will result in increases in weight. However, an increase in a fish's length is not always in direct proportion with an increase in its weight. These fish tend to change shape as they grow which is allometric growth. Relative Weight represents a modification of the Relative Condition Factor (Kn) that compensates for fish that exhibit these allometric growth patterns. The Wr is based on the assumption that the slope & intercept of the weight-length relationship are the same as in the "ideal" equation used in its calculation (Cone 1989). To determine the Wr for species sampled at Indian Valley the following equations were used:

Wr = (W/Ws) x 100

Where:

Wr = the condition of an individual fish.

W = weight in grams

Ws = length-specific standard weight predicted by a length-weight regression for a species.

The equation to determine the Ws is:

$$\log10(Ws) = a' + b * \log10(L)$$

Where:

a' = intercept value

b = slope of the log10 (weight) – log10 (length) regression equation

L = maximum total length

The intercept & slope parameters for standard weight (Ws) equations are taken from using the standard equations for that particular species found in Fisheries Techniques (Murphy and Willis 1996) when possible. In concept, a mean Wr of 100 for a broad range of size-groups may reflect ecological and physiological optimality for populations (Murphy and Willis 1996). Utilizing these Ws equations, fish of all lengths, regardless of species are in relatively good condition with a Wr of close to 100. 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.

If a minimum sample size of 30 of a given species is not collected or a minimum size is not met, no relative weights will be calculated.

Proportional Stock Density (PSD)

Proportional stock density (PSD) is a numerical description of length-frequency data. The PSD is the percentage of a given species which are of a stock length and those which are also of a quality length. Length categories that have been proposed by Gablehouse (1984) for various fish species are presented in Table 1.

PSD = (number of fish ≥ minimum quality length) / (number of fish ≥ minimum stock length) x 100

According to R.O. Anderson and R. M. Neumann (1996) when PSD is reported it should be rounded to the nearest whole number and should not include a percent symbol. If decimals are used they imply an accuracy which is not supported by this analysis.

Table 1. Proportional stock density length categories for selected species Gablehouse (1984). Measurements are minimum total lengths in millimeters (mm) for each category.

Species	Stock (mm)	Quality (mm)
Bluegill	80	150
Common carp	280	410
Largemouth bass	200	300
Redear sunfish	100	180

Relative Stock Density (RSD)

Similar to proportional stock density (PSD), the relative stock density (RSD) is a percentage of a given species of a minimum stock length as compared to those which are of a preferred, memorable, or trophy lengths.

RSD-P = (number of fish $\geq$ minimum preferred length) / (number of fish $\geq$ minimum stock length) x 100

RSD-M = (number of fish $\geq$ minimum memorable length) / (number of fish $\geq$ minimum stock length) x 100

RSD-T = (number of fish $\geq$ minimum trophy length) / (number of fish $\geq$ minimum stock length) x 100

For BG, Gablehouse (1984) found the preferred size is 200 mm and the memorable size is 250 mm. For RES, Gablehouse (1984) found the preferred size is 230 mm and the memorable size is 280 mm.

As with PSD, the RSD should be rounded to the nearest whole number so as not to imply a greater accuracy than is supported by this analysis. According to Gablehouse (1984) a balanced population of LMB PSD should be 40 to 70, RSD-P 10 to 40, and RSD-M 0 to 10 using the published smaller stock and quality sizes (Table 2). Anderson (1985) identified balanced populations of bluegill as having a PSD of 20 to 60, with RSD-P of 5 to 20 and RSD-M of 0 to 10 (Table 2).

Table 2. Generally accepted proportional stock density (PSD) index ranges for balanced fish populations (from Willis et al. 1993).

Species	PSD	RSD-P	RSD-M	Source
Bluegill	20-60	5-20	0-10	Anderson (1985)
Crappie	30 - 60	>10		Gablehouse (1984)
Largemouth Bass	40-70	10-40	0-10	Gablehouse (1984)

Weight-Length Relationship

Linear regression values for the length-weight relationship were determined for selected species. The linear regression line slope and intercept values enabled us to estimate the weight of a fish if the total length is known. The regression equation is expressed as:

$y = a + bx$

Where:

y = estimated weight

a = intercept of the line

b = slope of the line

x = independent variable of total length

The intercept and slope values were generated using Microsoft Excel©.

If the R^2 value was less than 0.8, no figure would be made due to the unreliability of calculating a weight from a given total length and vice versa.

Results and Discussion

Table 2 summarizes the species composition, mean total length and weight, and length ranges of species collected. A total of 107 fish representing seven species were collected during the 2017 survey (Table 2). Threadfin shad and common carp were only noted for presence and absence in each transect and not counted or measured. Largemouth bass comprised 63 percent of the total fish sampled in 2017. Sacramento pikeminnow followed with 12 percent of the total fish sampled. Sacramento sucker and RES each made up seven percent, respectively. Channel catfish, BCR, and SMB finished with approximately six, four, and three percent of the total catch each. The total CPUE for this survey effort was 1.78 fish/min.

Table 2. Species composition from Indian Valley Reservoir, April 17, 2013 and May 10, 2017.
Mean Total Length (TL) was measured in millimeters (mm) and mean weight was in grams (g).

		Number		Percent		CPUE		Total Length		Weight		Length Ranges	
	Species	2017	2013	2017	2013	2017	2013	2017	2013	2017	2013	2017	2013
1	Black crappie	4	1	4%	1%	0.07	0.01	245.0	168.0	250.5	179.0	220 - 302	NA
2	Channel catfish	6	2	6%	1%	0.10	0.03	342.8	299.0	406.5	225.0	247 - 436	293 - 305
3	Common carp	NA	45	NA	31%	NA	0.65	NA	NA	NA	NA	NA	NA
4	Green sunfish	NA	3	NA	2%	NA	0.04	NA	132.3	NA	44.0	NA	123 - 142
5	Largemouth bass	67	31	63%	21%	1.12	0.45	198.4	258.0	166.4	334.4	71 - 429	13 - 400
6	Rainbow trout	NA	1	NA	1%	NA	0.01	NA	390.0	NA	597.0	NA	NA
7	Redear sunfish	7	17	7%	12%	0.12	0.25	175.4	118.4	92.9	32.1	156 - 197	48 - 196
8	Sacramento pikeminnow	13	5	12%	3%	0.22	0.07	221.2	352.4	92.7	530.6	147 - 259	124 - 470
9	Sacramento sucker	7	30	7%	20%	0.12	0.43	357.0	405.2	633.9	831.2	152 - 468	288 - 528
10	Smallmouth bass	3	12	3%	8%	0.05	0.17	303.0	299.7	346.6	408.5	285 - 329	205 - 456
	Total	107	147										
	Generator minutes:	60	69.0										

Table 2 continued

CPUE (Fish/ gen. min)	1.78	2.13
Water Temperature	62° F	57° F

*Weights were only collected when the minimum total length for green sunfish was 60 mm, 70 mm for redear sunfish, 130 mm for channel catfish, 100 mm for black crappie, 100 mm for Sacramento sucker, 150 mm for largemouth and smallmouth bass, 120 mm for rainbow trout. Common carp were only tallied in 2013 and noted for presence and absence in 2017. Threadfin shad were just noted for presence and absence in 2017.

Largemouth bass

As seen in Table 3, LMB total length ranged from 71 – 429 mm (2.8 – 16.9 in.). The length frequency distribution for LMB is presented in Figure 3. The length classes with the highest frequencies in 2017 were in the 125 mm (4.9 in.), 150 mm (5.9 in.), 175 mm (6.9 in.), and 200 mm (7.9 in.) classes compared to the 275 mm (10.8 in.) class in 2013 (Ewing 2013). This indicates they are likely one to three year old fish (Moyle 2002). The length frequency distribution shows a LMB population in which the majority of fish measured were less than 225 mm (8.9 in.) (Figure 3).

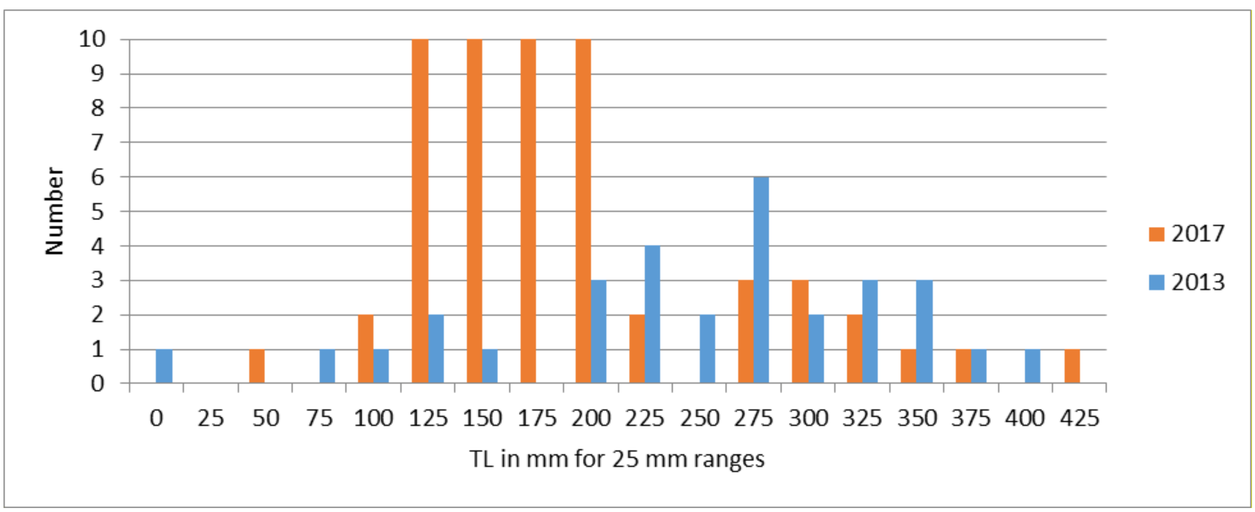

Figure 3. Length-frequency distribution for largemouth bass captured by electrofishing at Indian Valley Reservoir, Spring, 2013 and 2017.

Average Wr for LMB was 92 using the intercept and slope parameters determined by Wege and Anderson (1978). This value indicates the LMB at Indian Valley are in good condition.

PSD for LMB in 2017 was 33 and RSD was 4, decreases from the 2013 PSD and RSD of 40 and 8. These values indicated that there is an unbalanced population of quality and preferred -size LMB in Indian Valley.

The high R^2 value of 0.92 indicates estimating a weight from a given total length value for LMB reliable (Figure 4).

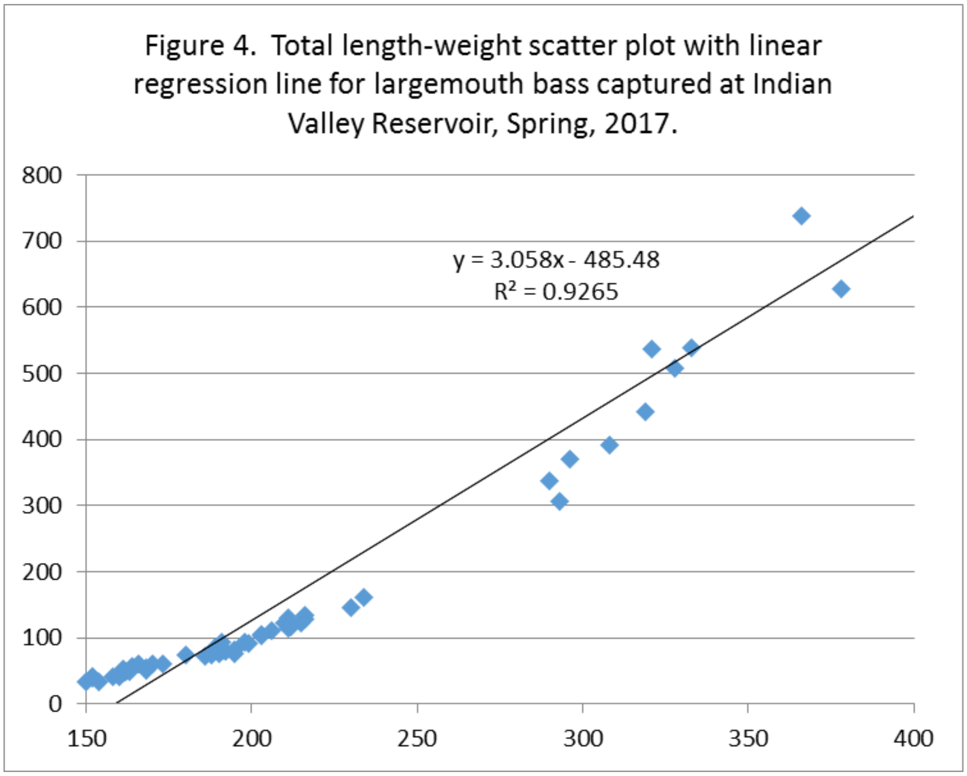

Figure 4. Total length-weight scatter plot with linear regression line for largemouth bass captured at Indian Valley Reservoir, Spring, 2017.

Discussion

Indian Valley is home to a wide variety of fish species and provides a great recreational fishery for those wanting to fish in Lake County. Although carp and TSH were not measured and tallied, they were accounted for presence and absence at each transect. Carp were present at four of the six transects and do not appear to be threatened of being extirpated from Indian Valley. Threadfin shad were present at three of the six transects, which is a positive sign since TSH are a good forage fish for other recreational fish in Indian Valley. It appears that the statewide drought from 2013 – 2016 may have had a negative affect on the overall population of the fishery, especially the kokanee fishery. In the fall of 2016, IVR was reduced down to a small strip of shallow, turbid water going through the valley. Loss of habitat used for protection, spawning, and increased competition for the remaining forage fish are a few negative results from the lake drawdown. For kokanee, it is likely the significant decrease in oxygen levels, available coldwater, and inflow into Indian Valley has contributed to a lack of kokanee reported caught the last seven years. Although the Department considers Indian Valley to be a viable fishery, it is likely the lake is underutilized. The Department is currently conducting a roving creel census and is considering installing angler creel boxes to further help determine angling characteristics at the lake. The rough, unpaved eleven-mile road into Indian Valley off of Highway 20 and small amount of campsites at the lake might deter a lot of anglers from Indian Valley, especially those with large families and/or those towing a boat. High winds, which are a regular occurrence at Indian Valley and can be very dangerous, could also be a big deterrent for anglers entertaining the possibility of fishing there. Future evaluations/surveys will be conducted at Indian Valley to determine how well it responds to the four-year drought and drawdown. The 2016/2017 historically wet winter filled IVR. With the reservoir being full, the great amount of forage fish such as TSH seen during the 2017 survey, and structure available for warmwater fish such as LMB, it is possible that IVR will be able to recover from the drawdown. The majority of fish caught were smaller than sizes seen in 2013. Although the sizes were down, it is possible with the great number of juvenile fish seen, that IVR will be back producing the unofficial reports of eight plus pound LMB that have been caught (Knight 1989) in a few years.

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