State of California
The Resources Agency
Department of Fish and Wildlife

New Hogan Reservoir General Fish Survey
Fall 2018

By

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Summary

In an effort to evaluate the fishery of New Hogan Reservoir (New Hogan), a general fish survey was conducted on October 23, 2018 by California Department of Fish and Wildlife (CDFW). For this survey, a Smith-Root electrofishing boat was used to sample the same eight locations that were were sampled in the spring of 2012 (Ewing 2012). Fish collected during the survey included largemouth bass (LMB) (*Micropterus salmoides),* black crappie (BCR) (*Pomoxis nigromaculatus*), channel catfish (CCF) (*Ictalurus punctatus*), redear sunfish (RES) (*Lepomis microlophus*), threadfin shad (TSH) (*Dorosoma petenense*), smallmouth bass (SMB) (*Micropterus dolomieu*), common carp (CC) (*Cyprinus carpio*), green sunfish (GSF) (*Lepomis cyanellus),* striped bass (SB) (*Morone saxatilis*) and spotted bass (SPB) (*Micropterus punctulatus).* Results from the 2018 survey demonstrate that New Hogan still has a wide diversity of fish species despite the multi-year drought that occurred between the 2012 and 2018 electrofishing surveys. The fall 2018 results in conjunction with future fall survey 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**

New Hogan is owned and operated by the United States Army Corps of Engineers (USACE) and is located approximately 30 miles northeast of the city of Stockton and 62 miles southeast of Sacramento (Figure 1). New Hogan is 554 ft. above mean sea level in the western foothills of the Sierra Nevada. At maximum capacity, New Hogan encompasses 4,410 surface acres and has 317,000 acre-feet of water storage. New Hogan was first filled in 1965 and has historically supported a significant sport fishery. In addition to what was found during this years' survey, the following have been observed from a prior survey: pumpkinseed (PSD) (*Lepomis gibbosus)* prickly sculpin (PSC) (*Cottus asper),* and Sacramento pikeminnow (SPM) (*Ptychocheilus lucius)* (Ewing 2012). New Hogan also supports a small, wild rainbow trout (RBT) (*Oncorhynchus mykiss)* fishery which are native to this area of the Calaveras River watershed.

Figure 1. Map of New Hogan Reservoir in relation to Stockton and Sacramento. (http://www.californiasgreatestlakes.com/new_hogan/hogan_directions.html)

Methods and Materials

The crew consisted of two forward netters, one crewmember working the livewell, and one boat operator. Eight sites (Figure 2) were sampled for an average of 600 electrofishing seconds each (10.0 minutes) each using an 18 ft. Smith-Root electrofishing boat. Sites were surveyed between the hours of 18:00 and 23:30. Pulsed DC current (8-12 amps) was used to “stun” the fish. The boat ran parallel to shore in a continuous manner with start and stop sites marked by GPS (Global Positioning System). 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 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 millimeters (mm) and weights in grams (g). Weights were determined using a digital scale for fish less than 6.6 lbs or a BogaGrip® scale for fish greater than 6.6 lbs. All fish after the first 25 per species were tallied at each transect.

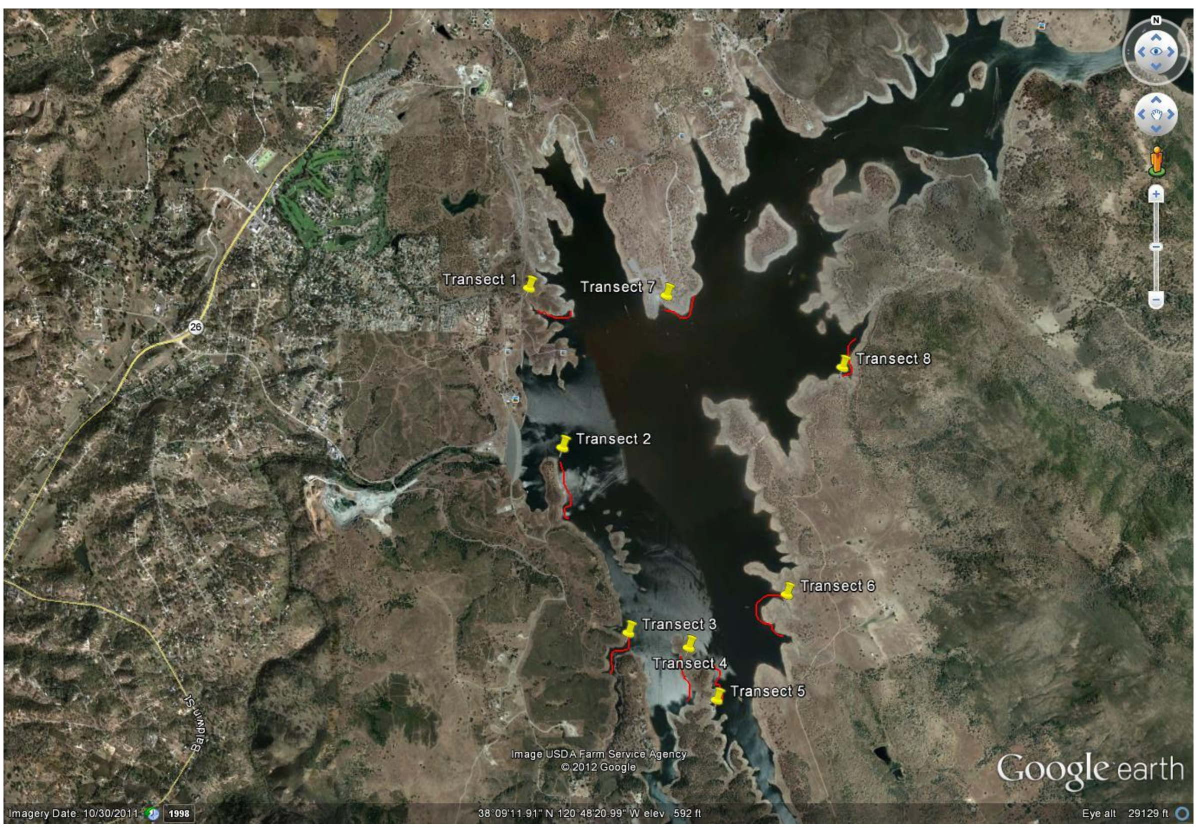

Figure 2. Electrofishing transect locations for both the May 16, 2012 and October 23, 2018 New Hogan Reservoir general fish surveys (Ewing 2012).

Catch Per Unit of Effort

Catch per unit effort (CPUE) is defined as the number fish collected per minute of electrofishing. 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 New Hogan. 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. Fish species encountered during this survey 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 and 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 New Hogan, 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:

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

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 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.

When a minimum sample size of 30 of a given species was not collected in a transect or a minimum total length was not met, no relative weight was 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
Largemouth bass	200	300
Redear sunfish	100	180

Relative Stock Density (RSD)

Similar to PSD, the relative stock density (RSD) is a percentage of a given species of a minimum stock length compared to those of preferred (P), memorable (M), or trophy (T) 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

Gablehouse (1984) identified the following preferred and memorable sizes for BG, LMB, and RES. For BG, the preferred size is 200 mm and the memorable size is 250 mm. For LMB, the preferred size is 380 mm and the memorable size is 510 mm. For RES, 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 should have a PSD of 40 to 70, RSD-P 10 to 40, and RSD-M 0 to

10 (Table 2). Anderson (1985) identified balanced populations of bluegill as having a PSD of 20 to 60, 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 CDFW to estimate the weight of a fish if the total length was known.

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 3 summarizes the species composition, mean total length and weight, length ranges, and relative weights of fish species collected. A total of 123 fish, representing eight species were collected during the survey (Table 3). LMB comprised 56.6% of the total fish sampled. BG followed with 17.2% of total fish sampled. SB was third, comprising 9.8% of the total catch, black bass with 6.6%, and SMB with 4.9%. GSF and RES both comprised 1.6% of the total catch. CCF and SPB each made up 0.8% of total fish caught. The fish collected that were identified as black bass were too small to accurately identify to their species by CDFW. The total CPUE for this survey effort was 1.53 fish/min.

Table 3. Species composition from Lake New Hogan, October 23, 2018.							
Mean Total Length (TL) was measured in millimeters (mm) and mean weight* was measured in grams (g).							
	Species	Number	Percent	Total Length (mm)	Weight (g)	Length Ranges	Mean Relative Weight (Wr)
1	Largemouth bass	69	56.6%	322.8	671.2	149-528	99
2	Bluegill	21	17.2%	97.3	19.9	48-146	-
3	Striped bass	12	9.8%	236.8	143.8	206-265	-
4	Black bass	8	6.6%	82.4	-	64-104	-
5	Smallmouth bass	6	4.9%	174.0	66.5	101-215	-
6	Green sunfish	2	1.6%	108.5	29.5	80-137	-
7	Redear sunfish	2	1.6%	105.0	37.0	73-137	-
8	Channel catfish	1	0.8%	525.0	1524.0	-	-
9	Spotted bass	1	0.8%	-	-	-	-
Total		123	*Weights were only collected when the minimum total length for green sunfish was 60 mm, 70 mm for redear sunfish, 80 mm for bluegill, 130 mm for channel catfish, 100 mm for black crappie, 150 mm for largemouth and smallmouth bass. Common carp, threadfin shad, and black crappie were noted for presence were not captured.				
Generator minutes		80					
CPUE (Fish/generator min)		1.53					

Largemouth bass

LMB total length ranged from 149 mm – 528 mm (5.9 in. - 20.8 in.) (Table 3). The LMB length frequency distribution is presented in Figure 3. The length class with the highest frequency was 325 mm (12.8 in.). These fish were likely three to four years of age (Moyle 2002). Of the 69 measured, only 12 (< 200 mm) were classified as young of the year.

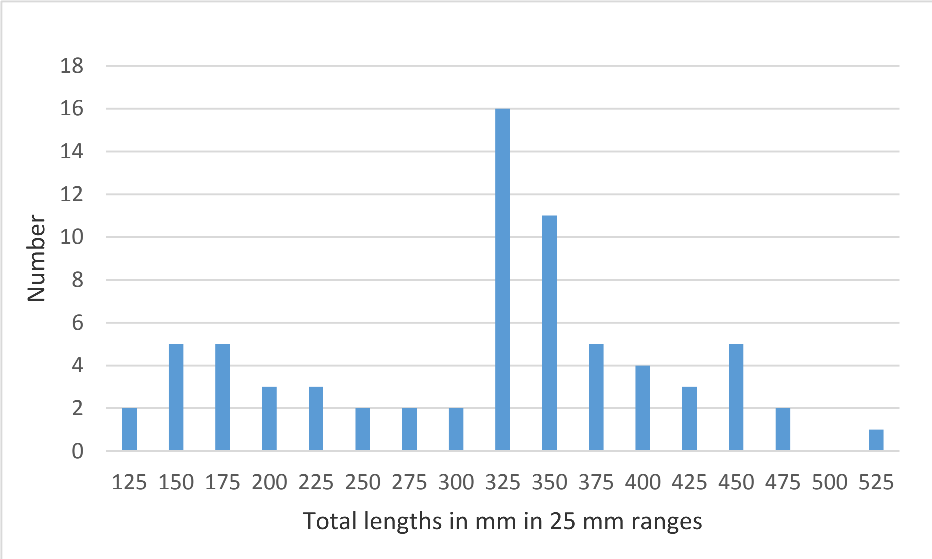

Figure 3. Length-frequency distribution for largemouth bass captured by electrofishing at New Hogan Reservoir, Fall, 2018.

PSD for LMB was 86. This indicates that the LMB population at New Hogan were imbalanced with more quality-sized over stock-sized LMB. While this is positive for anglers that seek to catch quality-sized LMB, in the long term there may be less recruitment to replace those quality-sized fish. The RSD-P was 30, which indicates that the population of stock-sized fish and preferred-sized fish was balanced. W_r of LMB was 99, indicating the LMB were in good condition. A linear regression model was made with a R^2 value of 0.85 (Figure 4). This high coefficient of determination indicated a reliable total length could be determined from a given weight, especially LMB between 225mm – 475mm.

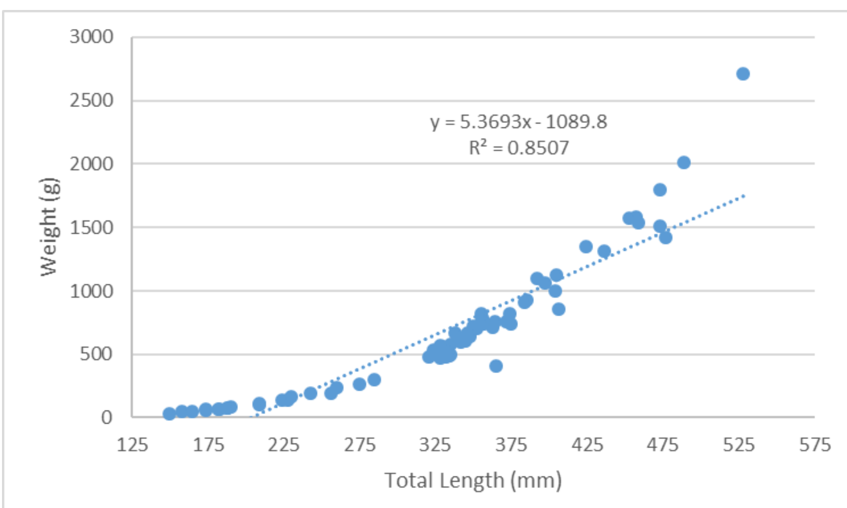

Figure 4. Total length-weight scatter plot with linear regression for LMB ≥150 mm (5.9 in) captured at New Hogan Reservoir, Fall 2018.

Bluegill

BG ranged from 48 mm - 146 mm (1.9 in - 5.8 in) total length (Table 3). The length class with the greatest frequency was 75 mm (3.0 in) (Figure 5). Not enough BG in this sample met the minimum total length criteria to be weighed, so no linear regression model was made, nor was a W_r calculated.

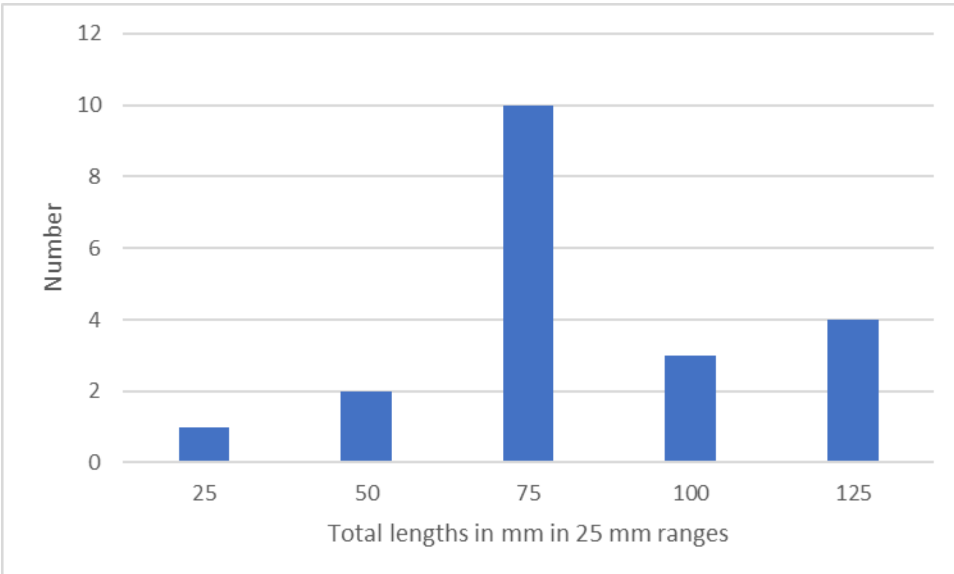

Figure 5. Length-frequency distribution for bluegill captured by electrofishing at New Hogan Reservoir, Fall, 2018.

Conclusions

Due to the small sample sizes collected for the other species, no summaries were made. This was due to the increased possibility the data collected would be an unreliable indicator of how that specific species was doing in New Hogan. The LMB population appeared to be doing well based on population numbers and their condition. However, the lack of stock-sized LMB was a concern. It was possible that a lot of adult LMB moved into deeper water for the fall/winter seasons where the water is warmer. With the adult LMB moving into deeper water, they become unavailable to sample with the electrofishing boat. From 2013 through the early part of 2017, California endured a record drought in which New Hogan experienced capacity levels as low as 12%. Lack of woody debris deposition in the littoral zone, limited access to backwaters and wetlands, and lack of seed banks and stable water levels to promote native aquatic vegetation (although in some areas of the lake, surveyors observed excessive growth of nonnative aquatic vegetation) characterize barren littoral habitats in many reservoirs (Miranda 2008). With the exposed shorelines of a low reservoir level, it is possible that many juvenile fish hatched during the drought years were not able to grow to stock-sizes. With exposed shoreline, juvenile LMB lack the suitable habitats that would provide beneficial protection from various terrestrial and aquatic predators. The majority of bluegill sampled were of stock-size with no BG of quality or preferred-sizes. With this being the first time CDFW conducting a boat-based electrofishing survey at New Hogan in the fall season, it is unknown whether the proportion of BG sizes collected were common for this time of year or not. Future fall surveys will be added to compare the 2018 survey to so that CDFW may have a better understanding of the New Hogan fishery and possible trends that may be occurring.

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