State of California
The Resources Agency
Department of Fish and Wildlife

New Hogan Reservoir General Fish Survey
Fall 2022

By

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North Central Region
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Summary

In an effort to evaluate the fishery in New Hogan Reservoir (New Hogan), a general fish survey was conducted on October 11, 2022, by California Department of Fish and Wildlife (CDFW). For this survey, a Smith-Root electrofishing boat was used to sample the same eight locations sampled in fall 2018 (Harris 2018). Fish collected during the survey included Largemouth Bass (LMB) (*Micropterus salmoides)*, Channel Catfish (CCF) (*Ictalurus punctatus*), Redear Sunfish (RES) (*Lepomis microlophus*), Bluegill (BG) (*Lepomis macrochirus*), Smallmouth Bass (SMB) (*Micropterus dolomieu*), Green Sunfish (GSF) (*Lepomis cyanellus),* Striped Bass (SB) (*Morone saxatilis*), and Alabama Bass (AB) (*Micropterus henshalli)*. Results from the 2022 survey demonstrate that New Hogan still has a wide diversity of fish species despite the below-average rainfall that occurred from 2020 – early 2022. Both fall 2022 and 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**
- **Make any comparisons to the 2018 Fall General Fish Survey**

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, two crewmembers 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 16:00 and 21:30. Pulsed DC current (2-10 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 galvanotaxis (involuntary movement toward an electrical field) were netted and placed in a holding tank. An effort was made to capture all shocked fish except Threadfin Shad (TSH) (*Dorosoma petenense*), which were noted for presence or absence in each transect. TSH were not netted due to the large numbers and relatively small differences in sizes of this species. Additionally, small fish (< 25 mm) sometimes eluded capture as did fish on the outer edge of the electrical field. The mean length and weight of 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) (**Figure 3**) 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.

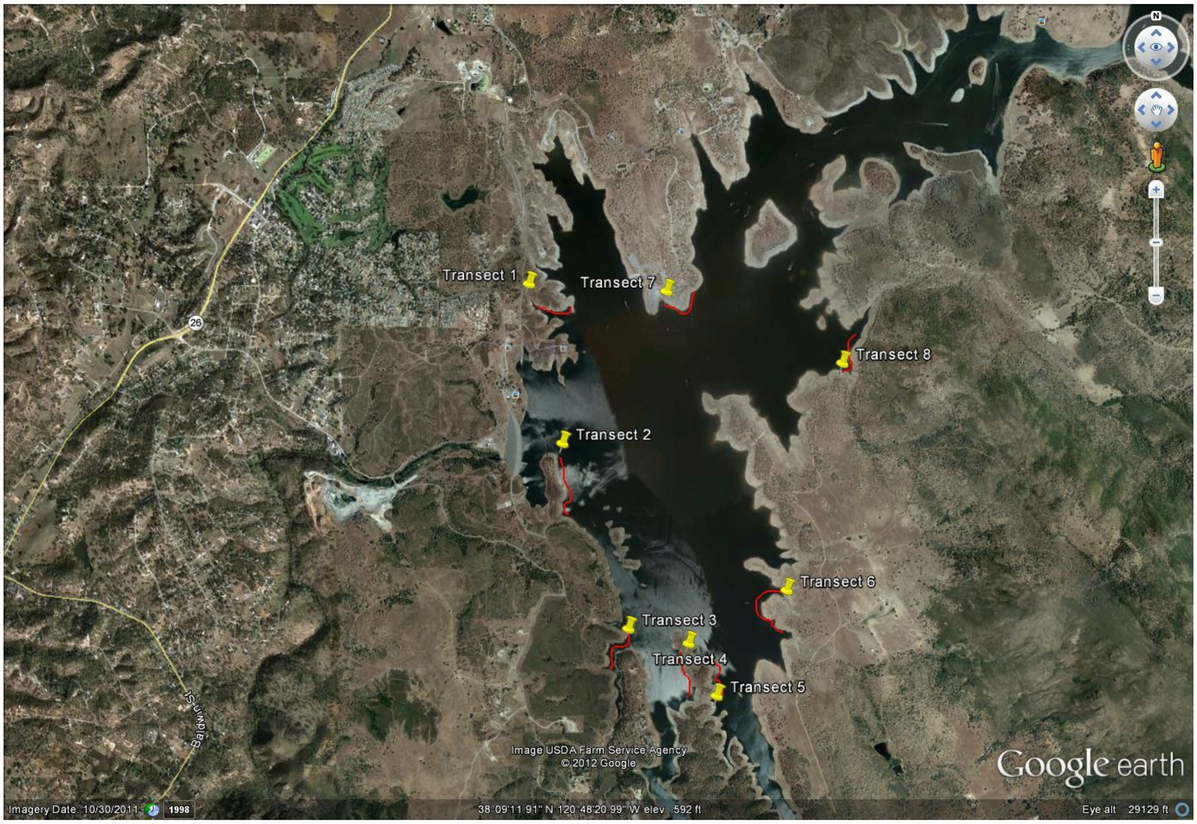

Figure 2. Electrofishing transect locations for both the October 23, 2018 and October 11, 2022 New Hogan Reservoir general fish surveys (Ewing 2018).

Figure 3. Channel Catfish being measured on October 11, 2022. (Photo by A. Montalvo)

Catch Per Unit of Effort

Catch per unit effort (CPUE) is defined as the number of fish collected per minute of electrofishing. This data is 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:

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, 90-109 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 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 $\geq$ minimum quality length) / (number of fish $\geq$ 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)

Length-Weight 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 in 2018 and 2022. A total of 187 fish, representing eight species were collected during the 2022 survey (**Table 3**) and an increase from the 122 fish collected in 2018 (Harris 2018). In 2022, black bass species comprised 28.3% of the total fish sampled. The fish collected that were identified as black bass were too small to accurately identify to their species by CDFW. SB followed with 26.2% of total fish sampled. LMB was third, comprising 13.4% of the total catch, SMB with 11.8%, and BG with 9.1%. RES comprised 5.9% of the total catch. AB (2.7%), GSF (2.1%), and CCF (0.5%) comprised the remainder of the species collected. Similar to 2018, TSH were present in four of the eight transects surveyed. The 2022 overall CPUE was 2.25 fish/min., compared to 1.53 fish/min. in 2018.

Table 3. Species composition from Lake New Hogan, October 23, 2018 and October 11, 2022.

Mean Total Length (TL) was measured in millimeters (mm) and mean weight* was measured in grams (g).

		Number		Total Length (mm)		Weight (g)	
	Species	2018	2022	2018	2022	2018	2022
1	Largemouth Bass	69	25	322.8	351.6	671.2	655.7
2	Bluegill	21	17	97.3	113.5	19.9	23.4
3	Striped Bass	12	49	236.8	141.6	143.8	83.7
4	Black Bass	8	53	82.4	80.2	-	-
5	Smallmouth Bass	6	22	174.0	256.1	66.5	237.8
6	Green Sunfish	2	4	108.5	81.8	29.5	12.5
7	Redear Sunfish	2	11	105.0	212.0	37.0	199.0
8	Channel Catfish	1	1	525.0	613.0	1524.0	2292
9	Alabama Bass	1	5	77.0	180.6	-	70.2
	Total	122	187				
	Generator minutes	80	83				
	CPUE (Fish/generator min)	1.53	2.25				

*Weights were 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, 150 mm for Largemouth, Striped, and Smallmouth Bass. Common Carp, Threadfin Shad, and Black Crappie were noted for presence/absence or were unable to be caught.

		Length Ranges (mm)		Mean Relative Weight (Wr)	
		2018	2022	2018	2022
1	Largemouth Bass	149-528	154-480	99	- -
2	Bluegill	48-146	85-141	-	- -
3	Striped Bass	206-265	65-244	-	- -
4	Black Bass	64-104	54-124	-	- -
5	Smallmouth Bass	101-215	151-405	-	- -
6	Green Sunfish	80-137	71-92	-	- -
7	Redear Sunfish	73 - 137	105-300	-	- -
8	Channel Catfish	-	-	-	- -
9	Alabama Bass	-	160-195	-	-

Striped Bass

In 2022, SB total length ranged from 65 mm – 244 mm (2.6 in. – 9.6 in.) (**Table 3**). The SB length frequency distribution is presented in **Figure 4**. In 2022, the length class with the highest frequency was 75 mm (3.0 in.) compared to 225 mm (8.9 in) in 2018 (Harris 2018). These 2022 SB were likely zero to one year of age (Moyle 2002). This large sample size of young SB was not present in the 2018 survey.

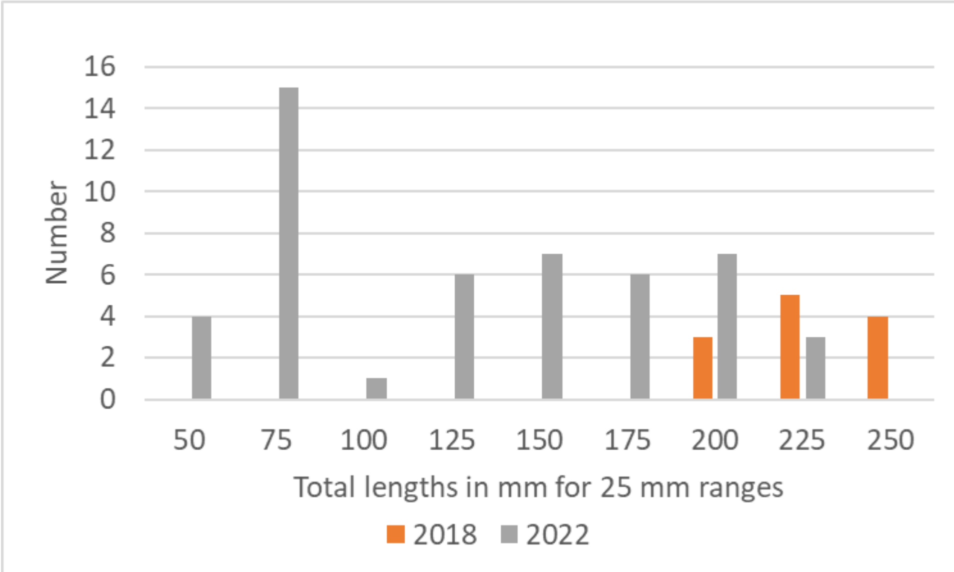

Figure 4. Length-frequency distribution for Striped Bass captured by electrofishing at New Hogan Reservoir, Fall, 2018 and 2022.

No length-weight linear regression model was made due to the low R^2 value.

Largemouth Bass

In 2022, LMB total length ranged from 154 mm – 480 mm (6.1 in. – 18.9 in.) (**Table 3**). The LMB length frequency distribution is presented in **Figure 5**. In 2022, the length class with the highest frequency was 350 mm (13.8 in.) compared to 325 mm (12.8 in.) in 2018 (Harris 2018). These fish were likely three to four years of age (Moyle 2002). Of the 25 measured in 2022, only two (< 200 mm) were classified as young of the year.

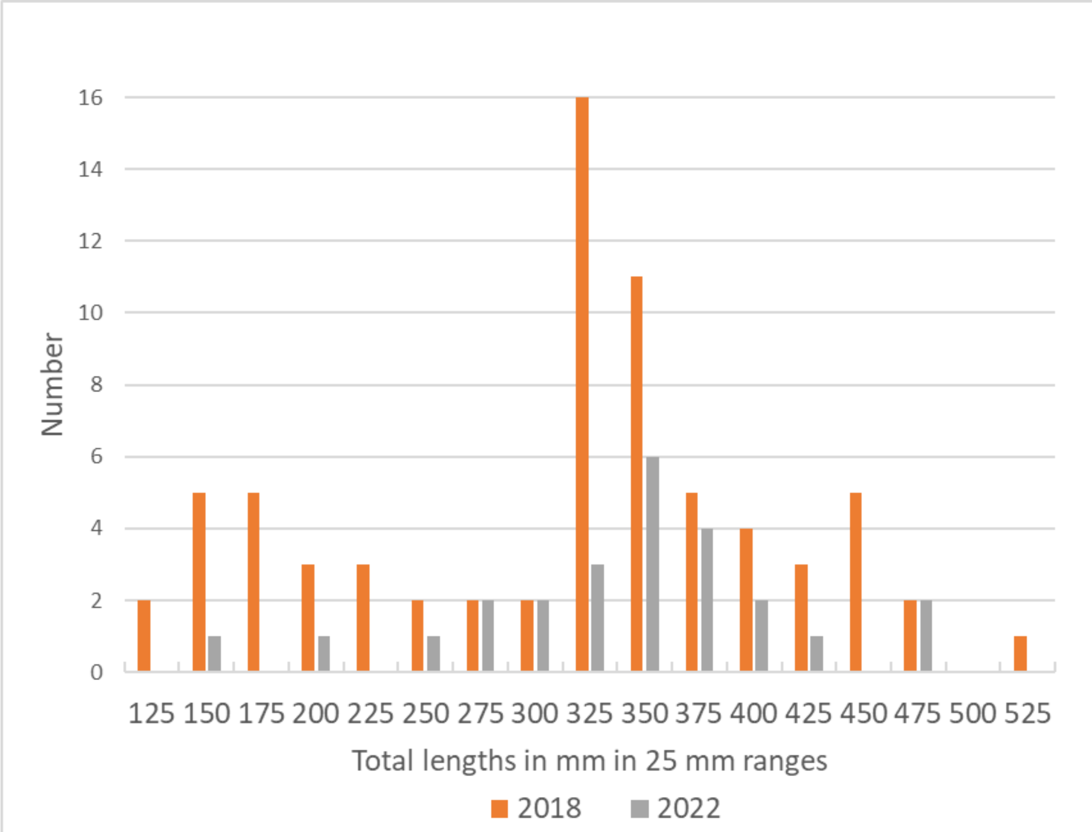

Figure 5. Length-frequency distribution for Largemouth Bass captured by electrofishing at New Hogan Reservoir, Fall, 2018 and 2022.

In 2022, PSD for LMB was 83, identical to the 83 value in 2018. 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 2022 RSD-P was 38, compared to 30 in 2018. This indicates that the population of stock-sized fish and preferred-sized fish was balanced in both years. A linear regression model was made with a R^2 value of 0.87 in 2022 and 0.85 in 2018 (**Figure 6**). The high coefficients of determination in both years indicates a reliable total length could be determined from a given weight, especially LMB between 225 mm – 475 mm.

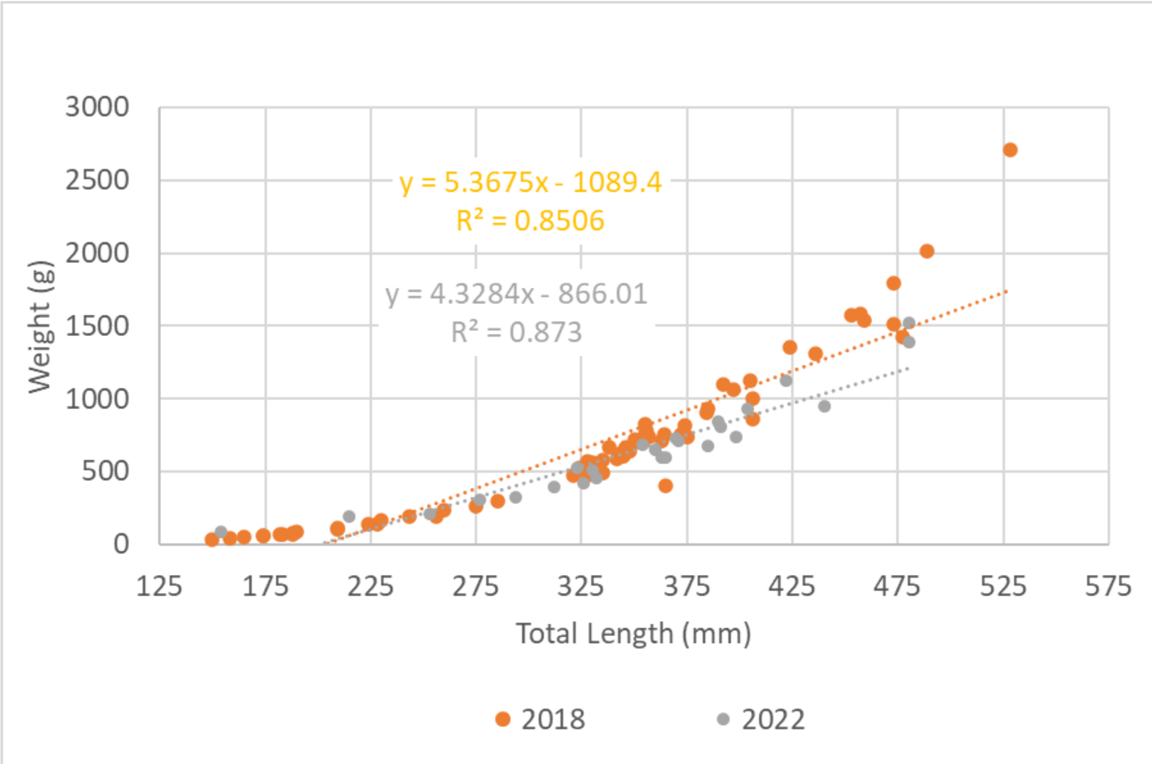

Figure 6. Total length-weight scatter plot with linear regression for LMB ≥150 mm (5.9 in) captured at New Hogan Reservoir, Fall 2018 and 2022.

Smallmouth Bass

In 2022, SMB total length ranged from 151 mm – 405 mm (5.9 in. – 15.9 in.) (**Table 3**). The SMB length frequency distribution is presented in **Figure 7**. The length class with the highest frequency was 225 mm (8.9 in.). These fish were likely one to four plus years of age (Moyle 2002). Of the 22 SMB measured, only four (< 200 mm) were classified as young of the year.

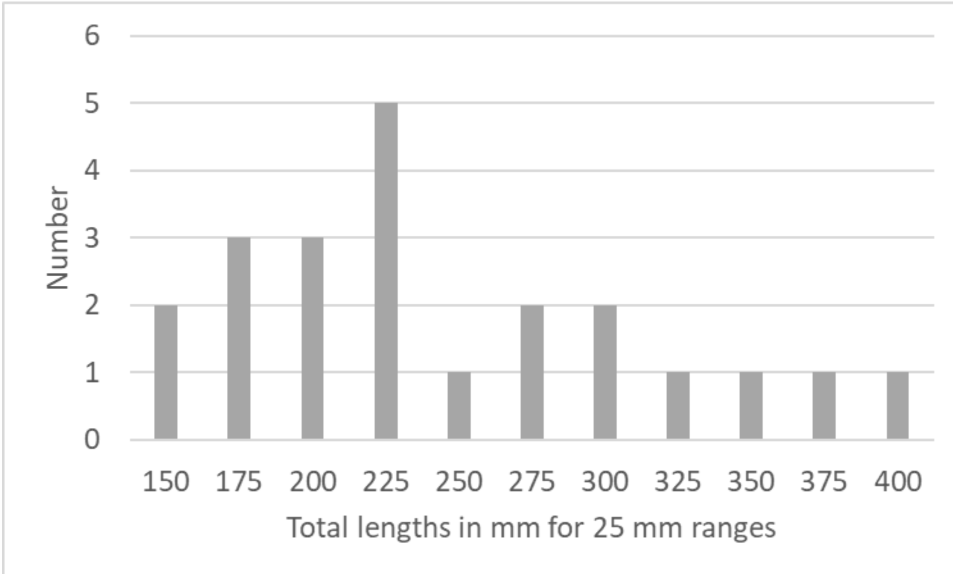

Figure 7. Length-frequency distribution for Smallmouth Bass captured by electrofishing at New Hogan Reservoir, Fall, 2022.

PSD for SMB was 40. There was not a designated PSD index range for SMB, but using the LMB range, the SMB collected indicated a balanced population ratio of quality-sized to stock-sized fish. This may be a positive for anglers that seek to catch quality-sized SMB. The RSD-P was 15, which again, based on the LMB index range, indicates that the population of stock-sized fish and preferred-sized fish was balanced. A linear regression model was made with a R^2 value of 0.93 (**Figure 8**). This high coefficient of determination indicated a reliable total length could be determined from a given weight.

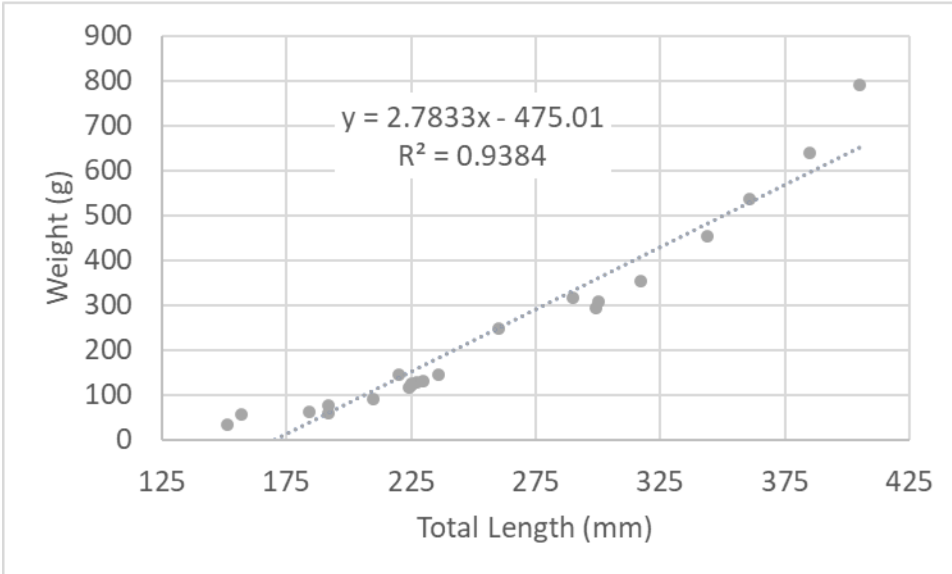

Figure 8. Total length-weight scatter plot with linear regression for SMB ≥150 mm (5.9 in) captured at New Hogan Reservoir, Fall 2022.

Conclusions

Overall in 2022, a greater number of fish were collected with the same amount of species collected in 2018, which is a positive sign. 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. Many unidentifiable black bass were collected in 2022. Due to their small size, it was not accurate to determine what specie of black bass these fish were, especially since there are three black bass species present in New Hogan. However, the large number of juvenile black bass is a positive sign of a good recruitment year.

The number of LMB collected decreased from the 2018 numbers, however those that were collected appeared to be doing well based on their condition. Although LMB numbers decreased from 2018, SB and SMB increased four and three times, respectively. It is possible with the large fluctuations in the lake level the last few years, that spawning habitat for LMB was limited. SB are mass, broadcast spawners, while SMB generally spawn deeper than LMB. With the different spawning habits, it is possible it offered these two species an advantage during drier water years. The 2020 – 2021 winter rainfall in the New Hogan region was below average (California Department of Water Resources 2022). With exposed shoreline, juvenile LMB lack the suitable habitats that would provide beneficial protection from various terrestrial and aquatic predators, as well as grow to stock-sizes.

All the BG collected in 2022 were of stock-size with no preferred-size and greater BG collected. This is similar to 2018 when the majority of bluegill sampled were of stock-size with no BG of quality or preferred-sizes. With this being the second time CDFW conducting a boat-based electrofishing survey at New Hogan in the fall season, it is possible the proportion of BG sizes collected were common for this time of year.

New Hogan is one of the only reservoir/lakes in California that has SB. Additionally to what CDFW collected in 2022, many SB were seen “boiling” all over the lake, with many anglers targeting them during the time of the survey. The lack of inland flatwaters in California with SB and the healthy population and condition of the SB in New Hogan, makes it a very popular fishery for anglers.

New Hogan also provides anglers a unique opportunity to catch three different species of black bass, including an opportunity to catch preferred-sized LMB and SMB.

Future fall surveys will be used for comparison to the 2022 and 2018 surveys so that CDFW may have a better understanding of the New Hogan fishery and possible trends that may be occurring.

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