State of California
Department of Fish and Wildlife

Memorandum

Date: December 2, 2024

To: Leslie Alber
Senior Environmental Scientist; Supervisor
Department of Fish and Wildlife

Cc: Darryl Lucien, Lucien Partners;
Chad Dibble, Deputy Director, Department of Fish and Wildlife; and
CDFW North Central Region Fish Files

From: Mitch Lockhart; Environmental Scientist
Department of Fish and Wildlife

Subject: General Fish Survey at Lake Putt, Placer County.

This memo presents the results of a general fish survey I conducted at Lake Putt, Placer County, on June 28, 2024. I surveyed the lake to inventory fish species present, characterize their populations, and inform the landowners of management opportunities.

Lake Putt (Lake ID 13475) is a privately owned impoundment of Blue Canyon Creek located in Placer County, near Nyack, California (**Figure 1**). An earthen fill dam was originally built in 1916 and is currently 19 feet tall and impounds approximately 249 acre-feet, forming a shallow lake 34.6 surface acres (14.0 hectares) in area. At 5,356 feet in elevation, Lake Putt experiences four seasons: high summer temperatures, an ice-over period in winter, and significant shoulder seasons where daytime and nighttime temperatures vary significantly.

On June 28, 2024, I launched a Smith-Root electrofishing vessel on Lake Putt and conducted a general fish survey. With me were three Department of Fish and Wildlife Scientific Aides: Brianna Shima, Hailey Donaldson, and Lucas Brattesani. We found Lake Putt to support warm-water fishery populations dominated by a sunfish assemblage of Green Sunfish (*Lepomis cyanellus*), Bluegill (*Lepomis macrochirus*), and Green Sunfish X Bluegill hybrids. Overwhelmingly, the sunfish we captured were phenotypical Green Sunfish; Bluegill and Green Sunfish hybridize and occupy the same ecological niche within Lake Putt, and I would expect Green Sunfish to outcompete Bluegill in most environments, therefore, for simplicity, I refer to this assemblage as a Green Sunfish population for the remainder of the memo. We also encountered small populations of Smallmouth Bass (*Micropterus dolomieu*), and Brown Bullhead (*Ameiurus nebulosus*).

The forage base at Lake Putt consists of insects, aquatic invertebrates, and

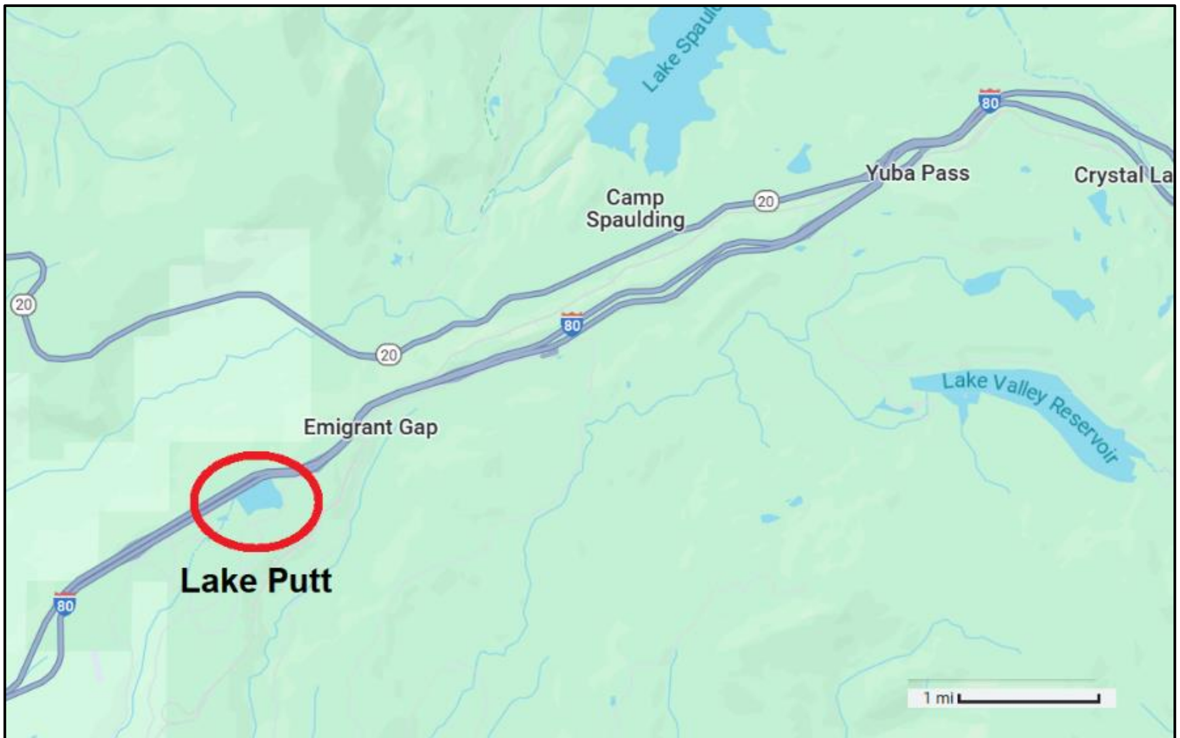


Figure 1. Overview map of Lake Putt, Placer County, and the surrounding region. The map displays Lake Putt's location (red circle) relative to notable landmarks such as Interstate 80, Highway 20, Emigrant Gap, and Yuba Pass (Retrieved from Google Maps Oct. 2024).

Signal Crayfish (*Pacifastacus leniusculus*). We observed abundant crayfish of all size classes throughout the littoral zone, and significant insect activity across the surface of the water, especially during the beginning of the survey near sunset.

Lake Putt's littoral zone is broad and shallow, dominated by silt, and with a typical water depth of one to three feet. The depth at the middle of the lake was 25 feet – sufficient to avoid freezing solid and allow fish to overwinter. We observed a fair number of submerged and partially submerged tree stumps and fallen snags, but aquatic vegetation was sparse with only a few large beds. Rock structures were exceedingly rare aside from the earthen-fill dam along the western shoreline, which is armored with large cobbles and boulders.

Survey Results

We began the general fish survey at 7:17 PM on June 28, 2024, and concluded at 10:23 PM, with a total survey effort of 91 minutes. The surface water temperature was 78 degrees Fahrenheit (25.5 C) at 7:15 PM. We divided the littoral zone into four survey sections roughly equivalent to the sides of Lake Putt's rectangularly shaped shoreline (**Figure 2**). We sampled each section in the same manner: we maneuvered the Smith-Root electrofishing vessel along the shoreline of the lake, applied a continuous electrical field into the water column, and captured as many stunned fish as

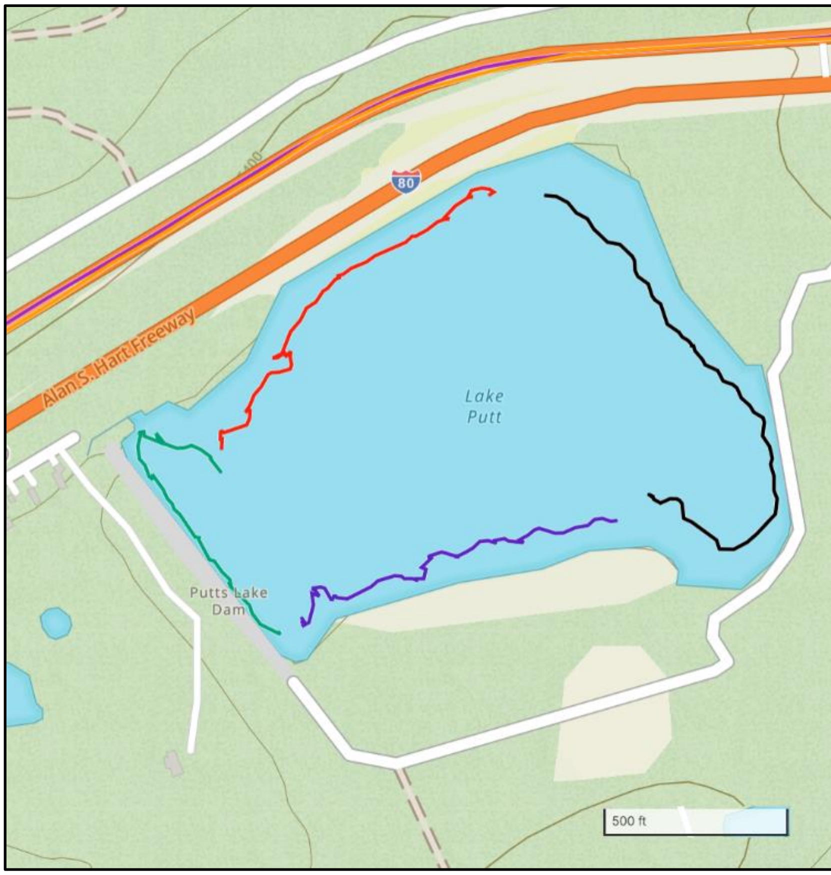


Figure 2. Focal map of Lake Putt, Placer County. The colored lines are GPS tracks of the four survey sections sampled during a general fish survey conducted on June 28, 2024. The North survey section is displayed in red; the West survey section is displayed in green; the South survey section is displayed in purple; lastly, the East survey section is displayed in black (Retrieved from gaiagps.com Sept. 2024).

possible. Once a section was complete, we identified all fish to species and weighed and measured at least 100 fish of a given species to the nearest gram and millimeter, respectively.

We captured a total of 568 fish (**Table 1**), 84% of which (n = 477) were Green Sunfish while only 10% were Smallmouth Bass (n = 56). Green Sunfish did not only dominate the total catch but was also the most abundant species captured in every survey section (**Table 2**). We found the East survey section to be the most densely occupied accounting for over 45% (n = 257) of the total catch.

Table 3 summarizes length measurements for all species and mean relative weight (W_r) for Smallmouth Bass and Green Sunfish. I used methodology presented by Neumann et al. (2012) to calculate W_r for each Smallmouth Bass at least 150 mm in total length, and each Green Sunfish at least 60 mm in total length. I did not calculate W_r for Brown Bullhead because standard weight calculations are not available for this

Table 1. Total catch at Lake Putt, Placer County, June 28, 2024.

Species	**% Catch**	**Total**
Smallmouth Bass	10%	56
Brown Bullhead	6%	35
Green Sunfish	84%	477
Total		**568**

Table 2. Summary of catch and effort by survey section.

Species	North	West	South	East	Total
	Survey Section				
Smallmouth Bass	6	7	14	29	56
Brown Bullhead	1	2	11	21	35
Green Sunfish	20	115	135	207	477
Catch Totals	27	124	160	257	**568**
Effort (min.)	19	20	27	25	**91**
CPUE (fish/min.)	1.4	6.2	5.9	10.3	**6.2**

Table 3. Summary of length and weight measurements by fish species.

	Total Length (mm)					
Species	**Min**	**Max**	**Mean**	***n***	**Mean W_r**	***n***
Smallmouth Bass	32	350	151	56	97	25
Brown Bullhead	131	337	265	35	-	-
Green Sunfish	36	202	78	138	105	14

species as of the time of writing. In addition, Brown Bullhead is not typically considered a desirable sport fish targeted by anglers. For these reasons, I excluded Brown Bullhead from the remainder of the analysis.

Mean W_r for both Smallmouth Bass and Green Sunfish fall in the ideal range of 95 to 105. This suggests that fish at Lake Putt are in good body condition relative to other populations of those species. However, it is typically more useful to look at mean W_r by size class rather than across the entire catch.

I summarized catch, mean W_r, and proportional stock density (PSD) for each of five size classes of adult Smallmouth Bass (**Table 4**) and Green Sunfish (**Table 5**). I used size classes and PSD calculations presented in Neumann et al. (2012). Stock size is defined as the minimum fish length that an angler would be contented to catch and is derived from angler interviews. Quality, preferred, memorable, and trophy sizes are derived from the stock size. PSD is the proportion of stock size fish that are also of a given larger size category. PSD values range from 1 to 100, and therefore are analogous to percentage. For example, a PSD value of 40.9 for Quality size Smallmouth Bass (**Table 4**) means that 40.9% of the stock size Smallmouth Bass we captured were also of quality size.

From **Tables 4** and **5** it is clear the largest fish we caught of both species fall into the preferred size class, and the largest size classes found in other populations of these species were absent from our catch at Lake Putt. PSD values for Green Sunfish fall within a range generally accepted to represent ‘balanced’ populations (Willis et al. 1993; Anderson 1985), albeit at the lower end of the range. Smallmouth Bass PSD

Table 4. Mean W_r and proportional stock density by size class for Smallmouth Bass.

	Stock Size 180 mm	Quality Size 280 mm	Preferred Size 350 mm	Memorable Size 430 mm	Trophy Size 510 mm
# Caught	22	9	1	0	0
Mean W_r	95	87	84	0	0
PSD	-	41	5	0.0	0.0
Expected PSD for balanced population	-	20-60	5-20	0-10	-

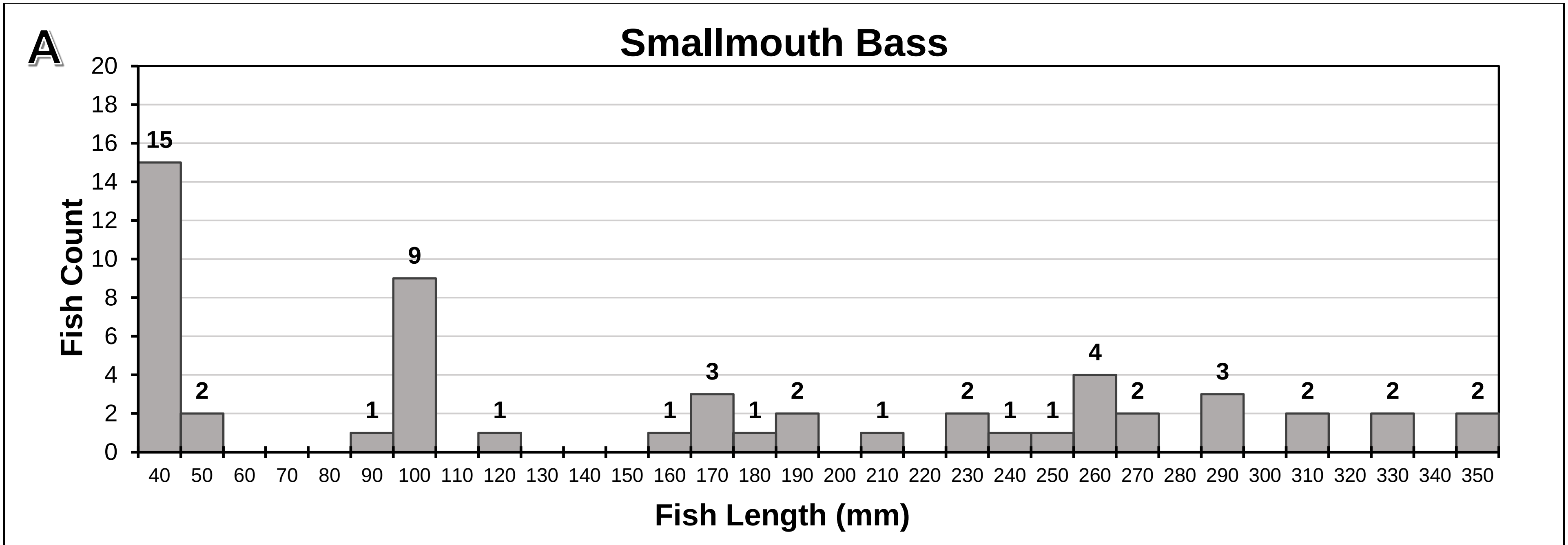
Table 5. Mean W_r and proportional stock density by size class for Green Sunfish.

	Stock Size 80 mm	Quality Size 150 mm	Preferred Size 200 mm	Memorable Size 250 mm	Trophy Size 300 mm
# Caught	42	15	2	0	0
Mean W_r	105	102	95	0	0
PSD	-	36	5	0.0	0.0
Expected PSD for balanced population	-	40-70	10-40	0-10	-

values, on the other hand, are below what we expect for a balanced population, which suggests that there is low recruitment and/or survival of larger size categories of Smallmouth Bass. However, I must point out that sample sizes are small and therefore confidence intervals for the PSD values are very low, less than 35% in all cases (Gustafson 1988). Lastly, mean W_r values for both species decrease as fish size increases, which is discussed further below.

Figure 3 - Panel A displays the length frequency of all Smallmouth Bass we captured (n = 56). The total length data organized in this fashion assemble into a few groups. Approximately 30% (n = 17) of the Smallmouth Bass we captured were 50 mm in length, or smaller. These are *year-0* fish that have moved into shallow areas after leaving the nest and were likely spawned three to seven weeks prior to our survey. Approximately half of these fish were caught in the South survey section, while the other half were captured in the East survey section.

The second grouping accounts for 20% (n = 11) of our Smallmouth Bass catch and are *year-1* fish 81 mm to 120 mm in length. We encountered roughly equal portions of fish in this category in the West, South, and East survey sections. The third grouping is the least distinct and includes fish 151 mm in length and greater. This group was 50% (n = 28) of our catch and accounts for *year-2* and older fish. Most of the fish in this group were captured in the East survey section. I suspect that the smallest fish in this grouping are exclusively *year-2* fish and that there is quite a bit of overlap in year classes as fish length increases.



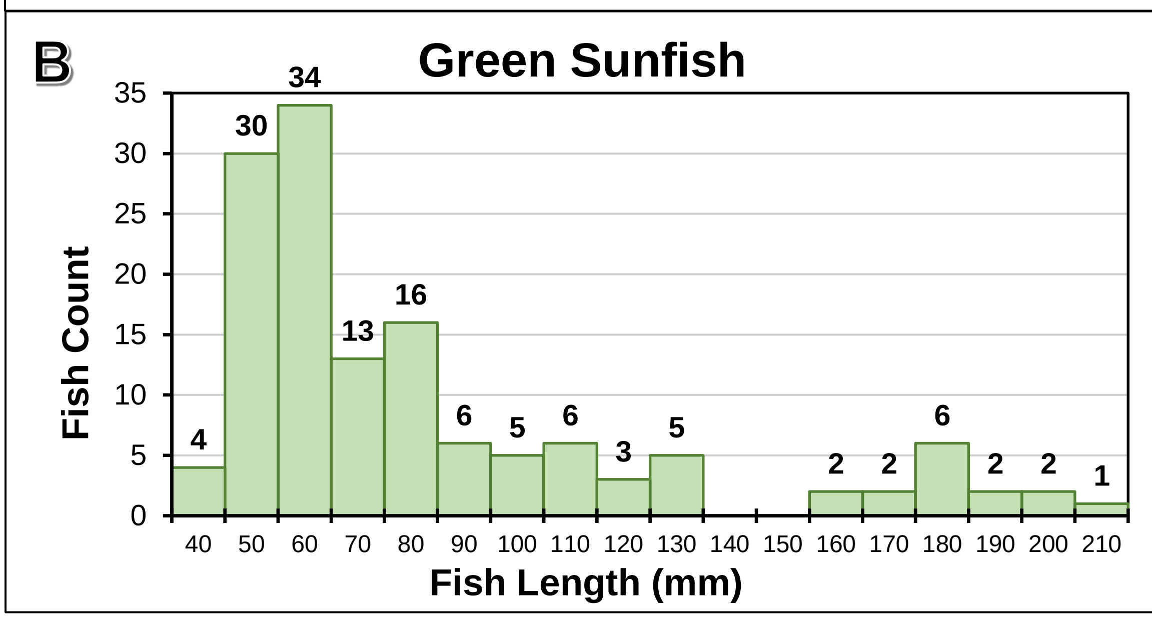


Figure 3. Length frequency histograms of Smallmouth Bass (Panel A) and Green Sunfish (Panel B) captured at Lake Putt, Placer Co., June 28, 2024. The *x-axis* displays total fish length divided into 10-millimeter groupings. The *x-axis* labels denote the upper limit of the grouping. For example, the grouping labeled 100 millimeters includes total lengths of 91-100 millimeters. The *y-axis* displays the number of fish within a given total length grouping. For example, we captured and measured nine Smallmouth Bass and five Green Sunfish with a total length of 91-100 millimeters.

Figure 3 - Panel B displays the subsample of Green Sunfish captured that we also measured (n = 138). Our Green Sunfish lengths assemble into a long-tailed distribution that is skewed toward smaller fish. Fish 41 to 60 mm in length form the peak of the distribution and account for 46% (n = 64) of our subsample. Nearly all the fish in this group were captured in the West survey section. Since the timing of our survey was a few weeks after spawning, I suspect fish of this size are *year-1*, *year-2,* and/or *year-3* fish. We observed a smaller size class of sunfish that were smaller than our net mesh size and difficult to capture. I suspect these tiny sunfish, poorly represented in our sample, were young-of-year. Eighteen percent (n = 25) of our Green Sunfish subsamples were 81 to 130 mm in length and are at least *year-3*. Similarly, nearly all fish in this grouping were captured in the West survey section. The fifteen largest fish 151 to 210 mm in length comprised 11% of our Green Sunfish subsample and could be *year-4* upwards of *year-10* fish. Nearly all fish in this length grouping were captured in the North survey section.

Summary

Green Sunfish were the most abundant fish we encountered and accounted for 84% of our catch (n = 477; **Table 1**). Our data are indicative of a robust Green Sunfish population with plenty of successful spawning and recruitment (**Figure 3 Panel B**). That our length-frequency distribution is compressed into a long-tailed distribution with overlapping year classes suggests that the population is slow-growing and/or limited by competition. This is not surprising given the small size of the lake and the short growing season compared to other Green Sunfish populations. Fish of all size classes were, on average, in excellent body condition compared to other Green Sunfish populations (mean W_r; **Tables 3 and 5**). This is especially notable since our survey coincided with the end of the spawning season when we expect the percentage body fat of spawned-out adult fish to be lower. PSD values suggest a ‘balanced’ population, but our confidence intervals are extremely low. I would need age data from Green Sunfish at Lake Putt to refine my analysis and to calculate PSD estimates with higher confidence. In addition, we did not spend time parsing out the composition of the sunfish assemblage, and I may be missing nuance in the populations by lumping Green Sunfish, Bluegill and hybrids into a single group for analysis.

We captured 56 Smallmouth Bass ranging from young-of-the-year up to our largest fish captured, which measured 350 mm (13.8 inches) and 543 grams (1.2 lbs) (**Tables 1 and 3**). We captured more young-of-the-year Smallmouth Bass than any other size class, which suggests fish spawn successfully (**Figure 3 – Panel A**), but recruitment into adult-size classes is limited, as evidenced by the flat length-frequency distribution. Mean W_r decreases as size class increases (**Table 4**), which may indicate competition increases as fish size increases, and/or it may be an artifact of the post-spawn timing of our survey. I suspect, like Green Sunfish, Smallmouth Bass at Lake Putt are slow growing and highly competitive for territory and forage due to the small size of the lake, limited depth and habitat, and limited growing season. However, my ability to draw conclusions from the Smallmouth Bass data is significantly impaired by our small sample size of adult-sized fish (n = 25). I would prefer a sample at least twice this number. As a result, I cannot discount that our Smallmouth Bass sample is not representative of the population.

Recommendations

The preliminary data collected during this survey supports the possibility of managing a bass and sunfish fishery; however, lake managers should collect additional data to inform which management option(s) would be best suited for the lake. My principal recommendation is to work with a professional consultant, experienced and trained in managing warm-water fisheries, to collect more information about the fish populations, age structures, and spawning locations to inform a fishery management plan. The survey information I provide here can serve as a baseline for future data collection, but due to our small sample size of adult Smallmouth Bass it is not suitably robust to clearly support specific actions.

My second recommendation is to monitor water quality across a water depth profile, across seasons, and water-years. I think that the depth and elevation of Lake Putt present significant challenges and are limiting to warm-water fish populations, especially larger fish. Lake Putt is not only a small lake by surface area, but the shallow depth concentrates fish into the few deeper sections. In late summer and fall, the water level is lower than it was during our survey, and in years without fall precipitation, may not rise again before air and water temperatures drop. As a result, I would expect water temperature and dissolved oxygen to vary significantly with the seasons, and especially during low water years. I believe that water quality data will help determine what, if any, parameters are limiting to fish populations and inform remediation. For example, if fall and winter water temperature, and/or late-summer dissolved oxygen are limiting the population, improving physical habitat for Smallmouth Bass might not provide significant benefits unless water quality is improved.

Thirdly, Green Sunfish seem to dominate the fishery, and direct action to limit Green Sunfish may ultimately be necessary to improve the Smallmouth Bass population. For example, Lucien Partners might contract with a consultant to remove Green Sunfish or encourage angler harvest of Green Sunfish.

My final recommendation is to improve angler access at Lake Putt. The littoral zone is dominated by broad, shallow silt flats, and therefore shoreline anglers will find it challenging to access and cast to the best habitats. Install a pier or boardwalk system that facilitates easier access to deeper water beyond the silt flats of the littoral zone. Improve the launch so that small watercraft can be easily deployed to access all areas of the lake. I think it might be possible to bring larger fish closer to the shoreline with targeted physical habitat improvements. For example, disrupt the homogenous broad silt flats that characterize the littoral zone and provide ‘channels’ between shoreline accesses and the deepest part of the lake. Add structures such as submerged woody debris and rock to provide quality holding habitat for larger fish closer to shorelines accessible to anglers.

Aside from my four principal recommendations, I have several other thoughts that are less impactful or not as well supported by our findings. First, we found definitive evidence that Smallmouth Bass spawn at Lake Putt, but we saw very little exposed gravel or cobbles. I think identifying the location of Smallmouth Bass nests would be useful when developing a management plan. It may be possible to improve Smallmouth Bass spawning habitat by building additional nests and/or providing more desirable nest materials.

I suggest collecting a subsample of fish age data to aid interpretation of fish length data. In addition, a subsample of the sunfish assemblage should be carefully identified to get a better understanding of the composition of sunfish species within the assemblage, which may reveal nuances I have missed in my analysis.

I believe Lake Putt could support a small, seasonal, put-and-take cold-water fishery. Rainbow Trout will not survive in Lake Putt long term, but I think a small plant of adult-sized triploid Rainbow Trout, upwards of 200 fish, planted in the late-spring, could provide angling opportunities for approximately two to six weeks. Seasonal water quality information would help inform the best timing and expected duration of the opportunity.

I do not recommend targeting Brown Bullhead for control or eradication. This has been attempted at other water bodies throughout the region and in all documented cases, has failed. For example, Brown Bullhead survived the 2007 piscicide treatment conducted by the California Department of Fish and Wildlife at Lake Davis.

Finally, I think that future surveys at Lake Putt should not necessarily follow the littoral-zone survey model I used. The lake is quite shallow, with a slow gradient towards deeper water. An electrofishing vessel can sample effectively beyond the littoral zone, and I recommend a transect model where the entire lake body is considered for sampling. Similarly, a trap or net sampling schema should consider the entire lake body.

Citations

Anderson, R. O. 1985. Managing ponds for good fishing. University of Missouri Extension Division. Agricultural Guide 9410, Columbia.

Gustafson, K. A. 1988. Approximating confidence intervals for indices of fish population size structure. North American Journal of Fisheries Management 8:139-141.

Neumann, R. M., C. S. Guy, and D. W. Willis. 2012. Length, weight, and associated indices. Pages 637 – 676 *in* A. V. Zale, D. L. Parrish, and T. M. Sutton, editors. Fisheries techniques, 3rd edition. American Fisheries Society, Bethesda, Maryland.

Willis, D. W., B. R. Murphy, and C. S. Guy. 1993. Stock density indices: development, use, and limitations. Reviews in Fisheries Science 1:203-222.