NEVADA DEPARTMENT OF WILDLIFE
STATEWIDE SPORT FISHERIES MANAGEMENT

FEDERAL AID JOB PROGRESS REPORT

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2017

LAKE MEAD
SOUTHERN REGION

NEVADA DEPARTMENT OF WILDLIFE, FISHERIES DIVISION
JOB PROGRESS REPORT

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NEVADA DEPARTMENT OF WILDLIFE, FISHERIES DIVISION
ANNUAL PROGRESS REPORT

State: *Nevada*
Project title: *Statewide Fisheries Program*
Job title: *Lake Mead*
Period Covered: *January 1, 2017 to December 31, 2017*

SUMMARY

General Sport Fishing Evaluation

In 2017, a total of 101 days were expended conducting creel surveys on Lake Mead. A total of 622 anglers were contacted whose catch totaled 3,118 fish of multiple species for a catch rate of 4.7 fish/angler-day and 1.03 fish/angler-hour. The observed 1,350 fish harvested provided a harvest rate of 2.2 fish/angler-day and 0.5 fish/angler-hour.

During the fall, NDOW, Arizona Game and Fish Department (AZGFD), and U.S. Bureau of Reclamation (USBR) cooperatively completed electroshocking and gill netting surveys. Electroshocking surveys were dominated by bluegill *Lepomis macrochirus*, green sunfish *L. cyanellus*, gizzard shad *Dorosoma cepedianum*, and largemouth bass *Micropterus salmoides.* Gill net surveys caught primarily gizzard shad, striped bass *Morone saxatilis*, and channel catfish *Ictalurus punctatus*.

Striped Bass Assessment

Striped bass catch per unit effort (CPUE) in the gill net survey showed a slight decrease from that in 2016, and angler interest in striped bass, as a percentage of total angler preference, increased slightly from last year to 70.4%. Harvested striped bass sampled during creel surveys were much the same as last year and in similar condition. Their mean total length was 424 mm (16.7 in), with a mean weight of 680 grams (g, 1.5 pounds [lbs]), and a mean condition factor ($K_{FL(fork\ length)}$) of 1.13. The mean total length of striped bass was slightly smaller in the gill net sample compared to last year; however, their body condition had improved. Striped bass had a mean total length of 362 mm (14.3 in) TL, mean weight of 454 g (1.0 lb), and a condition factor of 1.13 K_{FL}. This is a 0.11 K_{FL} increase in condition factor from 2016.

Black Bass Fisheries Assessment

Gill net surveys revealed increases in abundance for both largemouth bass and smallmouth bass *M. dolomieu*. Black bass harvest, as a percentage of the total harvest, decreased in 2017 to 1.4% compared to 2.2% last year. The fishery remains mostly catch and release with only 5.7% of the observed catch harvested. The percentage of angler preference for black bass increased to 27% of the total angling effort. Samples taken from tournament mortalities revealed largemouth bass were smaller than last year

by a mean total length of 15 mm (0.6 in) and a mean weight of 45 g (0.1 lbs). Their mean total length in 2017 was 401 mm (15.8 in) compared to 386 mm (15.2 in) in 2016. Black bass had mean weight of 961 g (2.1 lbs) in 2017 compared to 916 g (2.0 lbs) in 2016. Body condition was slightly improved with a relative weight (W_r) of 90. Smallmouth bass were similar in size and condition compared to last year, with a mean total length of 384 mm (15.1 in) and a mean weight of 728 g (1.7 lbs) and a W_r of 84. Snorkel survey results indicate reduced spawning success for largemouth bass this year, with a small decrease in young-of-the-year (YOY) snorkel observations. Smallmouth bass observations declined from last year, though they continue to have larger numbers of YOY than largemouth bass. In the electroshocking efforts, CPUE decreased for both largemouth and smallmouth bass, with CPUE declining greater for smallmouth bass.

Prey Base Studies

Threadfin shad *D. petenense* production was monitored during the spring/summer seasons in two basins of Lake Mead. A total of 26 standard transects were sampled in the Overton Arm and the Boulder Basin. The shad population typically exhibits a cyclical pattern with two to three years of poor production followed by a peak year in production. Both Overton Arm and Boulder Basin had peak shad production this year, which is unusual. The Boulder Basin shad production peaked at a mean of 219 shad/3,531 ft^3 (100 m^3), the mean peak production in the Overton Arm was 189 shad/3,531 ft^3 (100 m^3), and the overall lake-wide production mean was 204 shad/3,531 ft^3 (100 m^3). For comparison, last year the overall lake-wide mean was 36 shad/3,531 ft^3 (100 m^3).

Salmonid Fisheries Assessment

No rainbow trout *Oncorhynchus mykiss* were stocked in 2017 and no trout were captured in any surveys.

BACKGROUND

Lake Mead was created by the completion of the Hoover Dam in 1935. The newly formed impoundment was stocked with largemouth bass and sunfish *Lepomis* spp., and soon became known for its excellent largemouth bass fishery. In the 1940s, the largemouth bass fishery began to decline with reports of fish in poor condition. In 1954, threadfin shad were introduced to Lake Mead to provide additional forage. Initially there was some improvement in largemouth bass condition, but this was short-lived. In 1963, the construction of an upstream impoundment reduced flow conditions with the filling of Lake Powell. This also changed historic water storage patterns to one of lower springtime flows and higher wintertime flows, which caused drawdown during the largemouth bass spawning season. Changes in temperature fluctuation and nutrient loading to Lake Mead were also noted after the construction of Lake Powell.

Because of the declining largemouth bass fishery, introductions of coldwater fish were made in 1969 to enhance the fishery and to fill a vacant niche. These fish

included rainbow trout, cutthroat trout *O. clarkii*, hybrid bowcutt trout *O. mykiss* x *O. clarkii*, and silver salmon *O. kisutch*. Striped bass were also stocked at this time and up until 1972, at which time they were found to be naturally reproducing and stocking was discontinued. At the time of these introductions, the threadfin shad population had grown to become an over-abundant pelagic biomass mostly unavailable to littoral species. However, after ten years, striped bass had become well established in Lake Mead and subsequently they decreased the threadfin shad population. Moreover, increasing evidence indicated that striped bass were negatively impacting the concurrently established salmonid fishery and contributing to the severe decline of the long established black crappie fishery. Trout stocking was discontinued in 1983 for a variety of reasons, including poor long-term returns and other demands on hatchery production capability. Poor condition factors persisted in both striped and black bass.

Since 2007, the management strategy for striped bass has been an attempt to manipulate the structure of the lake-wide population by encouraging anglers to harvest the large number of available fish in the smaller size ranges through an increased possession limit. Increased harvest of the 12 to 15 in (305 to 381 mm) size cohort, primarily one and two year old fish, would decrease the impact on YOY shad, thus making more of the current shad production available to larger striped bass when they can feed upon them in late summer and early fall. Ideally, this should result in improved condition factors in larger fish. Similar regulations are now continuous throughout lakes Powell, Mead, and Mohave, with an unlimited take of striped bass less than 20 in (508 mm) and a 20 fish limit on striped bass over 20 in. Under these regulations, there are a large number of one and two year old striped bass available for harvest each year, though striped bass over 20 inches are in shorter supply.

Second to the popular striped bass fishery is the black bass fishery. The largemouth bass population has remained stable over the past 10 years, despite long-term drought conditions. Smallmouth bass, first detected in the creel survey in 1999, are now a large part of the tournament catch, are found lake-wide, and since 2010 have rivaled largemouth bass in abundance. The salmonid stocking program, reestablished in 1991, has been suspended as of March 2011 due to the Lake Mead Fish Hatchery closure.

The newest challenges to the Lake Mead fishery are invasive species. In 1994, blue tilapia *Oreochromis aureus* was captured in Lake Mead, then, in 2007, two more aquatic nuisance species (quagga mussel *Dreissena bugensis* and gizzard shad) made their way to Lake Mead. The impact these species will have on Lake Mead fisheries remains unclear at this time. So far, gizzard shad have been found to provide additional forage for striped bass; however, they grow rapidly to a size most fish cannot utilize as prey and could become competitors for food resources. Another recent invader, the New Zealand mud snail *Potamopyrgus antipodarum*, now inhabits the benthos with unknown effects to the fishery. Despite these invasions, Lake Mead continues to provide anglers with a variety of fishing opportunities.

OBJECTIVES and APPROACHES

Objective: To monitor angler use, catch, and fish population dynamics of the Lake Mead fishery.

Approach:

- Evaluate angler success through at least 100 days of contact creel surveys at four angler access points on Boulder Basin and Overton Arm.
- Collect angler catch data from black bass fishing tournaments.
- Conduct gill netting and trammel netting surveys lake-wide once in the fall in cooperation with AZGFD.
- Conduct fall electroshocking surveys in cooperation with AZGFD to evaluate changes in littoral zone fish species.
- Conduct summer black bass dive transects to assess impacts of reduced and variable lake elevations on black bass spawning and recruitment.
- Complete weekly meter net trawls during peak production of threadfin shad.
- Conduct quarterly stomach content analysis of a minimum of 200 tournament caught striped bass to detect changes in their diet.
- Utilize creel, tournament, and monitoring data to assess sport fishery performance and changes, and develop estimates of sport fish availability and condition to inform anglers.

PROCEDURES

Creel Survey

Contact creel surveys were conducted on 101 separate creel days during January through December. A total of four landings were surveyed. Boulder Harbor was surveyed on a weekly basis and Callville Bay was surveyed less frequently from zero to five times a month. Hemenway and Echo Bay were surveyed infrequently from 0 to two times per month.

The creel survey program was re-designed in September 2015 to a stratified random sampling where the four landings have different sampling probabilities based on angler use. The following are landings with their respective sampling probabilities: Boulder Harbor, 0.56; Callville Bay, 0.22; Echo Bay, 0.11; and Hemenway, 0.11. The days sampled are randomly selected from Tuesday through Saturday and stratified as either morning or afternoon hours.

Surveys were performed for a continuous period of time and information collected included total catch, unit of effort, location fished, bait type, species, angler origin, species preference, and presence of tags or marks on fish. Subsamples of harvested fish were weighed and measured to obtain length and weight data.

Black Bass Tournament Monitoring

Major largemouth bass fishing tournaments were monitored to evaluate weigh-in procedures, obtain any tag return data, and insure a proper release procedure was adhered to consistent with National Park Service permitting. Data on species composition and bag weights were collected. Additionally, species, length, and weight data were collected from tournament mortalities. Scale and otolith samples were also collected from the mortalities for future aging and stomach contents were identified to determine diet.

Gill Net Surveys

The gill net survey was carried out in the fall. Gill nets were set according to NDOW's Sport Fish Sampling Guidelines for Lakes, Ponds, and Reservoirs for gill netting warmwater species. An exception to the guidelines is the experimental gill nets used by NDOW on Lake Mead are multifilament experimental gill nets, 150 ft (46 m) in length, with five 30 ft (9 m) panels typically ranging in mesh size from 0.75 to 3 in (19 to 76 mm). Nets were set overnight and not deeper than 40 ft (12 m). Fish were identified to species, weighed, measured, and released back to the lake. Some striped bass and large- and smallmouth bass were tagged with Floy tags as part of an aging and growth study.

Electroshocking Surveys

Sampling was done in the fall, during the evening hours using a boat equipped with a Coffelt shocking apparatus and a Smith-Root VVP-15B electrical box. Boat electroshocking methods described in NDOW's Sport Fish Sampling Guidelines for Lakes, Ponds, and Reservoirs were used. Fish were identified to species, measured, weighed, and released back to the lake. Some bass were tagged with Floy tags as part of an aging and growth study.

Summer Dive Surveys

Dive counts were conducted using mask and snorkel. Observations were made at stratified random coves on the lake with cove selection dependent on visibility and clarity of water using methods described in NDOW's Sport Fish Sampling Guidelines for Lakes, Ponds, and Reservoirs for snorkeling. Dive transects were timed counts where all species were counted or estimated (e.g., threadfin shad schools) and black bass were further categorized into fry, fingerling, juvenile, or adult size-classes. Substrate composition, percent vegetation, water temperature, and visibility were also recorded to characterize habitat conditions.

Shad Trawls

Weekly meter-net trawls for shad were conducted from May 8 to June 29. The weeks of May 15 and June 5 were not sampled due to windy conditions, and Overton

Arm was not sampled the week of May 30 due to windy conditions. Samples were taken in Boulder Basin and Overton Arm using established transects and procedures in accordance with protocols established in a 1988 nutrient study, but with reduced number of sample sites. Due to the loss of the inner Las Vegas Bay transect, a new transect located in outer Las Vegas Bay (near Sand Island) was added in 2015. The procedure for shad trawls, established in the 1988 protocol, consisted of towing a cone-shaped net with an open end of 1 m (3.3 ft) in diameter and 1.6 mm (0.06 in) mesh screening. The net is 6 m (19.7 ft) in length, with a 25.4 cm (10 in) collecting cup on the end. The net is towed approximately 20 m (65.6 ft) behind the boat. A trawl lasts for 10 min at a boat speed of 2.0 knots (approximately at 1,000-rpm engine speed) and it is replicated three times to provide a mean. A flow meter is attached at the mouth of the net to record water movement through the net such that the volume of water sampled can be determined. Fish are counted and abundance is then converted to a value of fish/3,531.5 ft^3 (100 m^3) of water. This technique is efficient for small fish up to 20 mm (0.8 in), as larger fish tend to avoid the net and, therefore, it is an estimate of reproductive success and does not represent a true recruitment value. In 1997, after eight years of trend data, sampling was streamlined to concentrate on weekly surveys during peak shad production. Peak production values are calculated as a mean of the highest four or five weeks of shad production.

FINDINGS

Creel Survey

A total of 101 days were expended conducting creel surveys on Lake Mead, contacting 622 anglers at four sites. Boulder Harbor received the most survey effort of the four sites at 54.5% followed by Callville Bay, Echo Bay, and Hemenway (Table 1). These anglers caught 3,118 fish of multiple species for a catch rate of 1.03 fish/angler-hour (Figure 1) and 4.7 fish/angler-day. Excellent catch rates were observed throughout most of the year with the months of January, February, and April having the lowest catch rates of 0.69, 0.35, and 0.61 fish/hour, respectively. The highest catch rates were observed May through December with 0.83 to 1.68 fish/angler-hour with May and September having the highest catch rates of 1.68 and 1.65 fish/angler-hour, respectively (Figure 1). Of the 3,118 fish reported as captured, 1,350 were harvested. This resulted in a harvest rate of 0.5 fish/angler-hour and 2.2 fish/angler-day.

Since 2002, angler catch rates have exceeded the upper target catch rate of 0.75 fish/hour (Figure 2) for a water managed as a warmwater, general fishery, according to the Department's Fishery Management Concepts (NDOW). Even during the slow winter months for the past two years, angler success rates were above the minimum target catch rate of 0.25 fish/hour (Figure 1). Fish/angler rates have also exceeded the target rates of 1.0 to 2.0 fish/angler-day (NDOW) since 1991, with some of the highest angler catch rates occurring 2002 and after (Figure 3).

Species composition of harvested fish was led by striped bass at 96.7%, followed by channel catfish at 1.5%, and black bass at 1.4% (Table 2). Angling effort (angler

preference) for striped bass as a percentage of the total angling effort in 2017 increased to 70.4% of the total, with large- and smallmouth bass the second most sought after at 27.0%, bluegill at 0.5%, channel catfish and black crappie at 0.3%, and indiscriminate anglers dropping to 1% (Table 3). From a sample size of 266 harvested fish, striped bass had a mean total length of 423 mm (16.7 in) and a mean weight of 685 g (1.5 lbs), and had a mean condition factor of 1.13 K_{FL}, with 22% in poor condition. Striped bass condition was variable throughout the year with a large percentage of striped bass in poor condition due to the low shad productivity of 2016. By December, only 4.8% of the sample had a K_{FL} below 1.0 and had improved body condition (Table 4).

TABLE 1. Fishing docks (marinas) and number of days surveyed by month during the 2017 Lake Mead creel survey.

Month	Dock (Marina)				
	Hemenway	Boulder Harbor	Callville Bay	Echo Bay	Total days
January	1	5	2	1	9
February	0	4	4	0	8
March	2	5	0	1	8
April	0	6	1	2	9
May	0	5	2	1	8
June	1	4	5	0	10
July	2	3	1	0	6
August	0	5	2	1	8
September	1	4	3	1	9
October	1	4	3	1	9
November	1	5	1	2	9
December	0	5	1	2	8
Total days	9	55	25	12	101
Percent	8.9	54.5	24.8	11.9	

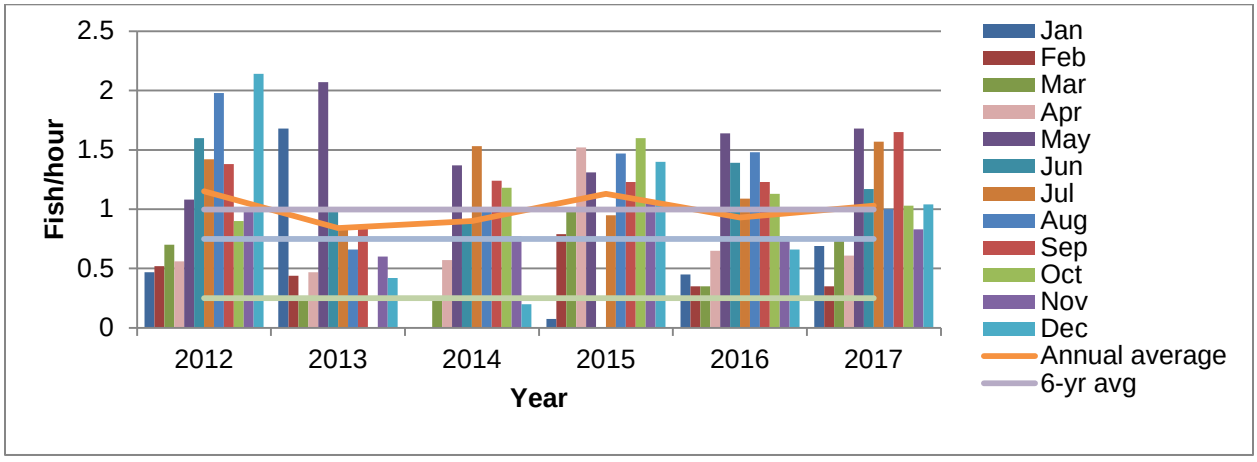

FIGURE 1. Lake Mead angler catch rates (fish/angler-hour) by month from contact creel surveys, 2012 - 2017.

Black bass percent of observed harvest decreased this year to 1.4% compared to 2.2% of the total harvest in 2016 (Table 2). This harvest figure represents only a portion of the angler use on Lake Mead for black bass because of the catch-and-release nature of this fishery, with 94.3% of black bass captured released back to the lake.

Preference black bass anglers, as a percentage of all anglers, increased to 27% (Table 3).

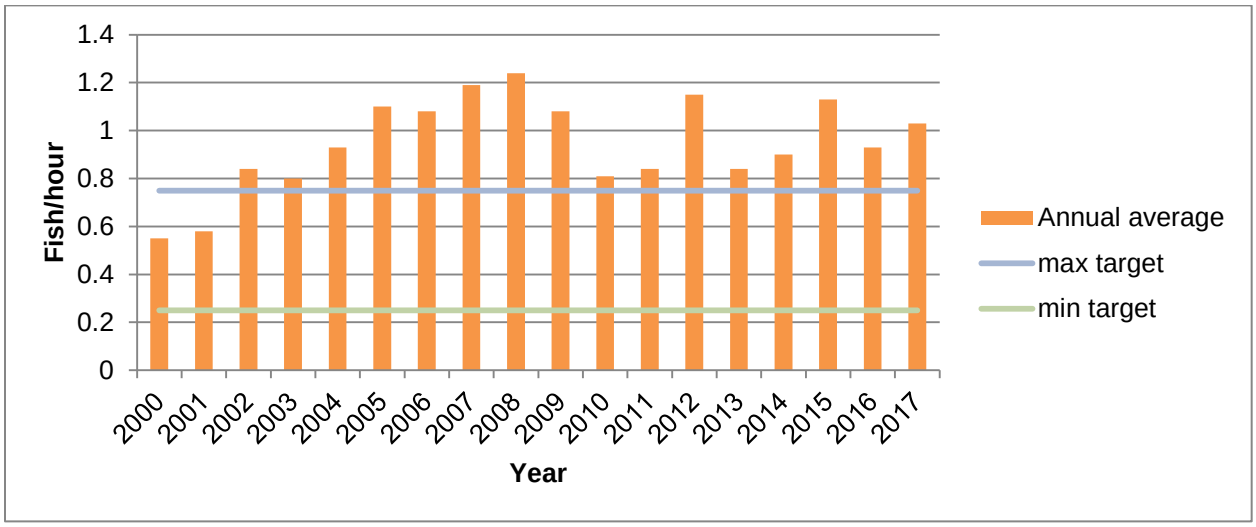

FIGURE 2. Mean catch rates (fish/angler hour) at Lake Mead from contact creel surveys, 2000-2017.

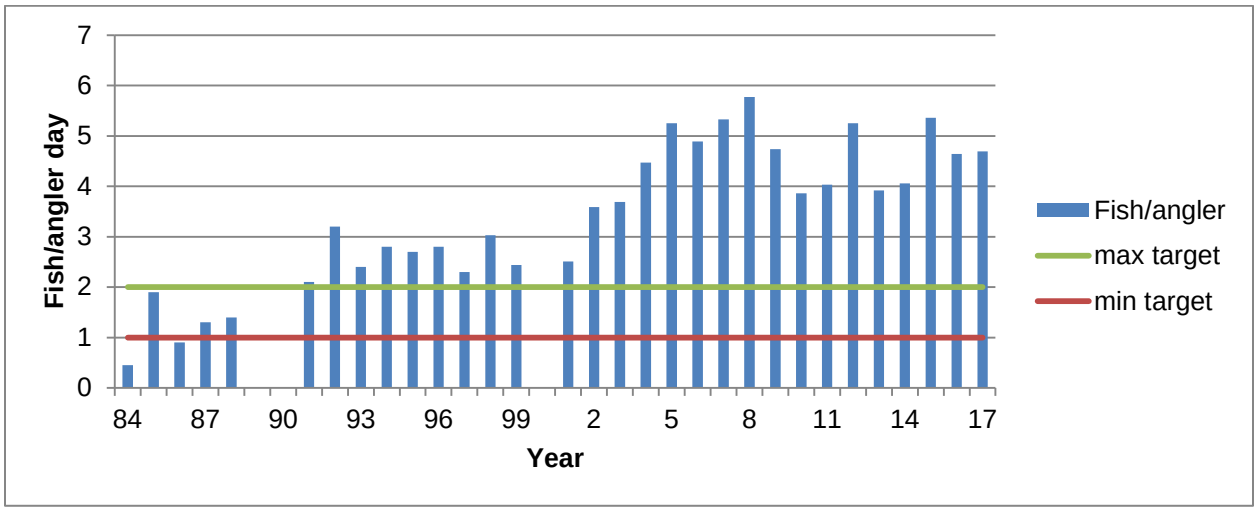

FIGURE 3. Lake Mead angler catch rates (fish/angler-day) by year from contact creel surveys, 1984 - 2017.

Channel catfish was the second most harvested fish on Lake Mead in 2017, with a harvest rate of 1.5% of the total harvest (Table 2). This rate has decreased from last year, yet was consistent with the current trend of less than 10% of the harvest since the year 2000. Interest for catfish dropped to 0.3% of the surveyed angling effort (Table 3). Interest for channel catfish has typically been under 10% of the angling effort. A total of 25 bluegill were reported in the 2017 creel survey effort, with five of these fish harvested and thereby making up 0.4% of the total observed harvest. Only one black crappie was reported captured in December from the upper Overton Arm making up 0.1% of the harvest composition.

TABLE 2. Composition of harvest by species (% of total harvest) from contact creel surveys on Lake Mead, 2007 - 2017.

Species	Year										
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Black bass	0.2	0.3	0.7	0.4	1.0	0.6	3.5	1.7	0.8	2.2	1.4
Bluegill	0.1	0.1	0	0	0.8	0.5	0.3	0	0	0	0.4
Black crappie	0	0	0	0	0	0	0.2	0	0.5	0.3	0.1
Channel catfish	2.4	3.5	3.0	5.9	7.7	3.5	4.6	2.2	2.8	2.6	1.5
Rainbow trout	4.3	2.2	7.3	12.0	3.1	0	0	0	0	0	0
Striped bass	92.9	94.0	88.9	81.6	87.4	95.2	91.4	95.6	95.8	94.8	96.7

TABLE 3. Lake Mead angler effort by species or preference (% of total angler use) from contact creel surveys, 2007-2017.

Species	Year										
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Black bass	6.1	5.4	8.0	5.1	8.7	11.2	14.8	21.0	15.0	25.6	27.0
Bluegill	0	0	0	0	0	0	0	0	0	0	0.5
Black crappie	0	0	0	0	0	0	0	0	0.5	0	0.3
Channel catfish	0.6	0.7	1.1	1.0	1.8	0.8	1.8	1.7	2.4	1.7	0.3
Rainbow trout	5.4	5.9	7.0	11.1	3.9	0	0	0	0	0	0
Striped bass	84.2	85.1	75.2	75.8	78.7	84.8	80.2	66.0	76.7	68.8	70.4
Multiple or any	3.6	2.8	8.7	7.0	6.6	3.0	2.9	9.6	4.8	3.9	1.0

TABLE 4. Striped bass mean total lengths, weights, and condition factor (K_{FL}) from 2017 monthly creel survey samples on Lake Mead.

Month	*n*	Mean total length		Mean weight		K_{FL}	K_{FL} %<1.0
		in	mm	lb	g		
January	14	17.6	447	1.6	725	1.00	57.0
February	15	18.0	456	2.0	889	1.12	6.7
March	10	19.5	494	2.1	962	1.00	50.0
April	30	16.9	428	1.6	715	1.11	20.0
May	41	16.9	428	1.8	809	1.08	24.4
June	43	15.3	390	1.2	535	1.08	11.6
July	30	16.6	420	1.5	682	1.11	20.0
September	26	16.8	428	1.5	692	1.09	38.5
October	13	15.0	380	1.2	549	1.15	15.4
November	23	15.0	382	1.2	522	1.11	21.7
December	21	16.2	412	1.5	659	1.12	4.8
Average		16.7	423	1.5	685	1.13	22.2
Total	266						

In 2017, the percentage of out-of-state anglers increased to 18.2% of anglers surveyed. Nevada anglers made up 81.8%, California 5%, Arizona 3.4%, and anglers from other states or countries made up 9.8% of angler use on Lake Mead. The percentage of California and Arizona anglers combined increased to 8.4% and anglers from other areas decreased to 9.8% (Table 5).

The Mail-in Angler Questionnaire Survey is another source of data that is used to track trends in angler use and fishing success. Each year, the previous year's angler questionnaire data becomes available, so the current angler questionnaire data is from 2016. Angler use at Lake Mead was highest in the 1980s and 1990s, with over 40,000

anglers/year. According to the questionnaire data, since 2000, angler use on Lake Mead has been on a steady decline with only occasional upturns in angler use. Data shows that angler use in 2016 increased by 2,445 anglers from the 2015 data. These anglers caught 302,196 fish (Figure 4) for a catch rate of 3.5 fish/day, down from 4.0 fish/day reported in 2015. This rate is above the 20-year mean of 3.1 fish/angler and over the maximum target rate of 2.0 fish/angler (Figure 5), as defined in the Department's Fishery Management Concepts for a general warmwater fishery (NDOW).

TABLE 5. Angler origin by state of residence (% of total angler use) from contact creel surveys on Lake Mead, 2007 - 2017.

State	Year										
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Nevada	78.5	75.5	86.0	88.6	84.8	87.0	77.6	72.7	76.5	82.7	81.8
California	3.0	3.4	2.1	1.1	2.3	1.4	1.4	2.2	5.5	2.6	5.0
Arizona	0.6	1.4	0.6	0.1	0.2	0.6	1.8	3.9	2.3	1.5	3.4
Other	17.9	19.5	11.3	10.2	12.7	11.0	19.2	21.2	15.8	13.3	9.8

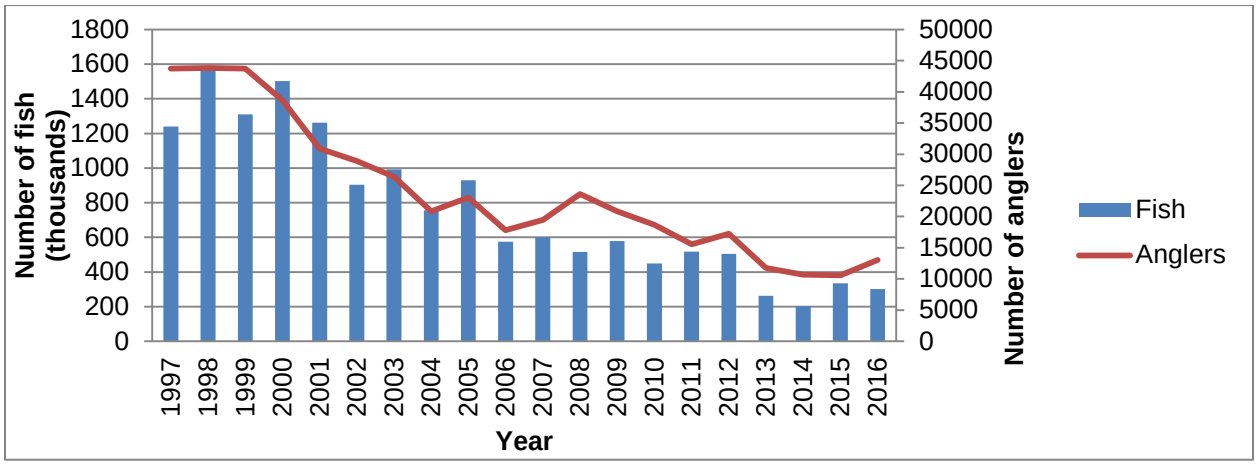

FIGURE 4. Expanded number of anglers and fish caught from the mail-in angler questionnaire data for Lake Mead, 1997 - 2016.

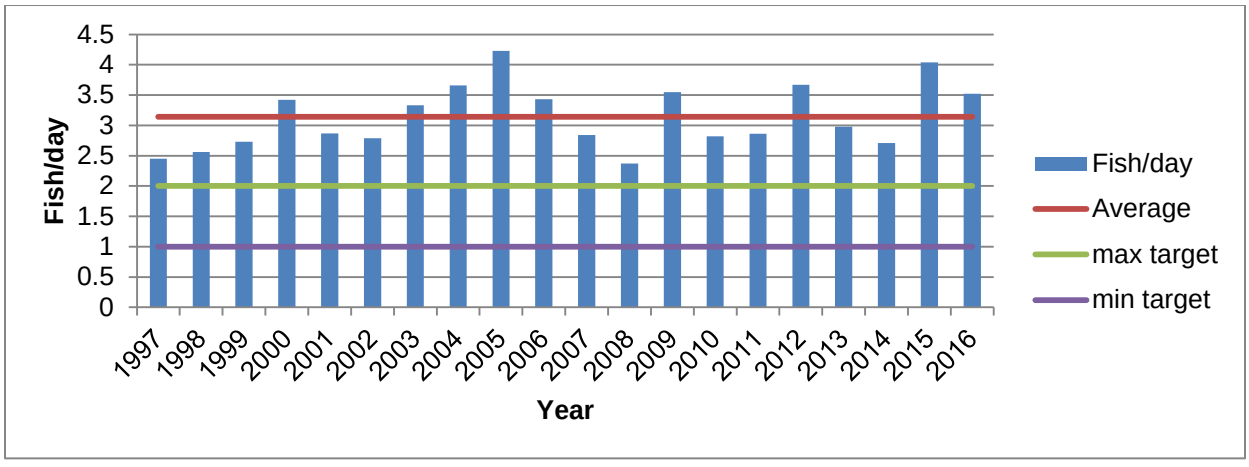

FIGURE 5. Expanded number of fish/day data from the mail-in angler questionnaire data for Lake Mead, 1997 - 2016.

Black Bass Tournament Monitoring

Ten black bass tournaments were attended to collect species composition, length, and weight data for investigating trends in the black bass fishery. Additionally, scale samples were taken and stomach contents were analyzed from the mortalities. From these mortalities, 7 largemouth bass and 65 smallmouth bass were measured and weighed. Largemouth bass had a mean total length of 402 mm (15.8 in) and a mean weight of 961 g (2.1 lbs) with a W_r of 90. The average condition improved slightly over last year's W_r of 88. Smallmouth bass had a mean total length of 384 mm (15.1 in) TL and a mean weight of 728 g (1.7 lbs) with a W_r of 84 (Table 6). The average smallmouth bass size was the same as last year though the condition was improved. The presence of smallmouth bass in the tournament catch remained high at 46% and reflected their abundance seen in the gill net survey and their importance to the black bass fishery.

Stomach content analysis was conducted on mortalities from a September tournament. The most frequent items were crayfish or fish mass. Other infrequent items found in the stomachs were insects, vegetation, lures, and some stomachs were empty. Overall, crayfish was the most occurring food item in 57% of smallmouth bass (*n*=44) and 67% of largemouth bass (*n*=*3*) stomachs. Fish mass frequency in stomachs was 11% for smallmouth bass and 0% for largemouth bass. Fish in the stomachs were too digested to identify to species. Sample sizes were small for largemouth bass due to their low mortality at tournaments. Smallmouth bass are much more susceptible to high mortality during the summer than are the largemouth bass.

Three Floy-tagged fish were captured and brought to weigh-in. These fish were tagged only one and two weeks prior to the October 16 – 18, 2017 bass tournament, so no growth was expected (Tables 6 and 7, Appendix 2). Two of the fish had lost some weight and one fish gained 10 g. The fish lengths were different by 3 - 4 mm for two of the fish and 13 mm for tagged fish 5408, likely a measuring error. Fish 5408 died and the other two-tagged fish were released in the Boulder Basin.

TABLE 6. Summary of black bass tournament mortality samples with number (*n*), length in inches (in) and millimeters (mm), weight in pounds (lbs) and grams (g), and condition expressed as relative weight (W_r).

Date	Largemouth bass						Smallmouth bass					
	n	in	mm	lbs	g	W_r	*n*	in	mm	lbs	g	W_r
4/15/2017	0	--	--	--	--	--	3	17.3	439	2.5	1117	84
9/8-9/2017	3	15.6	396	1.9	880	90	45	15	382	1.7	768	85
10/16-18/2017	4	16.0	407	2.3	1023	90	17	14.9	379	1.6	724	82
Mean		15.8	402	2.1	961	90		15.1	384	1.7	728	84
Total *n*	7						65					

TABLE 7. Floy-tag return summary from a September black bass tournament, 2017.

Floy tag #	Date tagged	Total length (mm)	Total weight (g)	Date re-captured	Total length (mm)	Total weight (g)
5408*	10/4/2017	345	500	10/17/2017	332	490
5429	10/11/2017	436	1360	10/18/2017	439	1280
5431	10/11/2017	330	430	10/18/2017	334	440

* mortality

Summer Snorkel Surveys

Snorkel surveys were completed from July 14 to August 22, 2017. A total of 11 randomly selected and two non-randomly selected coves were surveyed for a total of 13 coves. The 13 survey coves were located in the Boulder Basin (away from Las Vegas Bay).

Two divers snorkeled for a total of 664 min at 13 coves for a mean of 26 min/diver/transect. A total of 233 black bass of different ages were observed, which 110 were largemouth bass and 123 were smallmouth bass (Table 8, Figure 6). This year, smallmouth bass YOY were more abundant than largemouth bass and numbered 76 for an observation rate of 3.4 fish/30 min, compared to 42 largemouth bass YOY observed at a rate of 1.9 fish/30 min. Despite the decline in observation rates for YOY smallmouth bass, it remains higher than largemouth bass (Figure 7). Since 2014, smallmouth bass YOY observations have exceeded that of largemouth bass. This year, visibility was not an issue in most of the coves, with average visibility around 9.0 ft. Blue-green algae was not seen in the coves this year. Habitat conditions were improved this year, with lake elevation nearly 3.1 m (10 ft) higher than last year. Many of the coves had increases in aquatic vegetation or submerged tamarisk *Tamarix* spp. Vegetation cover in snorkeled coves increased to 25% this year, up from 18% in 2016.

TABLE 8. Young-of-the-year (YOY), juvenile, and adult Largemouth (LMB) and smallmouth (SMB) bass observation numbers (*n*) and rates (fish/30 min) from 2017 Lake Mead snorkel surveys.

	LMB YOY	LMB juvenile	LMB adult	LMB all	SMB YOY	SMB juvenile	SMB adult	SMB all
n	42	45	23	110	76	39	8	123
Fish/30 min	1.9	2.0	1.0	5.0	3.4	1.8	0.4	5.6

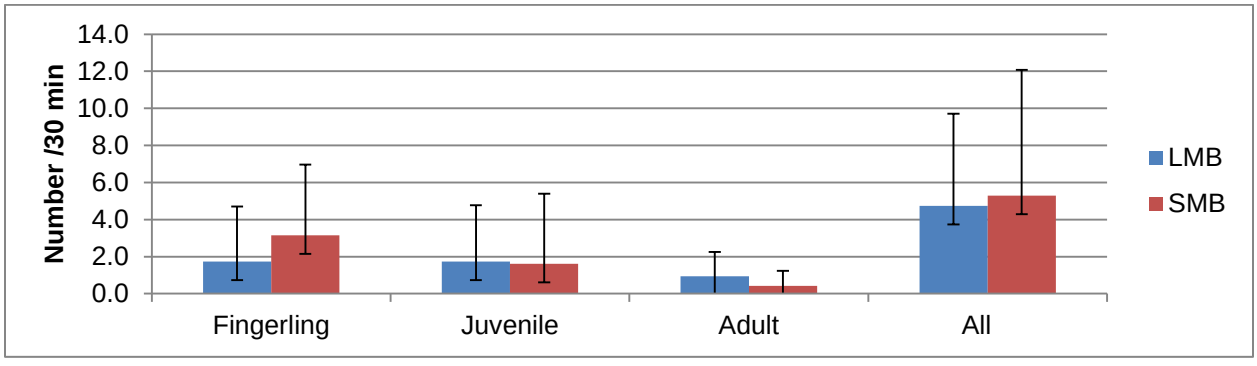

FIGURE 6. Count data from black bass snorkel surveys on Lake Mead, 2017.

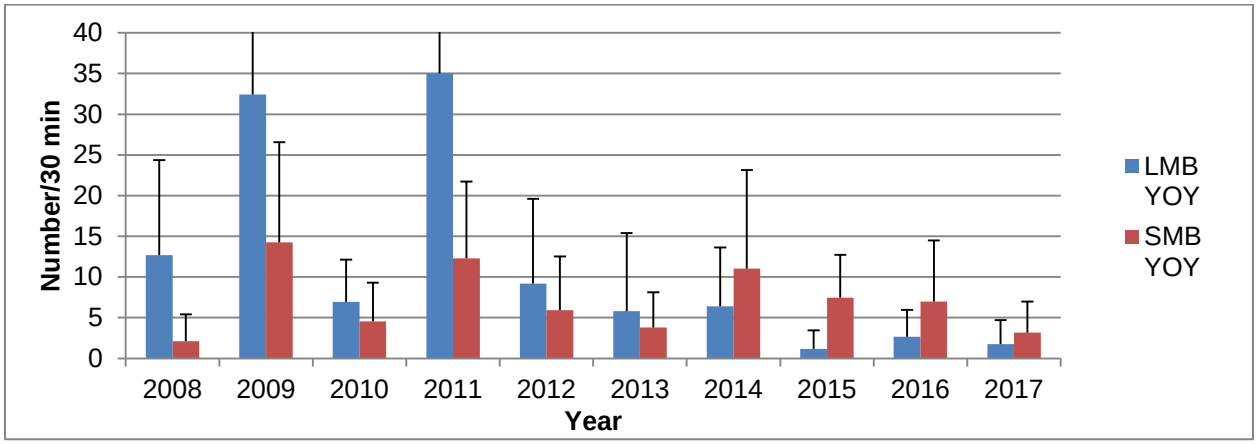

FIGURE 7. Young-of-the-year (YOY) count data from black bass snorkel surveys on Lake Mead, 2008-2017.

Black bass in the juvenile size class were similar in observations between smallmouth and largemouth bass, with slightly more largemouth than smallmouth bass (Figure 8). This comes after several years of smallmouth bass exceeding largemouth bass in the juvenile size class (Figure 8). The increase in lake elevation and resulting increase in vegetation this year may have contributed to higher juvenile and adult largemouth bass abundance.

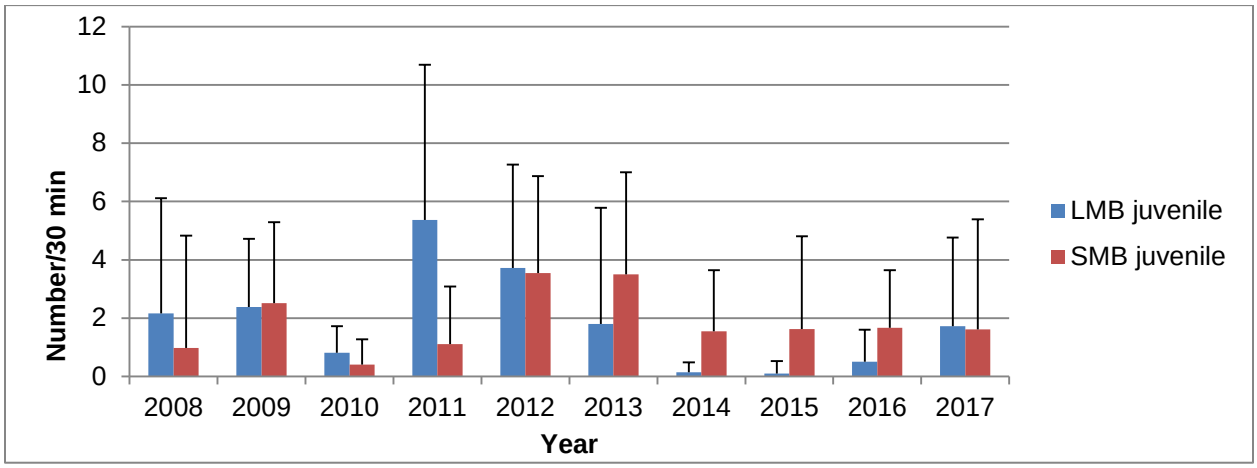

FIGURE 8. Juvenile black bass count rates from snorkel surveys, Lake Mead, 2008 - 2017.

Electroshocking Surveys

The electroshocking survey was conducted from October 10 to November 21 in conjunction with the gill-net survey. A total of 24 electroshocking sites were sampled (14 of those sites were sampled by NDOW). A total of 360.7 min of effort was expended yielding 1,740 fish of 12 species for a catch rate of 72.5 fish/15 min of effort. Bluegill and green sunfish were the most numerous species, followed by gizzard shad

and largemouth bass (Table 9). Other species represented in the catch include channel catfish, blue tilapia, bullhead catfish *Ameiurus* sp., common carp, red shiner *Cyprinella lutrensis*, and threadfin shad (Table 9). No black crappie were captured in either the Overton Arm or Virgin Basin this year.

TABLE 9. Summary catch data by species from the 2017 fall electroshocking survey on Lake Mead.

Species	*n*	CPUE (fish/15 min)	Composition (% of catch)	Mean total length		Mean weight	
				in	mm	lbs	g
Black crappie	0	0	0				
Blue tilapia	17	0.7	1	6.9	175	0.27	123
Bluegill	900	37.5	53	3.3	84	0.03	12
Bullhead catfish	2	0.08	0.1	9.2	234	0.53	240
Common carp	53	2.2	3.1	23.1	588	6.1	2746
Channel catfish	15	0.6	0.9	11.6	294	0.95	432
Gizzard shad	118	4.9	4.7	15.8	401	1.8	801
Green sunfish	443	18.5	26	2.7	69	0.01	6
Largemouth bass	98	4.1	5.8	8.3	210	0.48	217
Red shiner	1	0.04	0.1	1.5	39		<1
Smallmouth bass	40	1.7	2.4	5.9	150	0.12	54
Striped bass	23	1.0	1.4	6.8	172	0.17	77
Threadfin shad	30	1.3	1.8	3.7	95	0.02	8
Totals	1,740	72.5	100				

Striped bass CPUE in the electroshocking survey increased this year to 1.0 fish/15 min of effort. However, striped CPUE in 2017 was drastically lower than CPUE rates recorded in the mid-2000s. Striped bass CPUE has been variable but more consistent since 2009 (Figure 9). The reasons for this decline are unknown; however, McCall (1979) suggested that the area between Iceberg Canyon and Pearce Ferry was a main spawning area for striped bass. The ongoing drought and the resulting decrease in lake elevation have converted this area from a lentic environment to a riverine reach. This change to a cooler water riverine environment has changed the forage base in this area and created habitat that may be less suitable for Lake Mead striped bass reproduction.

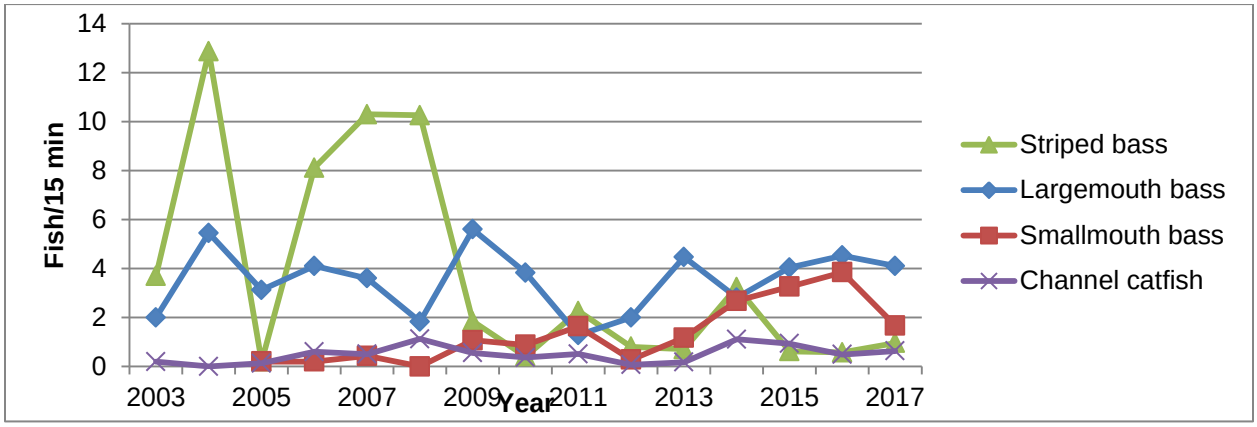

FIGURE 9. Striped bass, largemouth bass, smallmouth bass, and channel catfish CPUE (fish/15 min) from fall electroshocking surveys on Lake Mead, 2003-2017.

Largemouth bass CPUE was similar to the last two years and smallmouth bass CPUE declined sharply from last year. This may be due to the increase in lake elevation and resulting increase in vegetation and cover that favor largemouth bass. Channel catfish CPUE increased slightly from that observed in 2016 but was mostly unchanged (Figure 9, Table 10).

TABLE 10. Catch rates (fish/15 min) of all species captured during electroshocking surveys on Lake Mead, 2012 - 2017.

Species	Year					
	2012	2013	2014	2015	2016	2017
Black crappie	0	0.06	0.08	0	0.49	0
Blue tilapia	0.07	0.32	0.65	1.84	1.17	0.7
Bluegill sunfish	20.2	23.44	13.84	11.7	11.3	37.5
Bullhead catfish	0.03	0.09	0.03	0.8	0.08	0.08
Common carp	1.3	1.91	1.43	1.01	1.19	2.2
Channel catfish	0.07	0.18	1.11	0.93	0.49	0.6
Gizzard shad	0.24	2.64	2.73	4.56	2.68	4.9
Green sunfish	7.1	13.78	32.70	24.64	21.1	18.5
Largemouth bass	2.0	4.47	2.81	4.04	4.53	4.1
Rainbow trout	0	0	0.03	0	0	0
Red shiner	0.17	0.15	0.38	0.36	0.51	0.04
Smallmouth bass	0.28	1.18	2.68	3.26	3.85	1.7
Striped bass	0.8	0.71	3.24	0.62	0.57	1.0
Threadfin shad	2.49	3.53	6.14	2.44	2.3	1.3
Mosquitofish[a]	0	0.06	0	0	0	0
Totals	34.8	52.5	67.8	55.5	50.3	72.5

[a] *Gambusia affinis*

Gill Net Survey

The annual fall gill net survey was conducted from October 3 to November 14. Random sites were selected by AZGFD. A total of 100 nets were set with a mean soak time of 18.3 hours each, totaling 152 net-nights of effort (NDOW's effort was 50 nets). A total of 2,347 fish were captured for a catch rate of 15.5 fish/net-night (Table 11). The most numerous fish captured was gizzard shad at 71% of the catch, followed by striped bass (8%), smallmouth bass (5%), channel catfish (4%), and largemouth bass (4%) (Table 11). Black crappie continue to be captured in small numbers with seven caught in the upper Overton Arm and one caught in Gregg Basin.

Striped bass captured in the 2017 gill net survey had a mean total length of 362 mm (14.3 in) and a mean weight of 466 g (1.0 lb). Compared to 2016, mean total length for striped bass decreased by 25.4 mm (1.0 in) (Figure 10); however, their mean weight was similar to last year due to improved body condition. Striped bass were found to be in average condition, with a mean K_{FL} factor of 1.13 (Table 12), with 30% having a condition factor K_{FL} less than 1.0 and considered to be in poor condition. This is an improvement over the 1.02 K_{FL} observed last year. Striped bass condition observed in the 2017 October gill net survey was consistent with the annual mean condition factors found in the creel survey (Table 4). By basin, Boulder Basin striped bass had the best

condition, with the lowest percent in poor condition, followed by Overton Arm and Gregg Basin. Striped bass in Virgin Basin had the lowest condition factor with the highest percentage of fish in poor condition (Table 12).

TABLE 11. Summary of catch data from the 2017 fall Lake Mead gill net survey.

Species	*n*	CPUE (fish/net-night)	Composition (% of catch)	Mean total length		Mean weight		Percent biomass
				in	mm	lbs	g	
Black crappie	8	0.05	0.3	6.2	158	0.2	69	0.05
Blue tilapia	41	0.27	1.8	8.6	218	0.5	245	0.9
Bluegill	6	0.04	0.3	4.8	123	0.07	33	0.02
Bullhead catfish	1	0.007	0.04	10.6	270	0.5	245	0.02
Common carp	74	0.49	3.2	20.0	509	4.4	1987	13.4
Channel catfish	97	0.64	4.13	16.5	420	1.5	690	6.0
Flannelmouth sucker[a]	1	0.007	0.04	*15.7	*400			
Gizzard shad	1,659	10.97	70.7	13	331	1.1	520	64.9
Green sunfish	14	0.09	0.6	4.7	118	0.06	28	0.04
Largemouth bass	90	0.60	3.8	10.8	274	0.7	323	2.5
Razorback sucker[b]	1	0.007	0.04	25.8	656	7.4	3,350	0.3
Smallmouth bass	114	0.75	4.9	11.4	289	0.8	376	3.9
Striped bass	187	1.24	7.97	14.3	362	1.0	466	7.7
Threadfin shad	54	0.36	2.3	5.4	136	0.06	26	0.13
Totals	2,347	15.52	100					100.0

[a]*Catostomus latipinnis*
[b]*Xyrauchen texanus*

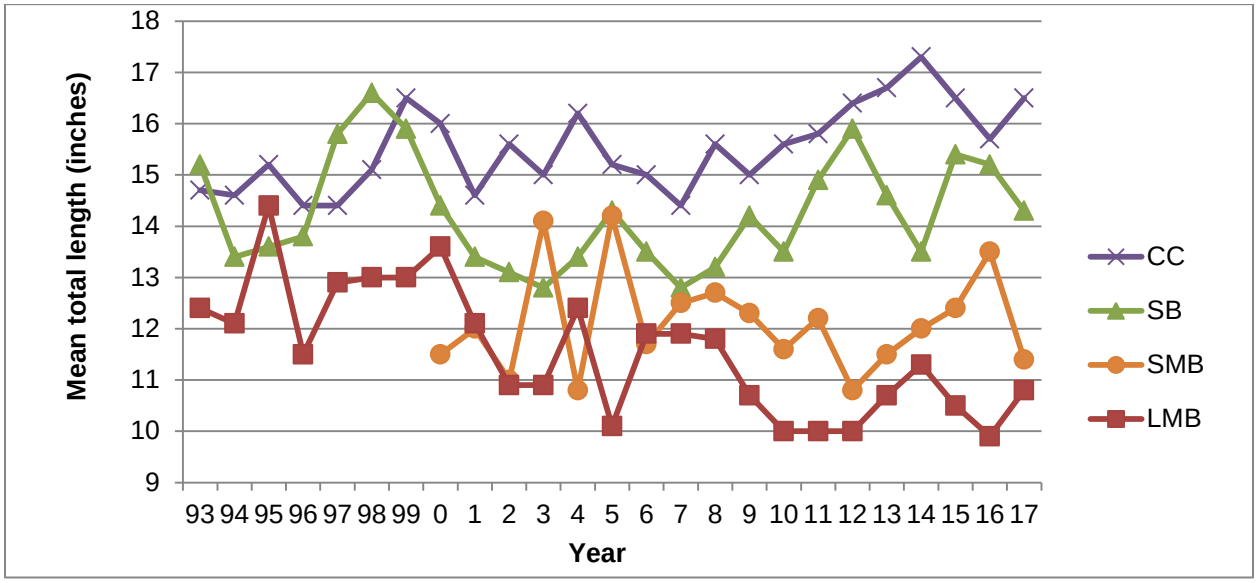

FIGURE 10. Mean total length for channel catfish (CC), striped bass (SB), smallmouth bass (SMB), and largemouth bass (LMB) captured during fall gill net surveys on Lake Mead, 1993 - 2017.

TABLE 12. Condition (relative weight [*Wr*] and Fulton's K_{FL}) of sport fish captured during 2017 gill net surveys on Lake Mead.

	Wr				K_{FL}	
Basin	Largemouth bass	Smallmouth bass	Channel catfish	Striped bass	Striped bass	% of striped bass in poor condition
Boulder Basin	91	88	88	85	1.30	4.3
Overton Arm	86	86	84	70	1.07	28
Virgin Basin	87	86	86	64	0.97	69
Gregg Basin	85	85	90	71	1.09	39
Overall average	87	88	85	73	1.13	30

The overall CPUE for striped bass decreased by 0.26 fish/net-night compared to last year (Figure 11). The CPUE varied by basin, however. The basin with the highest striped bass catch rate was Gregg Basin, with a CPUE of 1.77 fish/net-night. Boulder Basin had the second highest catch rate followed by Overton Arm and Virgin Basin having the lowest CPUE of striped bass (Table 13). Black bass CPUE also varied by basin with Gregg Basin having the highest CPUE of largemouth bass and Boulder Basin having the highest CPUE of smallmouth bass. Of the four basins, Gregg Basin had the highest CPUE of sport fish and Virgin Basin had the lowest CPUE (Table 13). Overall, Overton Arm and Boulder Basin had the highest CPUE at over 21 fish/net-nights and Virgin Basin having the lowest CPUE at 5.0 fish/net-nights (Table 13). These high catch rates were due to the large presence of gizzard shad in these areas. Gizzard shad CPUE was over 16 fish/net-night at both Overton Arm and Boulder Basin and comprised 76.8 and 73.5 % of the catch in these basins, respectively (Table 13).

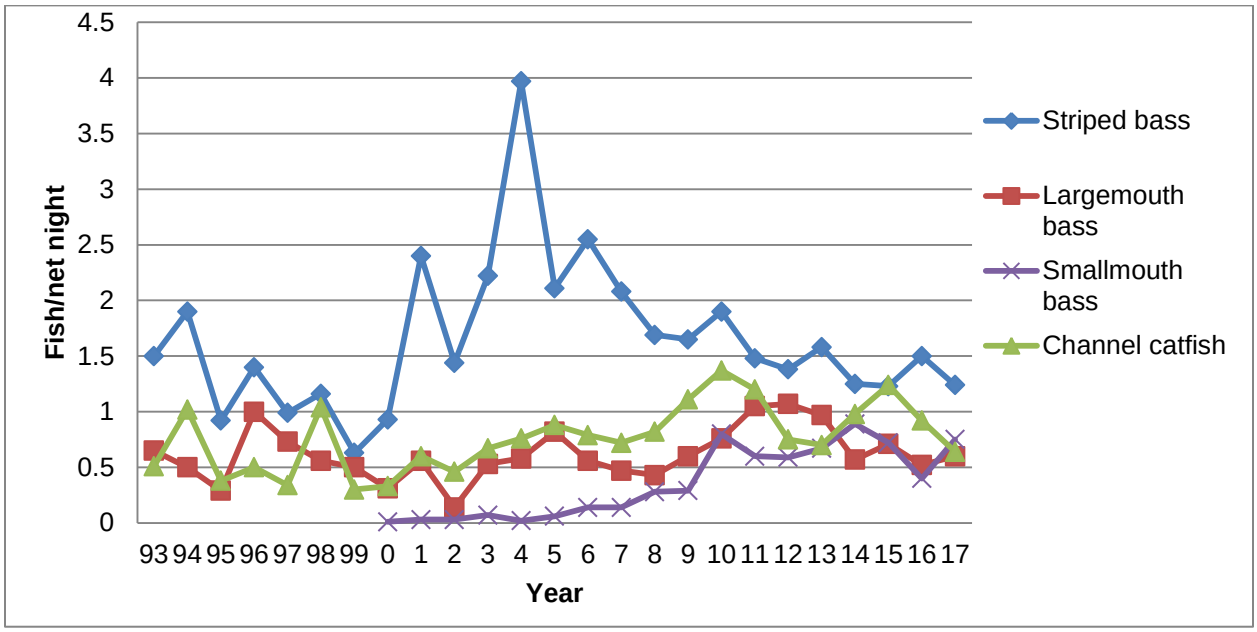

FIGURE 11. CPUE (fish/net-night) for striped bass, largemouth bass, smallmouth bass, and channel catfish from fall gill net surveys on Lake Mead, 1993 - 2017.

TABLE 13. Sport fish and gizzard shad CPUE (fish/net-night) by basin from the fall 2017 gill net survey on Lake Mead.

Species	Basin			
	Boulder	Overton Arm	Virgin	Gregg
Largemouth bass	0.60	0.48	0.41	2.56
Smallmouth bass	1.44	0.66	0.38	0.60
Striped bass	1.44	1.40	0.38	1.77
Channel catfish	0.66	0.76	0.60	0.40
Total CPUE (sport fish only)	4.14	3.30	1.78	5.30
Total CPUE (fish/net-night)(all fish)	21.8	22.0	5.0	15.9
Gizzard shad	16.0	16.9	2.8	9.1
Gizzard shad as percent of catch	73.5%	76.8%	55.0%	57.0%

Largemouth bass CPUE increased slightly to 0.60 fish/net-night compared to 0.52 fish/net-night observed in 2016 (Table 14, Figure 11). Mean total length increased to 274 mm (10.8 in) (Figure 9). The overall mean largemouth bass condition decreased slightly with a W_r of 87 (Table 12). This year, Boulder Basin had the best-conditioned largemouth bass with a W_r of 91, while Gregg Basin had the lowest W_r at 85 (Table 12). Smallmouth bass CPUE increased to 0.75 fish/net-night (Table 11) and its mean total length decreased by 50.8 mm (2.0 in), for a mean total length of 289 mm (11.4 in) (Table 11, Figure 9). The mean smallmouth bass condition expressed as W_r was 88, with the best-conditioned smallmouth bass located in the Boulder Basin at a W_r of 88 and Gregg Basin having the lowest W_r at 85 (Table 12).

TABLE 14. Mean CPUE (fish/net-night) for each species captured during fall gill-net surveys on Lake Mead, 2007-2017.

Species	Year										
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Black crappie	0.01	0.02	0.13	0.01	0.08	0	0.1	0.04	0.08	0.08	0.05
Blue tilapia	0.31	0.25	0.83	0.20	0.32	0.55	0.34	0.22	0.13	0.26	0.27
Bluegill Sunfish	0	0.06	0.09	0.02	0.04	0.10	0.06	0.04	0.03	0.06	0.04
Bullhead catfish	0	0	0.01	0.4	0.21	0.06	0.06	0.04	0.05	0.02	0.007
Carp	1.2	1.76	1.30	1.42	0.98	1.64	0.95	1.13	1.02	1.08	0.49
Channel catfish	0.72	0.82	1.11	1.37	1.20	0.75	0.70	0.98	1.24	0.92	0.64
Flannelmouth sucker	0	0	0	0.01	0	0.04	0.06	0	0	0	0.007
Gizzard shad	0.08	0.73	5.17	11.25	8.29	7.03	9.57	9.24	8.81	8.44	10.97
Green Sunfish	0.02	0.05	0.06	0.17	0.05	0.13	0.07	0.05	0.06	0.09	0.09
Largemouth bass	0.47	0.43	0.60	0.76	1.05	1.07	0.97	0.57	0.71	0.52	0.60
Northern walleye	0	0	0	0	0	0	0	0.01	0	0.007	0
Rainbow trout	0	0	0	0	0	0	0	0	0	0	0
Razorback sucker	0	0.02	0.03	0.04	0.01	0.03	0.02	0.06	0.01	0.04	0.007
Smallmouth bass	0.14	0.28	0.29	0.80	0.60	0.59	0.67	0.89	0.72	0.40	0.75
Striped bass	2.08	1.69	1.65	1.90	1.48	1.38	1.58	1.25	1.23	1.5	1.24
Threadfin shad	1.47	0.78	0.98	1.51	0.43	0.33	0.39	0.23	0.12	0.12	0.36
Total	6.53	6.89	12.24	19.5	14.75	13.72	15.5	14.75	14.2	13.54	15.52

Channel catfish CPUE decreased to 0.64 fish/net-night compared to 0.92 fish/net-night last year (Table 11, Table 14). Their mean total length decreased from last year to 420 mm (16.5 in) (Figure 10). Channel catfish condition was good with an average W_r of 85, a small decrease from 2016. Channel catfish condition varied across

basins with Gregg Basin having the best-conditioned channel catfish at a W_r of 90 (Table 12). Channel catfish were most abundant in the Overton Arm with a CPUE of 0.76 fish/net- night (Table 13). This basin also had the lowest condition with a W_r of 84 (Table 12).

Gizzard shad are well established in Lake Mead, reaching a maximum CPUE of 11.25 fish/net-night in 2010 (Table 14). They have since maintained a relatively high abundance and are the most numerous fish in the gill-net survey. In 2017, the CPUE almost reached the peak of 2010 at 10.97 fish/net-night (Figure 12). A subsample of 840 fish (50% of the catch) was measured and weighed, and the mean total length was 331 mm (13.0 in). From this subsample, the population appears to be mostly larger individuals over 300 mm total length (Figure 13). Most of these fish are not available as forage for sport fish but may be useful to anglers as cut bait.

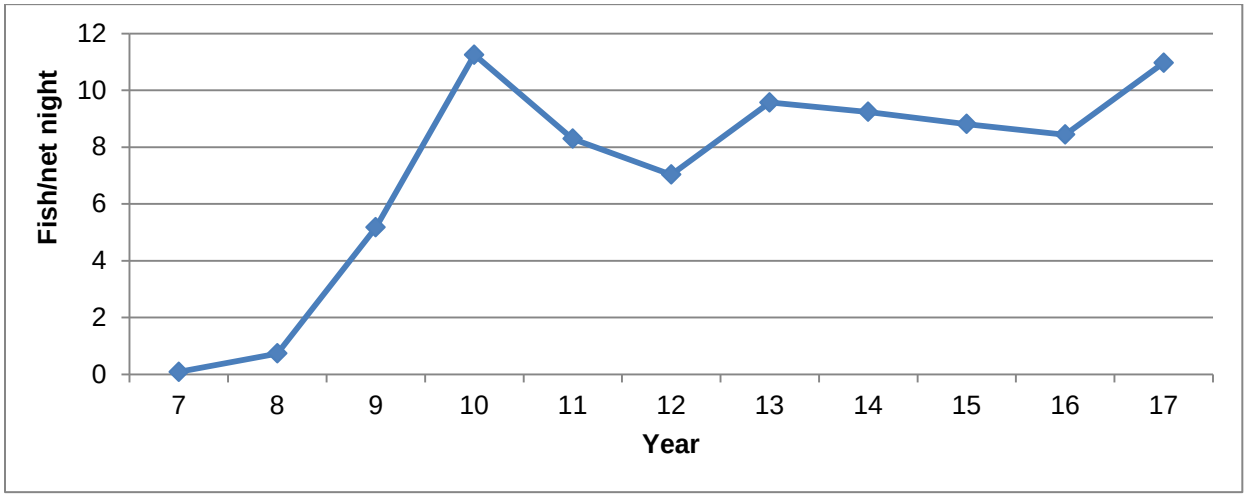

FIGURE 12. Gizzard shad CPUE (fish/net-night) from fall gill net surveys on Lake Mead, 2007 - 2017.

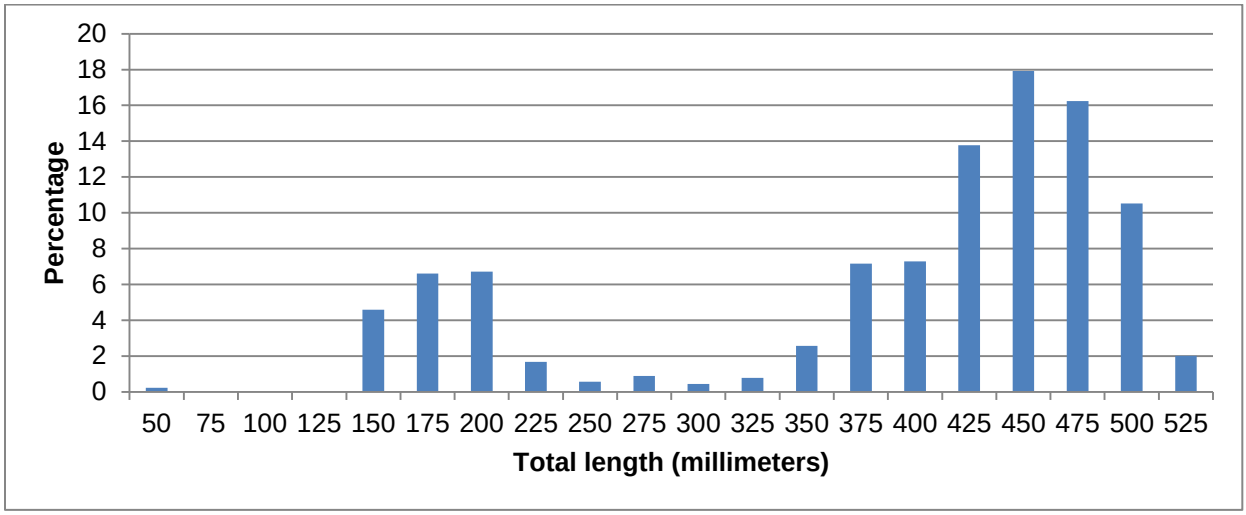

FIGURE 13. Gizzard shad length frequency distribution data from the 2017 fall gill net survey on Lake Mead.

Other species including common carp, tilapia, threadfin shad, bluegill, and black crappie were captured in the gill-net survey. Common carp CPUE has been consistent around 1 fish/net night for the past four years (Figure 14); however this year common carp CPUE declined sharply. In May, a spearfishing tournament was held at Lake Mead in which 1,603 carp weighing 4,808 kg (10,600 lbs) were removed from the lake. This likely contributed to the decline in CPUE. Bluegill and black crappie CPUE has been consistently low over the years with black crappie typically only captured in Overton Arm and Gregg Basin.

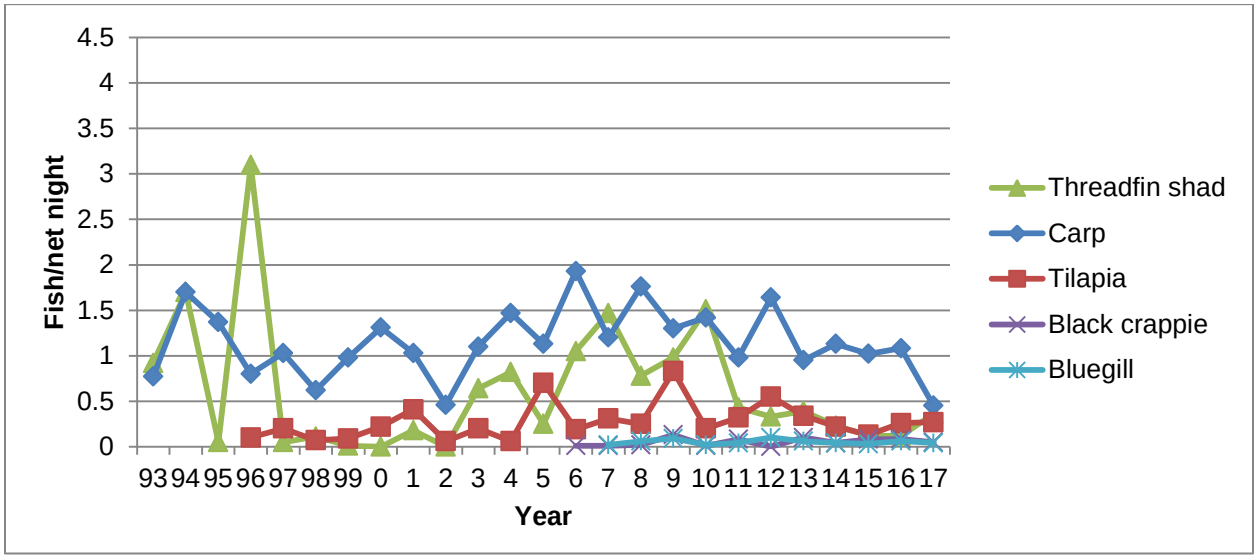

FIGURE 14. CPUE (fish/net-night) for threadfin shad, carp, tilapia, black crappie, and bluegill from fall gill net surveys on Lake Mead, 1993 - 2017.

This year, eight black crappie were captured in Overton Arm and Virgin Basin for a CPUE of 0.05 fish/net-night. Its mean total length was 157 mm (6.2 in) and mean weight was 69 g (0.2 lb) (Table 11). Seven of the black crappie were caught in the upper Overton Arm and one was caught in Gregg Basin.

Blue tilapia continues to be caught throughout the lake, though it has never achieved high abundance in Lake Mead likely due to the cool winter lake temperatures. This year, tilapia were captured in all four basins with Boulder Basin having the highest number, while one was captured in the Virgin Basin. The tilapia catch rate was low at 0.27 fish/net night (Figure 14) and unchanged from last year. Tilapia made up 1.8% of the gill net catch. Its mean total length was 218 mm (8.6 in) and mean weight was 245 g (0.5 lb) (Table 11). The highest tilapia CPUE recorded was in 2009 at 0.83 fish/net-night (Figure 14).

Two native species were captured in the gill net survey this year. A razorback sucker was caught for a CPUE of 0.007 fish/net-night. This fish was caught in the Overton Arm at Stewart's Bay. This fish was 656 mm total length and weighed 3,350 g (Tables 11 and 15). The fish was scanned and found to be a recapture. This wild razorback sucker was originally captured by BIO-WEST, Inc. near "The Meadows" area

of the Overton Arm on February 1, 2011. At that time, this female was 601 mm total length and weighed 2,480 g. No other captures were recorded for this fish. In the 6.67 years since its initial capture, the fish has gained 55 mm in total length and 870 g in weight for a growth rate of 8.25 mm/year and 130.4 g/year. The other native fish capture was a flannelmouth sucker *Catostomus latipinnis*. This fish was captured at Grebe Bay located in the Virgin Basin. The crew on the USBR boat saw the fish fall from the net before it could be brought aboard the boat, as noted on their datasheets. The total length was estimated at 400 mm (15.7 in) (Table 15).

TABLE 15. Razorback sucker (RZ) and flannelmouth sucker (FMS) capture summary from the fall gill net survey on Lake Mead, 2017.

Date	Species	Location	UTM coordinates	Total length (mm)	Weight (g)	Tag number
10/18/2017	RZ	Stewart's Bay	11S 0734315 4029454	656	3,350	3D9.1C2C2F86BA
11/1/2017	FMS	Grebe Bay	11S 0737447 3999353	*400		

*Length estimated. The fish fell from the net before it could be measured.

Prey Base Studies

Threadfin shad production was monitored from May 8 through June 20 in the Overton Arm and Boulder Basin of Lake Mead by use of a meter-trawl net. A total of 31 separate standard transects were completed. The 2017 lake-wide larval shad production estimate (peak values) on Lake Mead was above the 26-year mean of 66 shad/3,531 ft^3 [100 m^3]) (Figure 15). Both Overton Arm and Boulder Basin exhibited peak shad production, with Overton Arm having a mean production of 189 shad/3,531 ft^3 (100 m^3) and Boulder Basin a mean production of 219 shad/3,531 ft^3 (100 m^3) (Figure 15, Table 16). The Boulder Basin values are consistent with the cyclical 3-year boom and bust pattern seen with threadfin shad production. The Overton Arm pattern is not as predictable, and rarely do both basins have peak production at the same time.

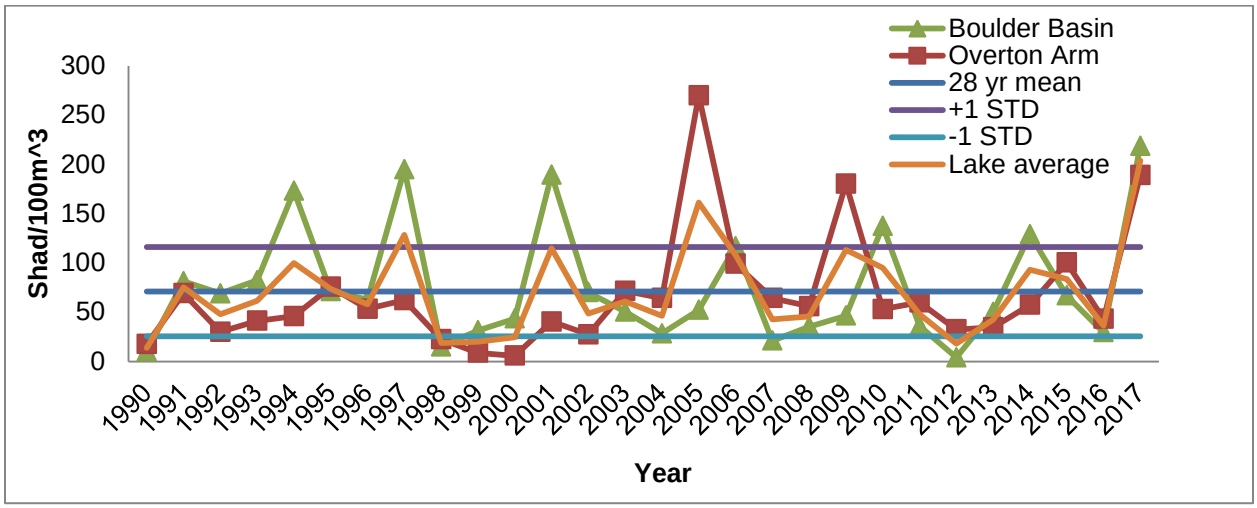

FIGURE 15. Shad densities from trawl surveys during peak production periods, 1990-2017.

TABLE 16. Lake Mead mean peak shad production from trawl surveys, 2008 - 2017. Values are number of shad/100m^3 of water sampled.

Year	Overton Arm stations					Boulder Basin stations					Lake-wide mean
	F-1	F-2	F-3	F-4	Overton Arm mean	ILVB	MLVB	OLVB*	BB	Boulder Basin mean	
2008	6	39	84	95	56	44	56		6	36	46
2009	199	295	120	108	180	84	38		18	47	113
2010	1	131	48	32	58	119	281		12	137	95
2011	37	65	77	62	60	12	83		13	36	48
2012	3	57	45	26	33	2	9		2	4	18
2013	2	34	42	62	35	73	69		5	49	42
2014	34	118	39	39	58	187	175		25	129	93
2015	95	129	89	89	100	Dry	124	23	54	67	84
2016	38	74	34	26	43	Dry	41	31	17	30	36
2017	143	134	245	235	189	Dry	314	305	37	219	204
28-year average											71

*New transect started due to the loss of ILVB from low water conditions.

Striped Bass Fisheries Assessment

Harvested striped bass were similar in size and condition to last year. The mean total length was 423 mm (16.7 in) and the mean weight was 685 g (1.5 lbs) with a mean condition factor of 1.13 K_{FL}. Of the 266 striped bass sampled in the creel surveys, 22.2% had a condition factor less than 1.0 K_{FL} (a value considered to represent poor condition) (Table 4). Angling preference for striped bass showed a slight increase to 70% of the total observed preference (up from 69% last year) (Table 3). Harvest rates increased to 0.59 fish/hour (compared to 0.55 fish/hour in 2016). Fish/day rates for successful striped bass preference anglers decreased slightly to 3.4 fish/day (compared to 3.5 fish/day in 2016). The striped bass percent of total observed harvest has remained high at 96.7% (Table 2).

In the fall gill net survey, 187 striped bass were caught. They had a mean total length of 362 mm (14.3 in), a mean weight of 466 g (1.0 lbs) (Table 11), and had a mean condition factor of 1.13 K_{FL} (Table 12), an increase from the 1.02 K_{FL} observed in 2016. The mean total length for striped bass length was 25.4 mm (1.0 in) shorter than last year (Figure 10). CPUE in the gill net survey decreased for striped bass from 1.5 fish/net-night to 1.24 in 2017 (Table 14, Figure 16). This capture rate falls below the 25-year mean of 1.64 fish/net-night, though is within ±1 standard deviation from the mean (Figure 16). Striped bass proportional stock density (PSD) (using Equation 1) from the gill net survey shows the population structure continues to be comprised mostly of small fish with less than 10% of the catchable-sized (≥13 in [330 mm]) striped bass being over 20 in (508 mm) (Figure 17). The length frequency distribution also shows this trend with three major size classes of striped bass; however, few are over 20 in (508 mm) (Figure 18).

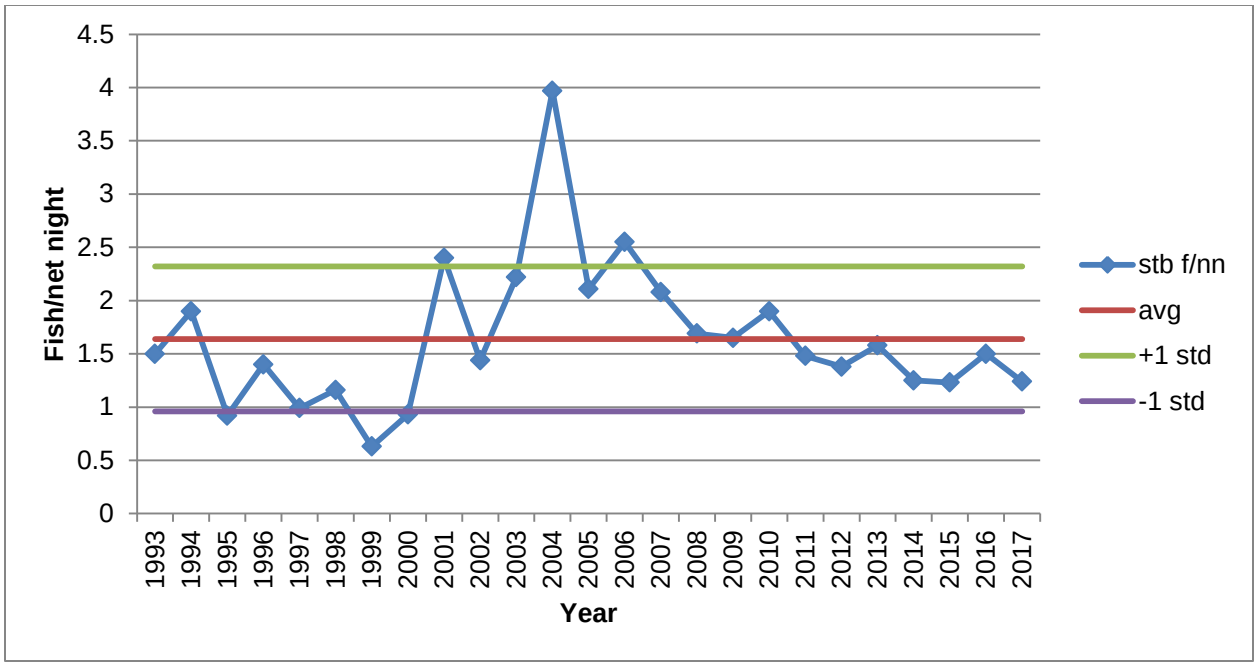

FIGURE 16. Striped bass CPUE (fish/net-night) from the fall gill net surveys with mean and ±1.0 standard deviation.

Striped bass proportional stock density is given by the following equation:

$$\text{Striped bass PSD} = \frac{number\ of\ fish \geq 20\ in\ (51\ cm)}{number\ of\ fish\ \geq 13\ in\ (33\ cm)} \times 100$$

Equation adapted from Anderson and Neumann 1996 (1)

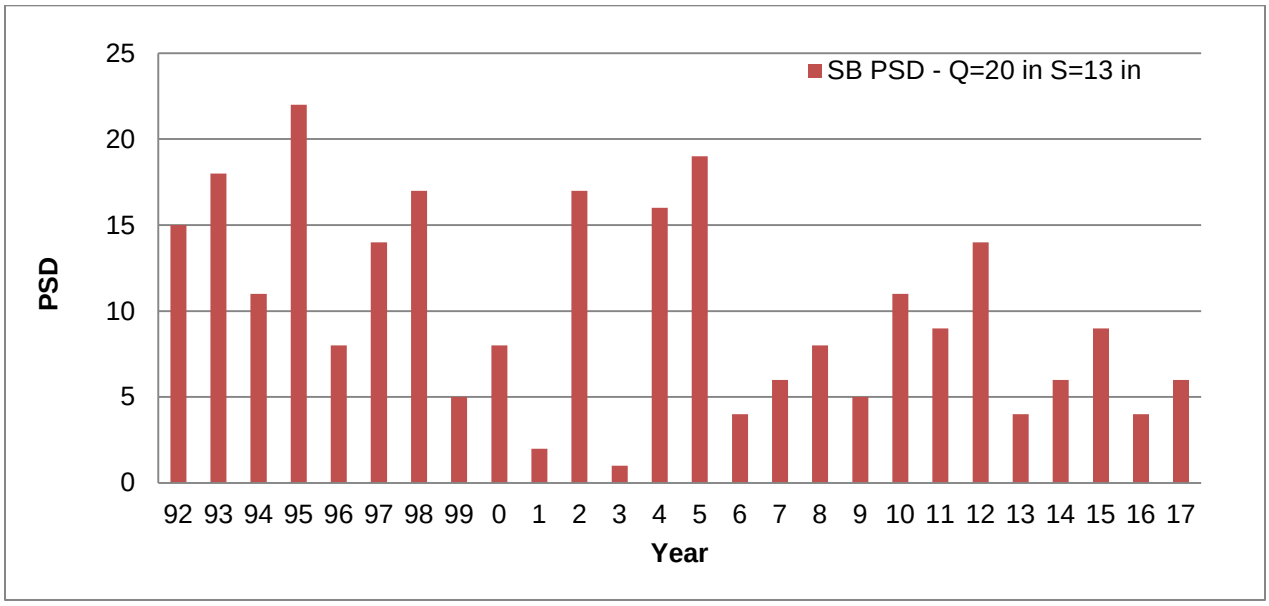

FIGURE 17. Striped bass proportional stock density (PSD) from Lake Mead gill net surveys, 1992 - 2017.

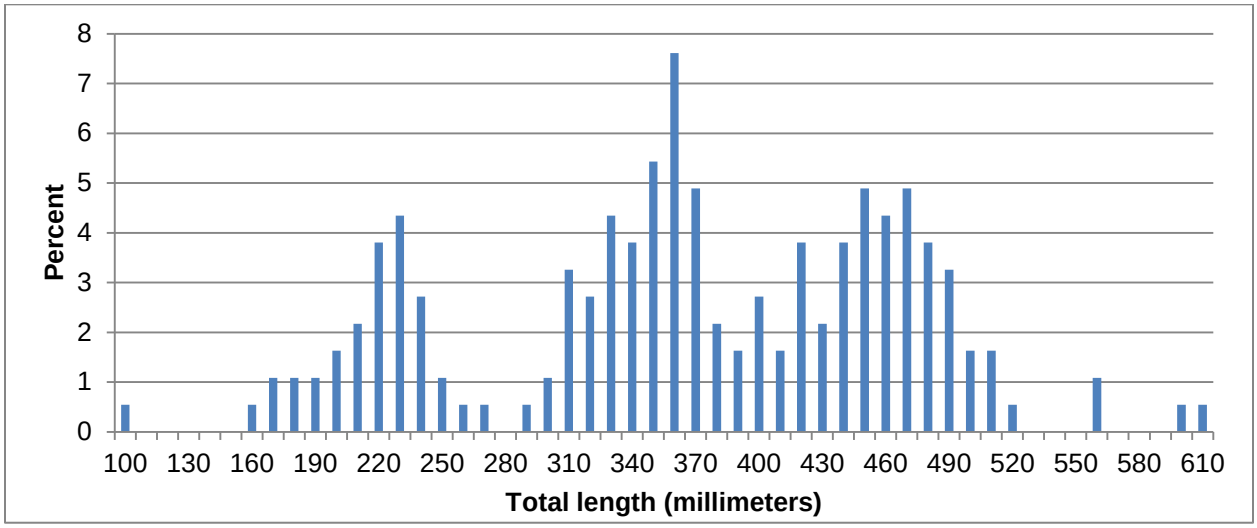

FIGURE 18. Striped bass length frequency distribution from 2017 fall gill net survey on Lake Mead.

Striped bass stomach content and body condition analysis from tournament caught fish

In addition to the NDOW surveys, striped bass data has been volunteered from tournaments held by the Nevada Striper Club for many years. This information helps to identify changes in diet, body condition, and size of fish over time. Tournaments are typically attended on a quarterly basis in March, June, September, and December. A subsample of 50 fish per tournament is sampled, except when fewer fish are brought to the weigh-in or tournament members opt out. With this sampling method, the first 50 fish brought to weigh-in are sampled.

During the weigh-in, anglers place plastic tags on their four fish with their name and fish number. After the fish is weighed on tournament scales, the fish is measured by NDOW staff, information is recorded to match fish number with length and weight information, and then the fish is placed in a cooler with ice. After 50 fish are obtained, they are taken to the fish cleaner where stomach contents are examined and recorded. Stomach contents were calculated as percentage of occurrence. Body condition was calculated using Fulton's K_{FL}.

A total of 182 fish were sampled and had a mean total length of 472 mm (18.6 in) and a mean weight of 892 g (2.0 lbs). The mean condition factor K_{FL} was 1.06, with 36% in poor condition and a K_{FL} <1.0, a value that indicates poor body condition. By season, the largest fish were caught in September and had a mean total length of 490 mm (19 in). For the rest of the sampling dates, striped bass had a mean total length of 457 mm (18 in). The largest single fish sampled weighed 2,223 g (4.9 lbs), which was caught in March. Overall, the catch had a mean total length that was 28 mm (1.1 in) smaller than last year, yet only 91 g (0.2 lbs) lighter due to their improved body condition. Striped bass were in poor condition much of the year due to the poor shad

production of 2016. By December, striped bass condition improved and 100% of the sample was in good condition.

The stomach contents reflect the access and availability of food resources to the striped bass. In March and June, stomach contents were primarily of lower quality food items such as anchovy and crayfish, and little in the way of shad or other fish mass. During these two months, over 50% of the sample was in poor condition. Shad and other fish were available in the fall and winter and striped bass condition began to improve with a smaller percentage of the sample in poor condition. By December, the diet was comprised of higher quality food items of shad and fish and all striped bass in the sample were in good condition (Table 17). No quagga mussel or New Zealand mud snails were observed in stomachs as they were last year.

Scale samples from the March tournament were obtained from nine fish for use in the striped bass aging study (Appendix 1).

TABLE 17. Summary of stomach contents, total length, weight, and condition of tournament-caught striped bass samples, 2017.

		% of food item by occurrence					Total length, weight, and condition			
Date	*n*	Shad	Fish mass	Crayfish	Anchovy	Quagga mussel or clams	Mean length (mm)	Mean weight (g)	Mean condition (K_{FL})	% below K_{FL} 1.0
3/12/2017	50	2	6	2	58	0	475	862	1.0	54
6/11/2017	32	3	3	16	34	0	462	776	0.99	53
9/17/2017	50	20	38	2	0	0	490	953	1.0	38
12/12/2017	50	14	36	2	0	0	456	951	1.23	0
Average							471	886	1.06	36
Total	182									

Black Bass Fisheries Assessment

Summer dive surveys showed a higher abundance of smallmouth bass over largemouth bass in the YOY age class, the juvenile age class had nearly the same observations between species, and adult largemouth bass were more abundant than adult smallmouth bass (Table 8, Figure 6). YOY smallmouth bass observations were decreased from that of the last two year, but were observed nearly two times more than YOY largemouth bass (Figure 7). Largemouth bass YOY observations were low for the past three years, although juvenile observations were triple what they were last year (Figure 8).

The gill net surveys showed increases in CPUE for both large- and smallmouth bass. For largemouth bass, it was only a slight increase, but for smallmouth bass, CPUE almost doubled from 0.4 to 0.75 fish/net-night. The largemouth bass CPUE was close to the long-term mean of 0.62 fish/net-night (Figure 19). The smallmouth bass CPUE was above the 10-year mean of 0.60 fish/net-night and closer to the mean plus ±1.0 standard deviation (Figure 20).

The electroshocking survey rates showed largemouth bass CPUE was similar to last year at 4.1 fish/15 min, while smallmouth bass CPUE declined to 1.7 fish/15 min. This was less than half of what was observed last year and supported the findings of the snorkel survey that also showed a decline in YOY to about half of what was observed last year (Table 10).

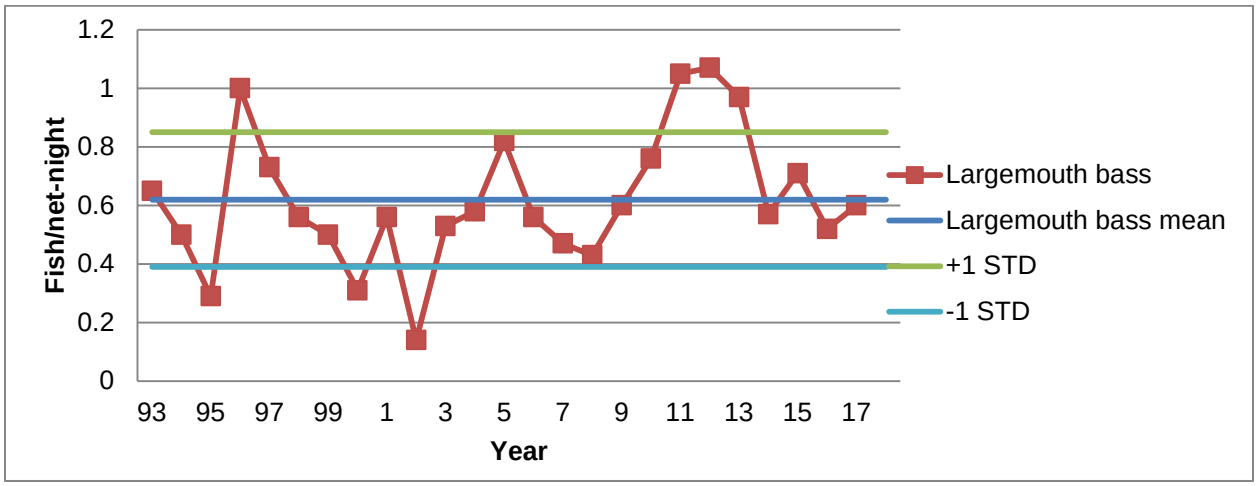

FIGURE 19. Largemouth bass CPUE (fish/net-night) from fall gill net surveys, 1993 - 2017.

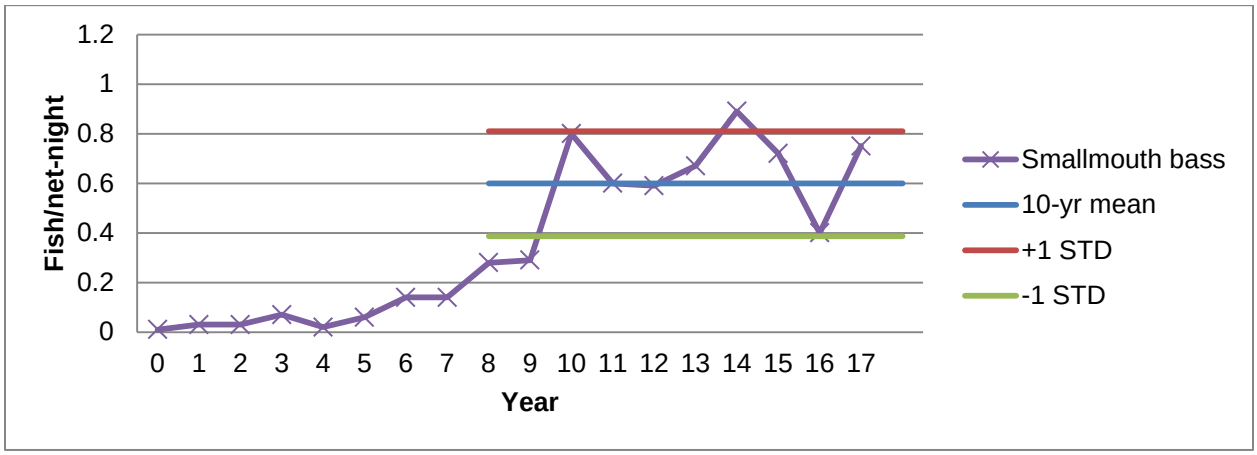

FIGURE 20. Smallmouth bass CPUE (fish/net-night) from fall gill net surveys, 2000 - 2017.

From the lake-wide gill net survey sample, the size structure of the largemouth bass fishery is made up of mostly fish measuring 203 - 305 mm (8 - 12 in) total length (69%), with 18% of the fish measuring over 305 mm (12 in) total length, as shown in the length frequency distribution (Figure 21). The proportional stock density (PSD) for the largemouth bass fishery shows a decrease in the percentage of quality 305 mm (12 in) total length and preferred length 381 mm (15 in) total length fish this year, using Equation 2 (Figure 22). There were no memorable length largemouth bass this year. With these values, the largemouth bass fishery is best classified under a balanced management strategy (Anderson and Neumann 1996).

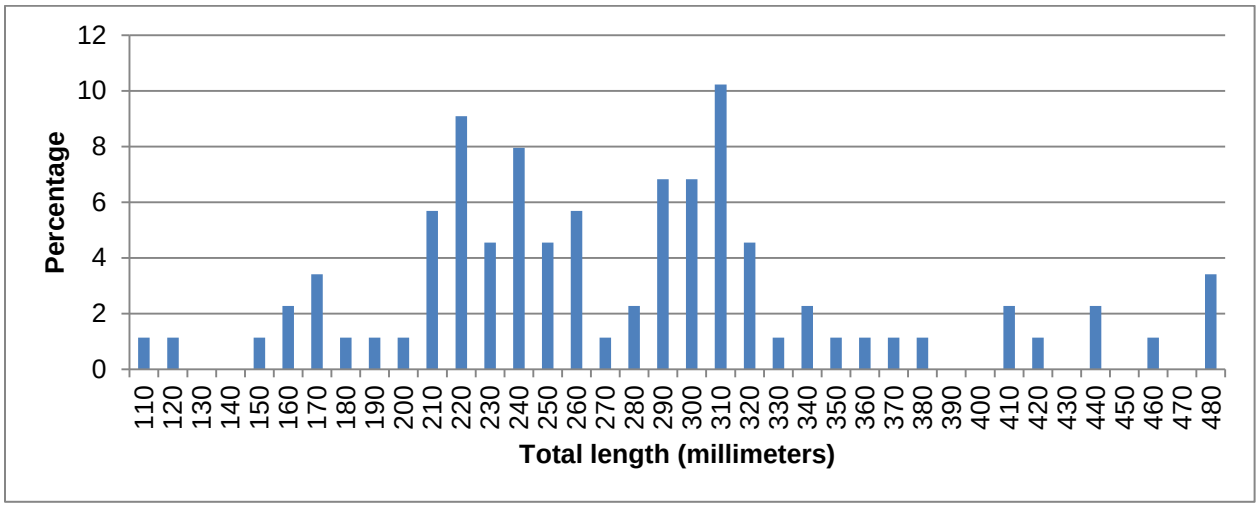

FIGURE 21. Largemouth bass length frequency distribution from fish captured during the 2017 Lake Mead gill net survey.

Largemouth bass proportional stock densities given by the following equations:

$$\text{Largemouth bass PSD quality length} = \frac{number\ of\ fish \geq 12\ in\ (30\ cm)}{number\ of\ fish\ \geq 8\ in\ (20\ cm)} \times 100$$

$$\text{Largemouth bass RSD preferred length} = \frac{number\ of\ fish \geq 15\ in\ (38\ cm)}{number\ of\ fish\ \geq 8\ in\ (20\ cm)} \times 100$$

$$\text{Largemouth bass RSD memorable length} = \frac{number\ of\ fish \geq 20\ in\ (51\ cm)}{number\ of\ fish\ \geq 8\ in\ (20\ cm)} \times 100$$

Equation adapted from Anderson and Neumann 1996 (Equation 2)

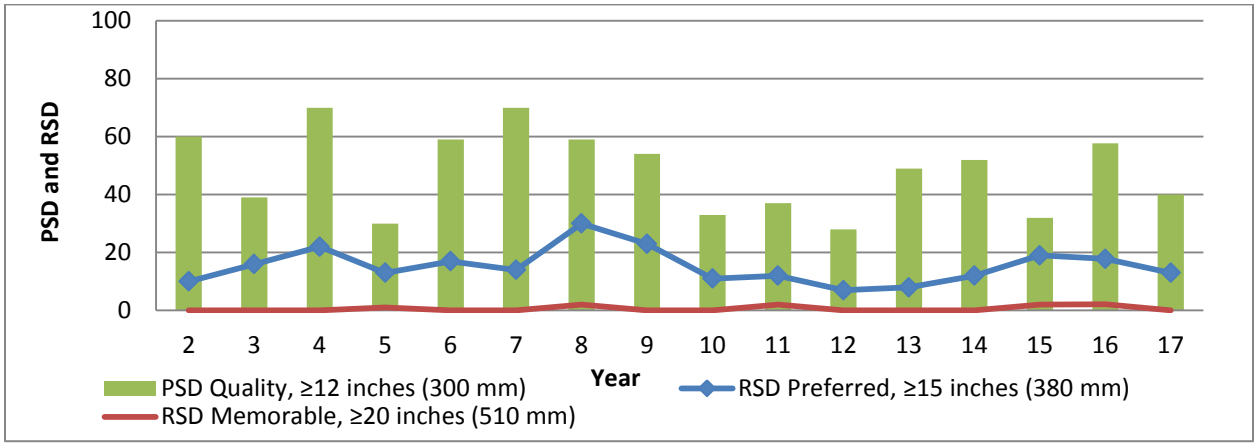

FIGURE 22. Largemouth bass proportional stock density (PSD) and relative stock density (RSD) from fall gill net surveys on Lake Mead, 2002 - 2017.

The smallmouth bass length frequency distribution shows the population is comprised of mostly of 221 - 360 mm (9 - 14 in) fish (70%) (Figure 23). The PSD (using Equation 3) shows almost 62% of the sample are over 280 mm (11 in) total length (quality length) or greater, 18% are 350 mm (14 in) total length (preferred length) or greater, and 5% are 432 mm (17 in) total length (memorable length) or greater (Figure 24). These results show a drop in larger fish, yet over 60% of the fish (stock length and greater) are quality length.

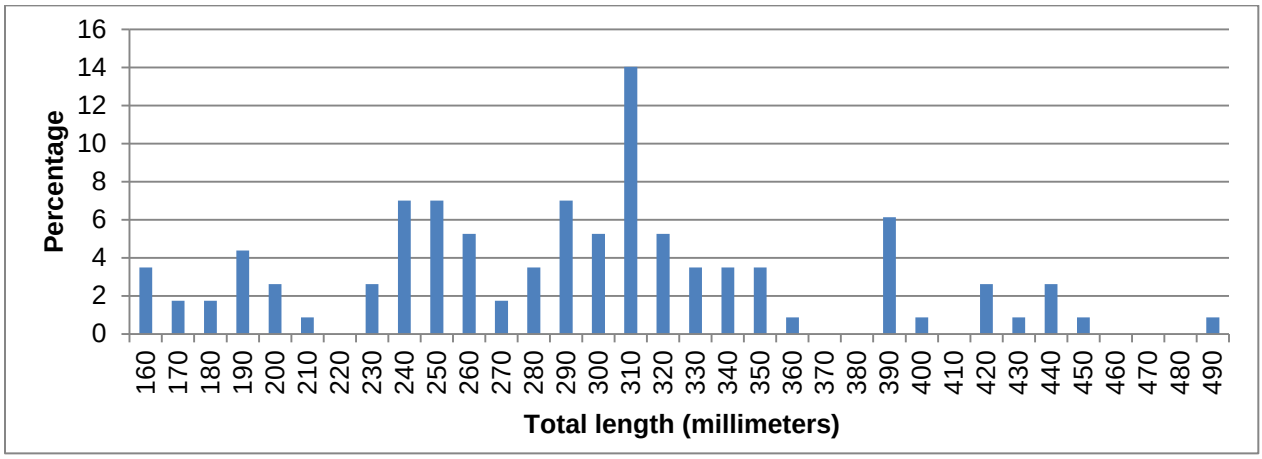

FIGURE 23. Smallmouth bass length frequency distribution from fish captured during the 2017 Lake Mead gill net survey.

Smallmouth bass proportional stock densities given by the following equations:

$$\text{Smallmouth bass PSD quality length} = \frac{number\ of\ fish \geq 11\ in\ (28\ cm)}{number\ of\ fish\ \geq 7\ in\ (18\ cm)} \times 100$$

$$\text{Smallmouth bass RSD preferred length} = \frac{number\ of\ fish \geq 14\ in\ (35\ cm)}{number\ of\ fish\ \geq 7\ in\ (18\ cm)} \times 100$$

$$\text{Smallmouth bass RSD memorable length} = \frac{number\ of\ fish \geq 17\ in\ (43\ cm)}{number\ of\ fish\ \geq 7\ in\ (18\ cm)} \times 100$$

Equation adapted from Anderson and Neumann 1996 (Equation 3)

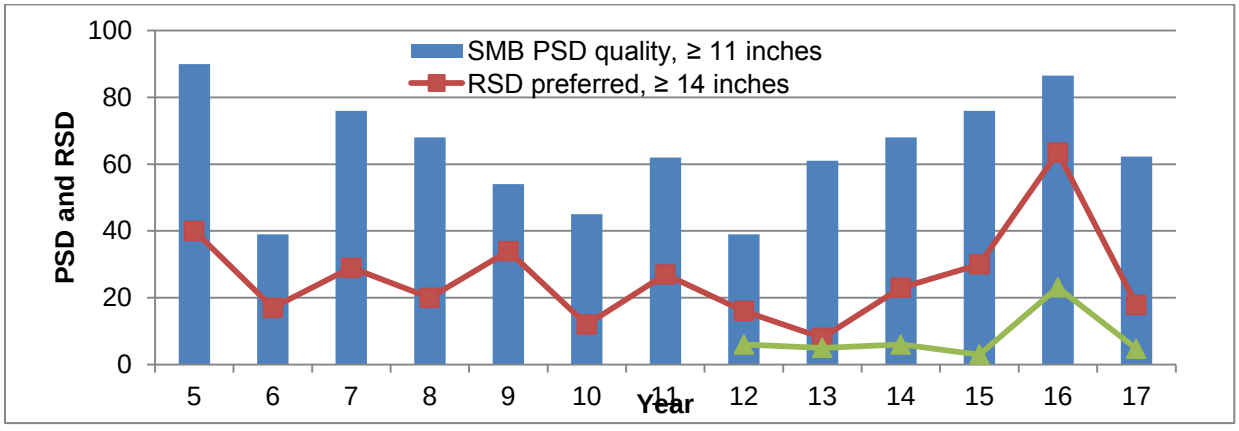

FIGURE 24. Smallmouth bass proportional stock density (PSD) and relative stock density (RSD) from fall gill net surveys on Lake Mead, 2005 - 2017.

Smallmouth bass continue to be brought to tournament weigh-ins in large numbers. This year, smallmouth bass averaged 46% of the weigh-in, with fall and winter months having higher percentages. Samples taken from tournament mortalities found largemouth bass had a mean total length of 402 mm (15.8 in), with a mean weight of 961 g (2.1 lbs) and a mean W_r of 90; smallmouth bass had a mean total length of 384 mm (15.1 in), a mean weight of 728 g (1.7 lbs), and a mean W_r of 84 (Table 6). Large- and smallmouth bass W_r increased this year compared to last year's W_r of 88 and 82, respectively. Despite a decline in recreational angler use on Lake Mead, bass tournament use is steady. A total of 49 bass tournaments were permitted through the National Park Service, with 42 of held on the Nevada side and seven on the Arizona side. Four of the Nevada tournaments had 100 or more anglers. The busiest months for tournaments were March, April, and May with six to eight tournaments per month.

Channel Catfish

Channel catfish abundance dropped for the second year. In the gill net survey, it was 0.64 fish/net-night, compared to 0.92 fish/net-night last year (Table 11, Table 14). Mean total length increased to 420 mm (16.5 in) (Figure 10), with a slight increase in PSD as well (Figure 25). The PSD shows that 72% of stock size fish (280 mm [11 in] total length) and greater was over 410 mm (16 in) total length (Figure 25). This is the fourth year of a PSD around 70, indicating a large abundance of quality-sized channel catfish. Figure 26 shows the distribution of channel catfish in this year's survey with a large number of fish (41%) between 421 – 490 mm (16.6 - 19.3 in) total length. Channel catfish were in good condition with an average W_r of 85, a small decrease from 2016. Channel catfish W_r ranged from 84 to 90 across all basins (Table 12). Gregg Basin showed the most robust fish with a W_r of 90. They were most abundant in the Overton Arm and least abundant in Gregg Basin (Table 13). Angler preference and harvest of channel catfish remains low with angling effort at 0.3% of the total effort, the lowest it has been in 10+ years (Table 3) and harvest at 1.5% of the total harvest (Table 2). Over 50% of the channel catfish reported in the creel survey were released.

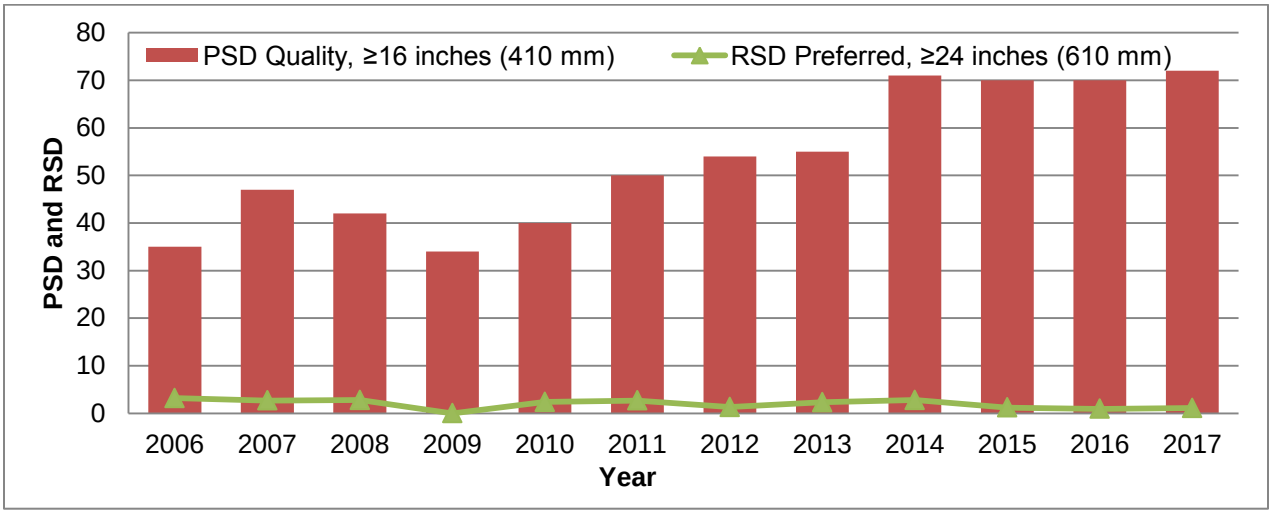

FIGURE 25. Channel catfish proportional stock density (PSD) and relative stock density (RSD) from fall gill net surveys, 2006 - 2017.

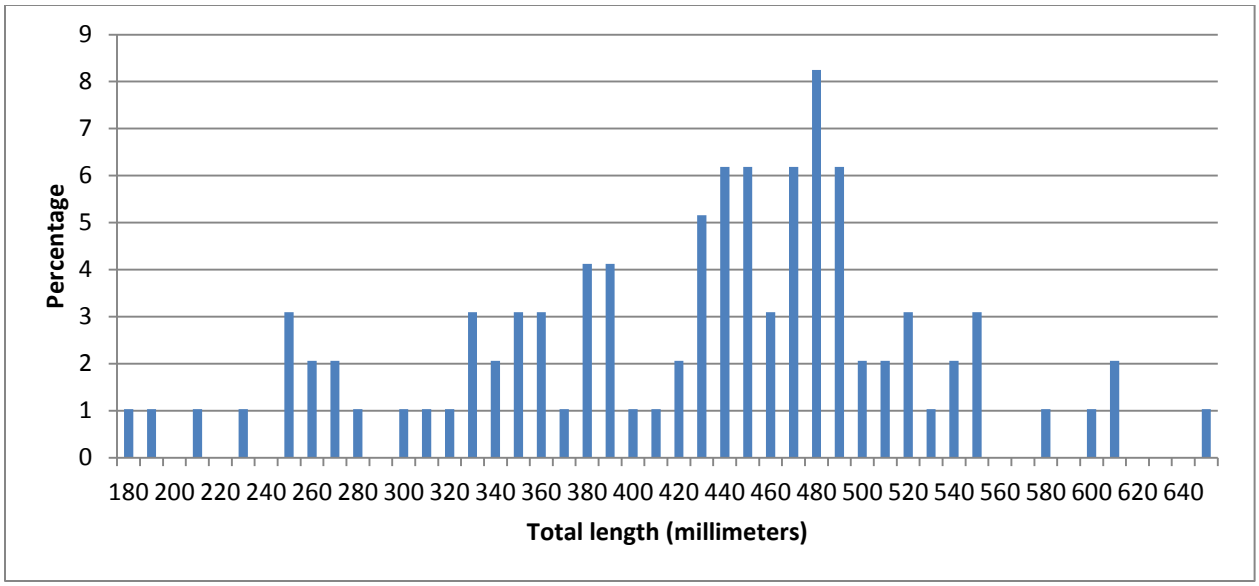

FIGURE 26. Channel catfish length frequency distribution from the fall gill net survey, 2017.

Salmonid Fisheries Assessment

No trout were stocked and no trout species were captured in Lake Mead surveys in 2017.

Lake Mead Fisheries Habitat Enhancement Study

Aquatic vegetation is important as cover for young fish to avoid predation, as a food source and habitat for aquatic invertebrates, and as a place for adult bass to congregate and feed. With Lake Mead's fluctuating lake elevation, aquatic vegetation is limited. During times of lake elevation increases, shorelines flood and provide inundated tamarisk and other vegetation for fish cover. However, these times are short lived and conditions soon return to an environment devoid of cover.

Artificial habitat has been used successfully in reservoirs to increase cover and attract fish for many years. Lake Mohave is one such reservoir where artificial habitat attracts and concentrates fish in an otherwise barren substrate. The purpose of this multi-year study is to identify habitat structures that can be deployed in Lake Mead, identify areas of Lake Mead suitable for habitat enhancement, and demonstrate successful movement of habitat structures. Because of Lake Mead's fluctuating lake elevation and current drought conditions, these habitat structures will need to be moveable. This project takes place at Bass Cove in Lake Mohave under the current Lake Mohave Fisheries Enhancement Study. Upon successful demonstration of movement and effectiveness at attracting fish, habitat structures will be proposed to the National Park Service for use in Lake Mead.

Potential habitat sites

During the first year of the study (2014), suitable sites were located in Boulder Basin and included Boulder Beach near the fishing pier, Finger/Fire Bowl Cove, and Lovers Cove. These sites were chosen due to their gradual depth contours from 25 - 50 ft (7.5 - 15 m), their proximity to launch ramps, and distance from endangered razorback sucker habitat (NDOW[b]). As lake levels change, additional suitable sites may be discovered.

Habitat

Habitat structure designs were primarily based on PVC designs currently in use at Lake Mohave (Figure 27 and 28). Additional designs including Fishiding (reclaimed PVC siding material) (Figure 29) and catfish condos (Figure 30) were included in the study. In 2015, 47 Fishiding structures, 2 PVC structures, and 4 catfish condos were deployed at Bass Cove (NDOW[b]). In 2016, two additional PVC structures were installed and, in 2017, 61 Fishiding structures and two four-cube structures were installed.

FIGURE 27. Three-cube PVC habitat structure.

FIGURE 28. Four-cube PVC habitat structure.

Habitat Assessment

In 2017, the installed habitat was assessed through a spring gill net survey, a fall trammel-net survey, a spring electroshocking survey, creel surveys, underwater video, and hook-and-line surveys.

Gill Net Survey

The spring gill net survey was part of the Lake Mohave General Sport Fish Management program. A total of 50 nets were set overnight for 50 net-nights of effort, with a net night of effort defined as one net set overnight. Out of the 50 sites, four nets

were set at habitat sites. To assess the effectiveness of the habitat, these sites were compared to the lake-wide mean and to non-habitat sites. The lake-wide and non-habitat cove CPUE was 4.6 fish/net-night. By comparison, Bass, Carp, and Box coves had a CPUE of 4.0, 4.0, and 7.0 fish/net-night, respectively (Table 18, Figure 31). The overall CPUE at Bass and Carp coves was similar to the lake-wide and non-habitat cove mean, while the CPUE at Box Cove was much higher. When looking at sport fish only, the lake-wide mean CPUE was 2.58 fish/net night. By comparison, Bass Cove had a similar CPUE, Carp Cove had a lower CPUE, and Box Cove had twice as many sportfish as the lake-wide and non-habitat coves CPUE. The results of this survey show little difference in fish abundance between Bass Cove and non-habitat coves and the lake-wide average. It is unknown why the different sites had such different CPUE. Box and Carp coves are older, more established habitat sites and Bass Cove is newer with fewer structures. Overall, Box Cove had the most sport fish, perhaps due to its established habitat structures.

FIGURE 29. Reclaimed PVC (Fishiding) artificial habitat structure.

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FIGURE 30. Catfish condo habitat structure.

Electroshocking Survey

Electroshocking surveys were carried out in the spring as part of the Lake Mohave general fisheries management program. A total of 15 sites were surveyed and five were habitat coves. To assess the effectiveness of the habitat, these sites were compared to the lake-wide mean and to non-habitat sites. The spring survey yielded 181 fish for a lake-wide CPUE of 12.1 fish/15 min. When looking at sport fish only, the lake-wide CPUE was 2.3 fish/15 min (Table 19, Figure 32). Comparing the five habitat

sites to the lake-wide mean, Bass and Box coves were well below the lake-wide and non-habitat cove mean CPUE for all fish, while Carp, Arrowhead, and Shoshone coves were greater than or equal to the lake-wide and non-habitat cove mean CPUE for all fish. When looking at sport fish CPUE, Bass Cove was equal to the lake-wide and non-habitat cove CPUE, while Carp, Arrowhead, and Shoshone coves exceeded the lake-wide and non-habitat cove CPUE for sport fish. Box Cove is the only cove that had fewer sport fish than the lake-wide and non-habitat cove CPUE. According to this survey, Bass Cove had no difference in sportfish abundance compared to the non-habitat coves or the lake-wide average.

TABLE 18. Total numbers of fish and CPUE (fish/net-night) from the 2017 spring Lake Mohave gill net survey.

Site	# fish	All fish CPUE	# sport fish	Sport fish CPUE
Lake-wide	231	4.6	129	2.58
Non-habitat coves	211	4.6	116	2.52
Bass Cove (with habitat)	4	4	3	3
Carp Cove (with habitat)	4	4	1	1
Box Cove (with habitat)	7	7	6	6
Arrowhead (with habitat)	5	5	3	3

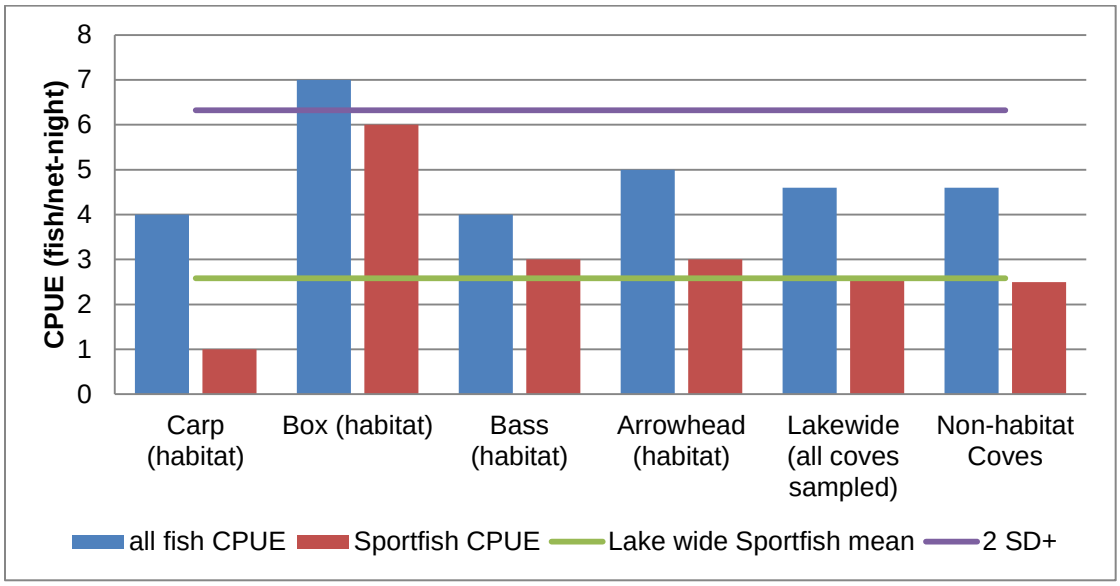

FIGURE 31. Lake Mohave spring gill net CPUE (fish/net-night) for habitat sites, the lake-wide mean, and non-habitat coves for the categories "all fish" and "sport fish only", 2017.

Fall Trammel Net Survey

Trammel nets (1-300 ft X 1.5 in mesh and 2 to 150 ft X 1.5 in mesh) were set the afternoon of December 18 at Bass Cove (habitat) and Painted Canyon Cove (non-habitat) to assess fish abundance at the two sites and to compare a habitat cove with a

non-habitat cove. Trammel nets were used due to the presence of razorback sucker spawning in the area, and they help to avoid injury compared to gill nets. The net set at Bass Cove was placed between habitat GPS waypoints to get as close to the habitat as possible. The nets were set overnight and pulled the next morning. As the fish were removed from the net, they were placed in a tub of water. After the net was pulled in, the fish were weighed, measured, and returned to the lake. The only exceptions were razorback sucker, which were weighed, measured, scanned for PIT tags, and fin clipped prior to the whole net being pulled in. Fin clips were taken for genetics studies. Clips were small and approximately 2 mm wide off the end of the right pectoral fin. They were placed in 1.5 mL snap cap vial filled with 95% ethanol. Labels were placed in the vials that included PIT tag number, location of capture, and date. The total effort was 2.9 net-nights of effort divided between Bass Cove (1.4 net-nights) and Painted Canyon Cove (1.5 net-nights), with a net-night of effort defined as 300 ft (91 m) of net set overnight for 12 hours.

TABLE 19. Total numbers of fish and CPUE (fish/15 min) from 2017 Lake Mohave spring electroshocking survey.

Site	# fish	All fish CPUE	# sport fish	Sport fish CPUE
Lake-wide	181	12.1	34	2.3
Non-habitat coves only	125	12.5	22	2.2
Bass Cove (with habitat)	6	6	2	2
Box Cove (with habitat)	4	4	1	1
Carp Cove (with habitat)	19	19	6	6
Arrowhead (with habitat)	12	12	3	3
Shoshone (with habitat)	11	11	3	3

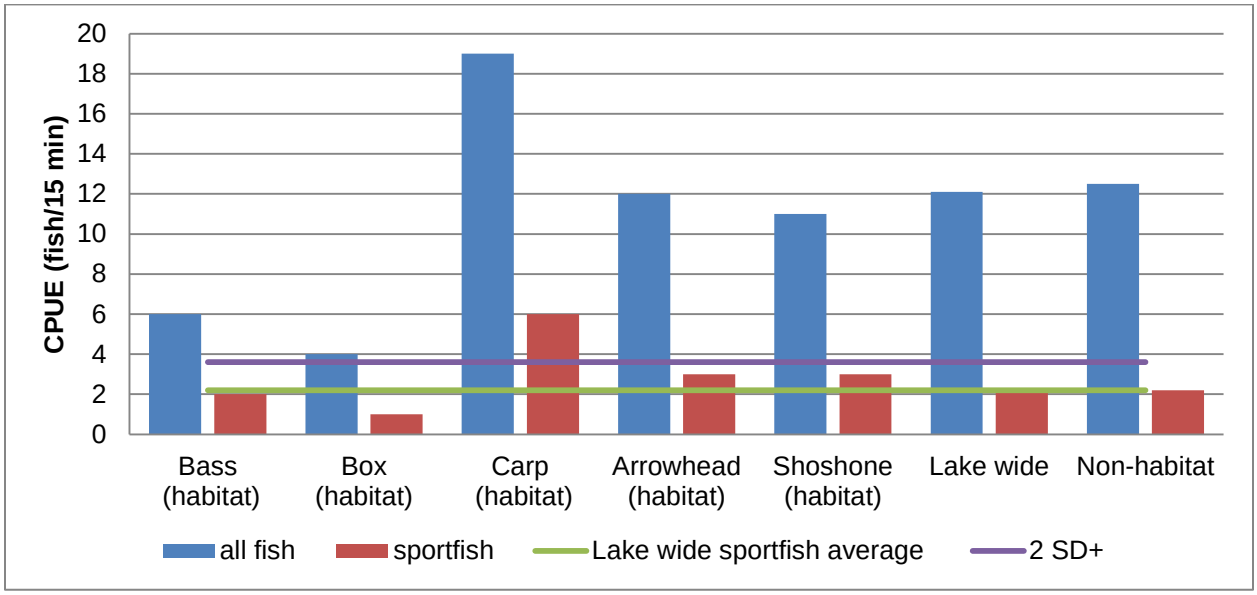

FIGURE 32. Lake Mohave spring electroshocking CPUE (fish/15 min) for habitat sites, the lake-wide mean, and non-habitat coves for the categories "all fish" and "sportfish only," 2017.

At Bass Cove, a total of 20 fish were captured (Table 20), of which, 70% were game fish (Figure 33) including 6 largemouth bass, 3 smallmouth bass, and 5 striped bass. Largemouth bass had a mean total length of 426 mm (16.8 in) and a mean weight of 1,282 g (2.8 lbs); smallmouth bass had a mean total length of 394 mm (15.5 in) and a mean weight of 630 g (1.4 lbs); and striped bass had a mean total length of 406 mm (16 in) and a mean weight of 1,006 g (2.2 lbs). Non-game fish included bullhead, common carp, and three-razorback suckers with a mean total length of 421 mm (16.6 in) and a mean weight of 1,163 g (2.6 lbs) (Table 20).

TABLE 20. Catch summary from 2017 trammel net surveys at Bass Cove, 2017.

Species	*n*	Fish/net-night	Composition (% of catch)	Mean total length		Mean weight	
				in	mm	lbs	g
Bullhead catfish	1	0.7	5	10.9	277	---	---
Common carp	2	1.4	10	24.6	626	8.9	4,040
Largemouth bass	6	4.3	30	16.8	426	2.8	1,282
Smallmouth bass	3	2.1	15	15.5	394	1.4	630
Striped bass	5	3.6	25	16.0	406	2.2	1,006
Razorback sucker	3	2.1	15	16.6	421	2.6	1,163
Total	20	14.3					

Painted Canyon Cove captures totaled 15 fish (Table 21) of which 47% were game fish (Figure 33). These fish include six largemouth bass with a mean total length of 363 mm (14.3 in) and a mean weight of 828 g (1.8 lbs) and one smallmouth bass at 315 mm (12.4 in) total length and weighed 410 g (0.9 lbs). No striped bass were captured at Painted Canyon Cove. Non-game fish included bullhead, common carp, and two razorback suckers with a mean total length of 392 mm (15.4 in) and mean weight of 620 g (1.4 lbs) (Table 21).

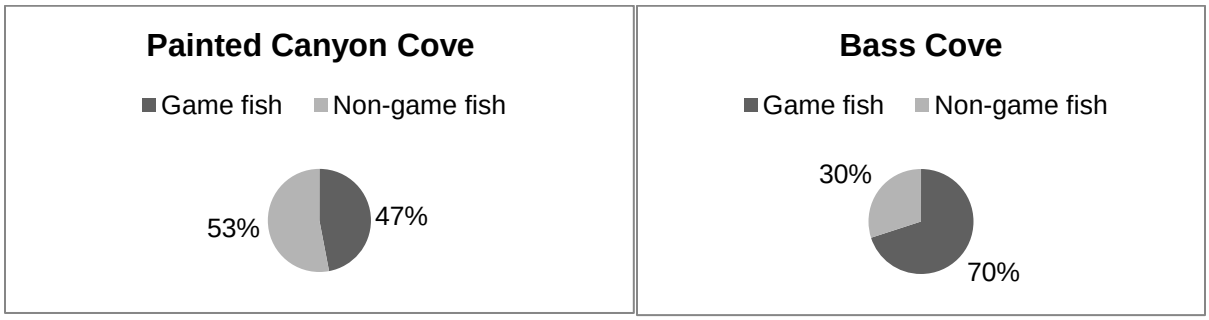

FIGURE 33. Percentages of fish that were game and nongame species captured during trammel net surveys at Painted Canyon Cove and Bass Cove, Lake Mohave, 2017.

Results suggest that Bass Cove attracted more fish than the non-habitat cove. The habitat appears to be attracting largemouth bass, smallmouth bass, and striped bass, and while both coves attracted the same number of largemouth bass, Bass Cove attracted larger fish with largemouth bass having a mean total length of 426 mm (16.8 in) compared to a mean total length of 363 mm (14.3 in) at Painted Canyon Cove. This can also be seen in the length frequency distribution of the two coves (Figure 34). The larger, more dominant bass may prefer the habitat structures and push the smaller bass to less desirable areas.

TABLE 21. Catch summary from 2017 trammel net survey at Painted Canyon Cove.

Species	*n*	Fish/net- night	Composition (% of catch)	Mean total length		Mean weight	
				in	mm	lbs	g
Bullhead catfish	3	2.0	20	11.7	296	0.8	350
Common carp	3	2.0	20	19.3	490	5.2	2,343
Largemouth bass	6	4.1	40	14.3	363	1.8	828
Smallmouth bass	1	0.7	7	12.4	315	0.9	410
Striped bass	0	0	0	---	---	---	---
Razorback sucker	2	1.4	13	15.4	392	1.4	620
Total	15	10.2					

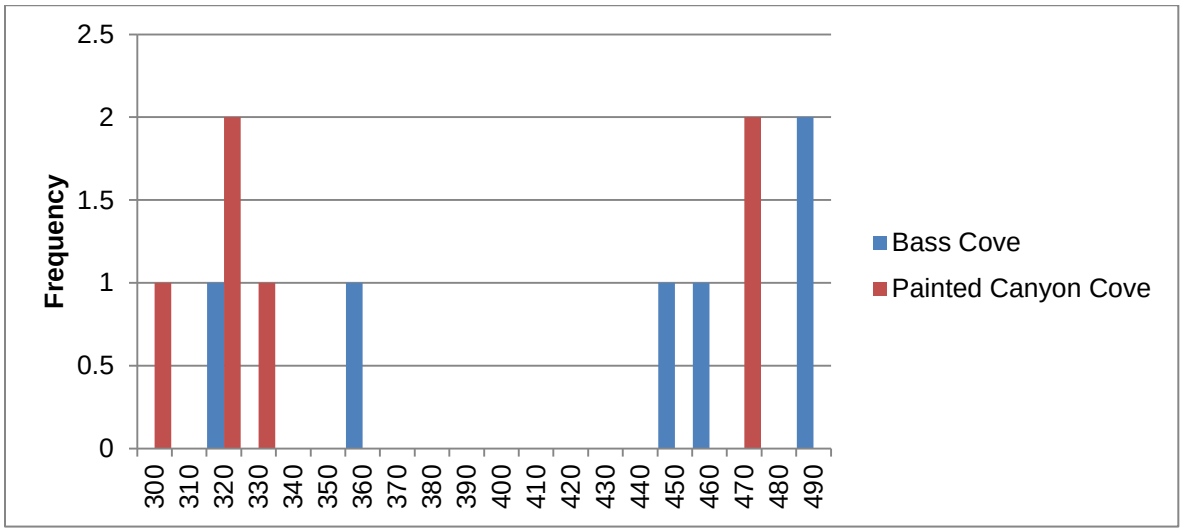

FIGURE 34. Length frequency distribution of largemouth bass captured during trammel net surveys at Painted Canyon Cove and Bass Cove, Lake Mohave, 2017.

Bass Cove also attracted more smallmouth bass than Painted Canyon Cove. This may be due to the preference of habitat structures or it could be due to the difference in the coves. Bass Cove is adjacent to the main channel while Painted Canyon Cove is more off the main channel. Likewise, the presence of striped bass on the habitat structures may also be due to availability of prey or its proximity to the main channel.

Razorback suckers were found in both coves. These fish were recaptured small adults and were not in the native fish database managed by Marsh and Associates, indicating that they had likely been tagged and recently stocked from the Willow Beach Hatchery to Cottonwood Cove. No bluegill was captured. This is likely due to the time of the year or the large size of the trammel net mesh as large amounts of bluegill are routinely observed during SCUBA surveys. Future netting using smaller mesh or experimental gill nets may capture bluegill or other prey species and better estimate prey availability on the structures and non-habitat sites.

Creel Surveys

A total of 14 days of creel surveys were conducted at Cottonwood Cove under the general fisheries monitoring program. Anglers were asked where they fished, if they were aware of habitat cove locations, and if they fished in habitat coves. They were also asked the amount of effort, species desired, type of fishing, bait used, and their state of residence. Anglers were not asked if they specifically fished Bass Cove.

Out of 34 anglers surveyed, 10 anglers fished at habitat sites, with 90% of anglers successful. These anglers fished for 35.8 hours catching 20 fish for a catch rate of 0.56 fish/hour and 2.0 fish/angler. By comparison, 24 non-habitat anglers were surveyed with 63% of anglers successful. They fished for 114.6 hours catching 36 fish for a catch rate of 0.31 fish/hour and 1.5 fish/angler (Table 22).

Species captured at habitat sites were different from that at non-habitat sites. Smallmouth bass dominated the catch at habitat sites while striped bass was the primary catch at non-habitat sites (Figure 35). Further, no striped bass or channel catfish were captured at habitat sites. There appears to be more species diversity in the anglers' catch at non-habitat sites, though catch rates are much better at habitat sites. Anglers fishing the habitat sites specifically targeted smallmouth bass or black bass in general, while non-habitat site anglers were targeting striped bass, smallmouth bass, largemouth bass, or anything. Based on these results, black bass anglers benefit the most from artificial habitat.

TABLE 22. Summary of creel survey contacts from Cottonwood Cove landing, Lake Mohave, 2017.

	Anglers	Hours	fish/hour	fish/angler	% successful
Habitat Coves	10	35.8	0.56	2	90
Non-habitat Coves	24	114.6	0.31	1.5	63

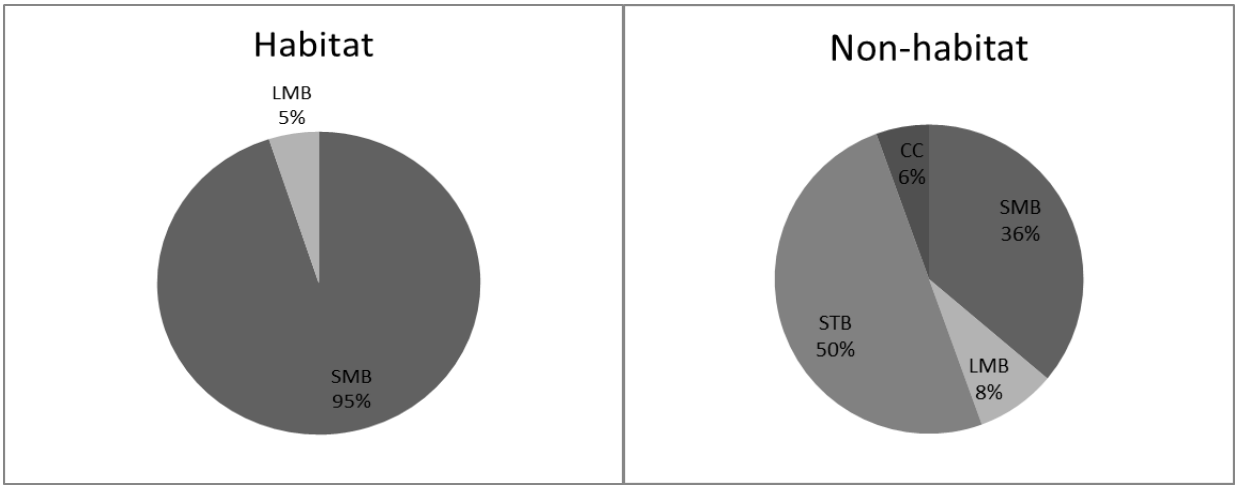

FIGURE 35. Species composition at habitat and non-habitat sites from angler creel from Cottonwood Cove, Lake Mohave, 2017.

Hook-and-line Sampling

Hook-and-line sampling was used to obtain additional catch data at habitat sites. Bass Cove and a non-habitat cove were sampled on three occasions (Table 23). During this time, a GoPro™ camera was deployed under the boat to video habitat. A variety of lures was used; however, no fish were captured.

TABLE 23. Summary of hook-and-line efforts on Lake Mohave, 2017.

Date	Location	Minutes	Catch
2/9/2017	Bass Cove	90	0
2/9/2017	Ski Cove	120	0
3/14/2017	Bass Cove	60	0
3/14/2017	North Basin Light Cove	120	0
9/22/2017	Bass Cove	60	0

Video Sampling

A GoPro™ Hero 4 was used to video habitat and non-habitat coves to assess fish attraction at different times of the year. The boat was positioned as close to the habitat as possible, and the camera was lowered on a rope and then lifted from the lake bottom. Higher total fish counts and fish/min rates were seen in the warmer months of June and September (Table 24). The lowest abundance was seen in the March video when only one channel catfish was seen inside the cube-structure habitat. During June, North Basin Light Cove, the non-habitat cove, had a higher abundance of fish though most of the fish were carp. In June, the fish/min rate was similar between Bass and Painted Canyon coves, with Bass Cove having more sport fish and Painted Canyon Cove having more common carp.

TABLE 24. Summary of video sampling effort on Lake Mohave, 2017.

Date	Location	Video minutes	Total fish	fish/min	Species
2/9/2017	Bass Cove (habitat)	40.5	4	0.1	4 smallmouth bass adult
2/9/2017	Ski Cove (non-habitat	37.4	3	0.08	3 smallmouth bass adult
3/14/2017	Bass Cove (habitat)	40.5	1	0.02	1 channel catfish (in habitat)
3/14/2017	N. Basin Light Cove (non-habitat)	38.3	25	0.65	20 carp, 3 smallmouth bass adults, 1 largemouth bass adult, 1 channel catfish adult
6/23/2017	Bass Cove (habitat)	36.4	12	0.3	10 black bass (9 adults, 1 fingerling), 1 channel catfish, and 1 carp
6/23/2017	Painted Canyon Cove (non-habitat)	16.5	3	0.2	3 carp
9/22/2017	Bass Cove (habitat)	69.6	20	0.3	17 black bass (3 adult, 9 juvenile, and 5 fingerling), 3 carp

Use of the GoPro™ to video underwater habitat does not necessarily allow for accurate counts of fish. As the camera moves around, and fish move in and out of the frame, some fish may be counted more than once. It seems to work better as a presence/absence form of sampling. The cube structures attract black bass the most with YOY black bass occurring sometime after March. Channel catfish have also been attracted to the habitat. It is unknown if the nearby catfish condos increase the attraction to the habitat. No channel catfish have been seen directly in the catfish condos. At this time, it is unclear if the Fishiding structures also attract fish. No fish have been seen directly on the structures; however, they are placed right next to the cube structures. Further video and/or SCUBA surveys are needed to assess the structures.

Lake Mead Smallmouth Bass Age and Growth Study

Smallmouth bass were first documented in Lake Mead in 1999 when they began showing up in small numbers in tournament catches and then captured in gill net surveys for the first time in 2000. The initial catches were limited to the Overton Arm, and it is unknown how smallmouth bass came to Lake Mead, as they were not stocked by NDOW. By 2010, their abundance equaled that of largemouth bass and they were found throughout the lake. They are now common in fish surveys and tournament catches, and are an important sport fish for Lake Mead anglers. Currently, little is known about smallmouth bass growth rates in Lake Mead. The purpose of this study is to develop a length at age table using analysis of hard parts (e.g., scales or otoliths) and back calculation of past growth to understand better growth rates and population size structure of smallmouth bass in Lake Mead.

Approaches:

- Obtain scale samples and otoliths from angling mortalities for smallmouth bass captured during trammel netting, gill netting, electroshocking, and bass tournaments during the fall.
- Collect samples over a three-year period with a record of date, location, GPS coordinates, and length and weight data for each fish.
- During general management activities, tag smallmouth bass with Floy tags to observe growth in recaptured fish and to validate back calculated growth in scale analyses. When fish are tagged, scales will be collected along with date, length, weight, location, and GPS coordinates.
- Analyze and age scales using a microscope with a camera, or by the use of a microprojector or microfiche projector. Analyze and age scales and otoliths using accepted methods.
- Develop an age at length table and an analysis of smallmouth bass population age structure.

In the first year of this study (2015), a total of 127 scale samples and 89 otoliths were collected. Scales were removed from the left side of the fish just behind the pectoral fin using a scraping motion with a knife. Scales were placed into labeled scale envelopes. Most of the samples were obtained from bass tournament mortalities

(*n*=104) and the rest (*n*=23) came from the gill net survey (Table 25, Appendix 1). The fish ranged in size from 152 – 483 mm (6 – 19 in) total length. In 2016, a total of 100 scale samples and 85 otolith samples were collected, with 13 scale and 8 otolith samples from the gill net survey, and 81 scale and 77 otolith samples collected from tournament mortalities. An additional six scale samples were obtained from trammel netting (Table 25). In addition to scale samples, five smallmouth bass were Floy-tagged (Appendix 2). This year, 73 scales and 70 otoliths were collected from smallmouth bass during the gill net survey and tournaments. Most samples came from tournament mortalities (*n* = 63) and 10 samples came from the fall gill net survey.

The scales were cleaned by placing them in warm water and then rubbing debris off with a paper towel. They were then mounted on glass microscope slides with either five or six scales per slide. The slides were labeled with sample number, species, and date. The fish length data was kept separate from the scales to avoid any influence it may have in aging of the scale. Initially, in 2015 and 2016, many scale samples were obtained without accompanying otoliths, and after aging attempts, it was found that an otolith was needed in most cases to validate and help in the aging of scales. In 2017, most scale samples were taken from mortalities so that the otolith could also be used for aging.

TABLE 25. Number of smallmouth bass scales and otoliths collected by year and by survey type, 2015 - 17.

Survey type	2015		2016		2017	
	Scales	Otoliths	Scales	Otoliths	Scales	Otoliths
Gill-net	23	9	13	8	10	8
Tournaments	104	80	81	77	63	62
Trammel netting	0	0	6	0	0	0
Total	127	89	100	85	73	70

This year, 90 smallmouth bass scale samples from the 2016 collection were aged along with 82 otoliths. Scales were read by a biologist and a technician using a stereo zoom microscope. Scales were photographed at 10X with a 3-megapixel camera and measurements were taken using the calibrated measuring software that accompanied the camera. Otoliths were sectioned and mounted on microscope slides using a variable speed drill and a 13 cm sanding disc with 320-grit sandpaper as described by Maceina (1988). Only those scales that ages could be agreed upon were used to back-calculate lengths. Back calculation of annular growth was achieved by using the direct proportion method (Devries and Frie 1996). Table 26 summarizes length at age data for 27 samples. Back-calculations show these fish had mean total lengths of 148 mm (5.8 in) at age-1, 233 mm (9.2 in) at age-2, 323 mm (12.7 in) at age-3, 333 mm (13.1 in) at age-4, and 371 mm (14.6 in) at age-5. Only one fish was aged beyond 5 years. This fish was aged to 8 years old, with back calculated lengths of 406 mm (16.0 in) at age-6, 437 mm (17.2 in) at age-7, and 475 mm (18.7 in) at age-8. After the scales and otoliths were aged, it was found that many of the ages could not be agreed upon by two readers and that the scales and/or otoliths would have to be revisited or redone.

TABLE 26. Mean back-calculated total lengths for smallmouth bass using scales and otoliths collected in 2016.

Year class	*n*	Length at age in inches (millimeters) at each annulus							
		1	2	3	4	5	6	7	8
2014	6	5.6 (143)	11.5 (292)						
2013	7	6.0 (153)	11.1 (283)	14.2 (361)					
2012	10	5.8 (148)	10.0 (253)	13.1 (332)	15.2 (385)				
2011	3	5.4 (138)	9.1 (232)	11.9 (301)	13.8 (350)	15.5 (393)			
2009	1	6.3 (160)	9.9 (252)	11.7 (298)	10.3 (262)	13.7 (348)	16.0 (406)	17.2 (437)	18.7 (475)
Mean		5.8 (148)	9.2 (233)	12.7 (323)	13.1 (333)	14.6 (371)	16.0 (406)	17.2 (437)	18.7 (475)

TABLE 27. Mean total lengths for smallmouth bass throughout North America (Coble 1975).

Age	1	2	3	4	5	6	7	8	9
Length in (mm)	3.7 (94)	6.7 (170)	9.2 (234)	11.0 (279)	12.7 (323)	14.1 (358)	15.0 (381)	15.9 (404)	16.9 (429)

Lake Mead smallmouth bass have faster growth rates than the North American average (Coble 1975) (Table 27) for all ages. The number of aged samples for this study is still small, as more scales and otolith samples are aged, the back-calculated lengths may change.

In addition to collecting scale and otolith samples for aging, smallmouth bass have been Floy-tagged to obtain observed growth data. In 2016, five smallmouth bass were tagged and in 2017, 23 smallmouth bass were tagged (Appendix 2). To date, three tagged smallmouth bass have been captured and brought to a black bass tournament for weigh-in (Table 7). These fish had only been tagged two weeks or less before they were captured, so no growth was observed in these fish.

Largemouth Bass and Striped Bass Age and Growth Study

Many changes have occurred at Lake Mead over the past decade including drought conditions and the introduction of invasive species. Quagga mussels and gizzard shad are two invasive species that were discovered in Lake Mead in 2007. Both of these species have the potential to affect growth rates of sport fish through competition for habitat and food resources. This study will allow for the comparison of current striped bass scale samples with scale samples collected prior to the invasion of quagga mussel and gizzard shad to see if growth rates have changed. Largemouth bass scale analysis can be compared to published growth rates for Lake Mead (Allan and Roden 1978; Jonez and Sumner 1954). The development of a length at age table using scale analysis and back-calculation of past growth (DeVries and Frie 1996) will provide a better understanding of largemouth bass and striped bass growth rates and

the current population size structure compared to previous years. In addition to scale and otolith sample analysis, live captures of striped bass and largemouth bass from netting surveys will be Floy tagged so that growth can be observed in recaptured fish.

Approaches:

- Obtain scale samples from largemouth bass and striped bass captured from trammel netting, gill netting, and electroshocking surveys during the fall. Obtain otolith samples in the event of largemouth bass mortality during netting. Scales and otoliths may also be obtained from largemouth bass and striped bass tournament mortalities.
- During general management activities, tag largemouth bass and striped bass with Floy tags to observe growth in recaptured fish and to validate back-calculated growth in scale analysis. When fish are tagged, scales will be collected along with date, length, weight, location, and GPS coordinates.
- Collect samples over a three-year period with a record of date, location, GPS coordinates, and length and weight data for each fish.
- Store scales and otoliths in envelopes or vials and prepare for analysis.
- Analyze and age scales using a stereo zoom microscope with camera, or by the use of a microprojector or microfiche projector. Analyze and age scales and otoliths using accepted methods.
- Develop a length at age table and an analysis of largemouth bass and striped bass population age structure and compare to scales collected during the 1980s and/or compare to scale analysis from previous years or published data.

This study began in 2016 with scales and otoliths to be collected through a three-year period, ending with the collection of samples in 2018. In anticipation of the study, some scales and otoliths were collected in 2015 and will be included (Table 28). In 2016, a total of 53 largemouth bass scales and 29 otoliths were collected, and 86 scales and 77 otolith samples of striped bass were collected (Table 28, Appendix 1). Twenty-four fish were Floy tagged, which included 16 largemouth bass and eight striped bass (Appendix 2). In 2017, 16 largemouth bass scales and otoliths were collected and 56 striped bass scales and 38 otoliths were collected (Table 29). Furthermore, 6 striped bass and 18 largemouth bass were Floy tagged in 2017 (Appendix 2).

Scales were read by a technician and a biologist using a stereo zoom microscope. Scales were photographed at 10X with a 3-megapixel camera and measurements were taken using the calibrated measuring software that accompanied the camera. Otoliths were sectioned and mounted on microscope slides using a variable speed drill and a 13 cm sanding disc as described by Maceina (1988). Fine, 320-grit sandpaper was used to grind the otoliths down. Often times the same scales were interpreted differently by the readers, so only those scales that ages could be agreed upon were used to back-calculate lengths.

TABLE 28. Number of largemouth bass (LMB) and striped bass (STB) scales and otoliths collected by year and by survey type, 2015 - 16.

Survey type	2015 LMB		2016 LMB		2015 STB		2016 STB	
	Scales	Otoliths	Scales	Otoliths	Scales	Otoliths	Scales	Otoliths
Gillnet	33	8	13	6	74	53	54	50
Tournaments	7	1	24	23	17	1	24	19
Trammel netting	0	0	12	0	0	0	0	0
Creel	1	0	0	0	36	29	8	8
Electroshocking	0	0	4	0	0	0	0	0
Total	41	10	53	29	127	83	86	77

TABLE 29. Number of largemouth bass (LMB) and striped bass (STB) scales and otoliths collected by survey type, 2017.

Survey type	2017 LMB		2017 STB	
	Scales	Otoliths	Scales	Otoliths
Gillnet	8	8	35	35
Tournaments	8	8	9	1
Trammel netting	0	0	0	0
Creel	0	0	0	0
Electroshocking	0	0	0	0
Total	16	16	56	38

Striped Bass

A total of 53 striped bass scales that were collected in 2016, along with 47 otoliths, were aged. Many of the scales and otoliths need to be revisited or redone because they were unreadable or the age could not be agreed upon by readers. Eleven fish ranged from age-1 to age-8 (Table 30). Back-calculation of annular growth was achieved by using the direct proportion method (Devries and Frie 1996). Results show these fish had mean total lengths of 157 mm (6.2 in) at age-1, 259 mm (10.2 in) at age-2, 320 mm (12.6 in) at age-3, 364 mm (14.4 in) at age-4, 378 mm (14.9 in) at age-5, 380 mm (15.0 in) at age-6, 405 mm (16.0 in) at age-7, and 476 mm (18.7 in) at age-8 (Table 30). These growth rates are much lower than rates published in Allan and Roden (1978) for both stocked fish and wild produced fish (Table 31). Even age-1 fish were slightly larger than current age-1 striped bass at 196 – 246 mm (7.7 - 9.7 in) total length. By age-3, the historical striped bass population was nearly double the length of current age-3 fish. Harvested striped bass this year had a mean total length of 424 mm (16.7 in), which corresponds to an age-7 fish. From these early findings, striped bass growth rates appeared to decline from historical growth rates. These findings also explain why 20 in (508 mm) striped bass are in short supply.

Largemouth Bass

A total of 34 scale and 25 otolith samples collected in 2016 were aged. Of these samples, five ages could be agreed upon by two scale readers. The other scales and

otoliths will need to be revisited or redone. Some otoliths did not section well enough to read in order to validate the scale ages. Back calculation of annular growth was achieved by using the direct proportion method (Devries and Frie 1996). The calculated growth for the five fish is listed below in Table 32. Largemouth bass had mean total lengths of 109 mm (4.3 in) at age-1, 183 mm (7.2 in) at age-2, 234 mm (9.2 in) at age-3, 335 mm (13.2 in) at age-4, and 423 mm (16.7 in) at age-5. These lengths at age values are very different from published growth rates for largemouth bass at Lake Mead (Table 33). The largemouth bass of the late 1970s were anywhere from 25 – 102 mm (1 - 4 in) greater in length at each annulus. The rise of smallmouth bass in Lake Mead and interspecific competition between the two species may have reduced growth rates of largemouth bass.

TABLE 30. Mean back-calculated total lengths for striped bass using scales and otoliths collected in 2016.

Year class	*n*	Total length at age in inches (millimeters) at each annulus							
		1	2	3	4	5	6	7	8
2013	2	5.1 (130)	10.4 (265)	13.5 (344)					
2012	3	6.4 (162)	10.8 (274)	14.2 (360)	16.7 (425)				
2011	4	6.2 (157)	10.6 (268)	13.0 (330)	15.2 (386)	16.7 (423)			
2009	1	5.5 (140)	7.4 (189)	9.0 (229)	10.7 (272)	12.0 (304)	12.9 (328)	14.0 (355)	
2008	1	7.8 (198)	11.8 (300)	13.2 (335)	14.8 (377)	16.0 (407)	17.0 (431)	17.9 (455)	18.7 (476)
Mean		6.2 (157)	10.2 (259)	12.6 (320)	14.4 (364)	14.9 (378)	15.0 (380)	16.0 (405)	18.7 (476)

TABLE 31. Published growth rates of striped bass from Lake Mead (Johnson and Roden 1977), published in Allan and Roden 1978.

Striped bass	Length at age in inches (millimeters) at each annulus						
	1	2	3	4	5	6	7
Stocked fish	7.7[1] (196)	14.8 (376)	21.2 (538)	26.7 (678)	30.7 (780)	33.2 (843)	36.0 (914)
Wild fish	9.7[1] (246)	19.3 (490)	25.2 (640)	28.3 (719)	30.4 (772)		

[1]Fork length

TABLE 32. Mean back-calculated total lengths for largemouth bass using scales and otoliths collected in 2016

Year class	*n*	Length at age in inches (millimeters)				
		1	2	3	4	5
2014	1	3.3 (84)	5.7 (144)			
2013	1	4.0 (101)	6.3 (160)	7.6 (194)		
2011	2	4.4 (112)	7.7 (196)	10.5 (267)	12.2 (311)	
2010	1	5.5 (139)	9.1 (230)	9.4 (240)	14.2 (361)	16.7 (423)
Mean		4.3 (109)	7.2 (183)	9.2 (234)	13.2 (335)	16.7 (423)

TABLE 33. Published growth rates of largemouth bass from Lake Mead (Allan and Roden, 1978).

	Length at age in inches (millimeters) at each annulus					
Largemouth bass	1	2	3	4	5	6
Before introduction of threadfin shad	5.3	10.3	13.7	16.4	18.5	20.5
(Jonez and Sumner, 1954)	(135)	(262)	(348)	(417)	(470)	(521)
After introduction of threadfin shad	7.9	12.4	14.1			
(Minckley, 1972)	(201)	(315)	(358)			

GENERAL MANAGEMENT REVIEW

The approaches for the general management objective were completed. The objectives were met through creel surveys, tournament data collection, gillnetting, electroshocking, dive surveys, shad trawls, and striped bass stomach content analysis. The Lake Mead Fisheries Habitat Enhancement Study approaches were completed by the construction and placement of artificial habitat and assessment using trammel netting, gill netting, electrofishing, hook-and-line sampling, and video sampling. The third year of the smallmouth bass age and growth study approaches were met through the collection of scales and otoliths, Floy tagging of fish, and aging of scales and otoliths using accepted methods. The second year of the largemouth bass and striped bass age and growth study approaches were met through the collection of scales and otoliths, Floy tagging of fish, and the aging of scales and otoliths using accepted methods.

RECOMMENDATIONS

- Continue with the current creel program using stratified random sampling of at least 100 days. More creel days should be shifted to Echo Bay during the winter period due to increased angler use from out-of-state anglers. This can be accomplished by switching the sampling probabilities of Callville (0.22) and Echo Bay (0.11) in the winter.
- Seasonal gill net surveys and summer dive investigations should be continued.
- Collect black bass catch data from major tournaments to track trends in the black bass fishery.
- Continue with assigned electroshocking transects during the fall survey.
- Continue the quarterly checking of stomach samples of tournament striped bass to detect changes in diet.
- Continue weekly shad trawl transects during the peak spawning season.
- Continue to investigate the feasibility and effectiveness of moveable underwater habitat structures for future deployment in Lake Mead.
- Study the growth rates of largemouth bass and striped bass to detect changes since the invasion of quagga mussels and gizzard shad.

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Date: March 14, 2018

Appendix 1. Scale and otolith data collections of striped bass (SB), largemouth bass (LMB), and smallmouth bass (SMB), 2015 - 2017.

Envelope Number	Date	Species	Survey type	Area caught	TL mm	FL mm	Weight g	Otolith
1001	7/17/2015	SB	Creel	Hatchery Cove	446	417	660	
1002	7/17/2015	SB	Creel	Hatchery Cove	490	457	1020	x
1003	7/17/2015	SB	Creel	Hatchery Cove	452	430	820	
1004	7/17/2015	SB	Creel	Hatchery Cove	460	428	690	x
1005	7/17/2015	SB	Creel	Hatchery Cove	404	383	560	
1006	7/17/2015	SB	Creel	Hatchery Cove	526	493	1140	
1007	7/23/2015	LMB	Creel	The Narrows	390	375	690	
1008	8/3/2015	SB	Creel	The Narrows	469	440	910	x
1009	8/3/2015	SB	Creel	The Narrows	430	402	660	x
1010	8/3/2015	SB	Creel	The Narrows	445	415	840	x
1011	8/3/2015	SB	Creel	The Narrows	516	490	1220	x
1012	8/3/2015	SB	Creel	The Narrows	410	385	610	x
1013	8/3/2015	SB	Creel	The Narrows	445	420	790	x
1014	8/3/2015	SB	Creel	The Narrows	420	400	670	x
1015	8/3/2015	SB	Creel	The Narrows	472	442	880	x
1016	8/3/2015	SB	Creel	The Narrows	470	430	900	x
1017	8/3/2015	SB	Creel	The Narrows	420	390	690	x
1018	8/3/2015	SB	Creel	The Narrows	420	390	650	x
1019	8/3/2015	SB	Creel	The Narrows	460	425	810	x
1020	8/3/2015	SB	Creel	The Narrows	465	430	780	x
1021	8/3/2015	SB	Creel	The Narrows	475	455	900	x
1022	8/3/2015	SB	Creel	The Narrows	440	415	710	x
1023	8/3/2015	SB	Creel	The Narrows	454	423	810	x
1024	8/3/2015	SB	Creel	The Narrows	338	318	390	x
1027	9/13/2015	SB	Tournament	Unknown	545	503	1270	
1028	9/13/2015	SB	Tournament	Unknown	498	460	953	
1029	9/13/2015	SB	Tournament	Unknown	475	450	953	
1030	9/13/2015	SB	Tournament	Unknown	490	450	907	
1031	9/13/2015	SB	Tournament	Unknown	490	455	975	x
1032	9/13/2015	SB	Tournament	Unknown	475	442	839	
1033	9/13/2015	SB	Tournament	Hatchery Cove	524	485	1225	
1034	9/13/2015	SB	Tournament	Hatchery Cove	555	510	1270	
1035	9/13/2015	SB	Tournament	Unknown	499	465	1111	
1036	9/13/2015	SB	Tournament	Unknown	485	445	998	
1037	9/13/2015	SB	Tournament	Hatchery Cove	503	467	1202	
1038	9/13/2015	SB	Tournament	Unknown	626	585	2223	
1040	9/13/2015	SB	Tournament	Unknown	558	520	1588	
1041	9/13/2015	SB	Tournament	Unknown	535	498	1361	
1042	9/13/2015	SB	Tournament	Unknown	532	495	1338	
1043	9/13/2015	SB	Tournament	E of Black Point	540	501	1338	
1044	9/14/2015	SMB	Tournament	Unknown	386	367	790	x

Envelope Number	Date	Species	Survey type	Area caught	TL mm	FL mm	Weight g	Otolith
1045	9/14/2015	SMB	Tournament	Unknown	400	380	910	x
1046	9/14/2015	SMB	Tournament	Unknown	440	415	990	x
1047	9/14/2015	SMB	Tournament	Unknown	407	385	780	x
1048	9/14/2015	SMB	Tournament	Unknown	407	390	890	x
1049	9/14/2015	SMB	Tournament	Unknown	400	380	750	x
1050	9/14/2015	SMB	Tournament	Unknown	348	330	590	x
1051	9/14/2015	SMB	Tournament	Unknown	352	335	590	x
1052	9/14/2015	SMB	Tournament	Unknown	352	335	570	x
1053	9/14/2015	SMB	Tournament	Unknown	330	310	430	x
1054	9/14/2015	SMB	Tournament	Unknown	380	362	780	x
1055	9/14/2015	SMB	Tournament	Unknown	400	380	870	x
1056	9/14/2015	SMB	Tournament	Unknown	430	410	970	x
1057	9/14/2015	SMB	Tournament	Unknown	348	332	590	x
1058	9/14/2015	SMB	Tournament	Unknown	360	350	550	x
1059	9/14/2015	SMB	Tournament	Unknown	353	335	580	x
1060	9/14/2015	SMB	Tournament	Unknown	375	355	620	x
1061	9/14/2015	SMB	Tournament	Unknown	418	398	1000	
1062	9/14/2015	SMB	Tournament	Unknown	417	398	960	
1063	9/14/2015	SMB	Tournament	Unknown	387	370	700	
1064	9/14/2015	SMB	Tournament	Unknown	406	383	790	
1065	9/14/2015	SMB	Tournament	Unknown	400	380	790	
1066	9/14/2015	SMB	Tournament	Unknown	463	444	1380	
1067	9/14/2015	LMB	Tournament	Unknown	450	432	1150	
1068	9/14/2015	SMB	Tournament	Unknown	452	432	1010	
1069	9/14/2015	LMB	Tournament	Unknown	455	435	1330	
1070	9/14/2015	LMB	Tournament	Unknown	403	387	980	
1071	9/14/2015	SMB	Tournament	Unknown	358	340	560	
1072	9/14/2015	SMB	Tournament	Unknown	435	410	1250	
1073	9/14/2015	SMB	Tournament	Unknown	405	385	810	
1074	9/14/2015	LMB	Tournament	Unknown	333	318	520	
1075	9/14/2015	SMB	Tournament	Unknown	405	385	850	
1076	9/14/2015	SMB	Tournament	Unknown	348	330	520	
1077	9/14/2015	SMB	Tournament	Unknown	380	358	690	
1078	9/14/2015	SMB	Tournament	Unknown	428	408	1130	
1079	9/14/2015	SMB	Tournament	Unknown	375	360	680	x
1080	9/14/2015	LMB	Tournament	Unknown	355	341	540	x
1081	9/14/2015	SMB	Tournament	Unknown	330	300	420	x
1082	9/14/2015	SMB	Tournament	Unknown	439	414	1060	x
1083	9/14/2015	SMB	Tournament	Unknown	457	435	1220	x
1084	9/15/2015	SMB	Tournament	Unknown	373	353	600	x
1085	9/15/2015	SMB	Tournament	Unknown	361	341	560	x
1086	9/15/2015	SMB	Tournament	Unknown	428	407	1110	x
1087	9/15/2015	SMB	Tournament	Unknown	400	384	860	x

Envelope Number	Date	Species	Survey type	Area caught	TL mm	FL mm	Weight g	Otolith
1088	9/15/2015	SMB	Tournament	Unknown	369	347	660	
1089	9/15/2015	SMB	Tournament	Unknown	350	330	580	x
1090	9/15/2015	SMB	Tournament	Unknown	370	350	610	
1091	9/15/2015	SMB	Tournament	Unknown	361	347	530	x
1092	9/15/2015	SMB	Tournament	Unknown	440	422	1260	x
1093	9/15/2015	SMB	Tournament	Unknown	355	338	560	
1094	9/15/2015	SMB	Tournament	Unknown	395	376	690	x
1095	9/15/2015	SMB	Tournament	Unknown	390	365	820	x
1096	9/15/2015	SMB	Tournament	Unknown	403	380	780	x
1097	9/15/2015	SMB	Tournament	Unknown	390	374	740	x
1098	9/15/2015	SMB	Tournament	Unknown	392	372	780	x
1099	9/15/2015	SMB	Tournament	Unknown	360	342	570	x
1100	9/15/2015	SMB	Tournament	Unknown	397	377	780	
1101	9/15/2015	SMB	Tournament	Unknown	405	389	880	x
1102	9/15/2015	SMB	Tournament	Unknown	324	315	480	x
1103	9/15/2015	SMB	Tournament	Unknown	385	365	670	x
1104	9/15/2015	SMB	Tournament	Unknown	365	350	630	x
1105	9/15/2015	SMB	Tournament	Unknown	360	339	540	x
1106	9/15/2015	SMB	Tournament	Unknown	341	327	500	x
1107	9/15/2015	SMB	Tournament	Unknown	345	328	510	x
1108	9/15/2015	SMB	Tournament	Unknown	400	385	890	x
1109	9/15/2015	SMB	Tournament	Unknown	378	358	700	x
1110	9/15/2015	SMB	Tournament	Unknown	410	390	900	
1111	9/15/2015	SMB	Tournament	Unknown	370	349	620	x
1112	9/15/2015	SMB	Tournament	Unknown	482	459	1490	x
1113	9/15/2015	SMB	Tournament	Unknown	439	416	1100	x
1114	9/15/2015	SMB	Tournament	Unknown	365	347	660	x
1115	9/15/2015	LMB	Tournament	Unknown	465	445	1050	x
1116	9/15/2015	SMB	Tournament	Unknown	330	312	440	x
1117	9/15/2015	SMB	Tournament	Unknown	440	415	1090	x
1118	9/15/2015	SMB	Tournament	Unknown	402	378	710	x
1119	9/15/2015	SMB	Tournament	Unknown	387	368	820	x
1120	9/15/2015	SMB	Tournament	Unknown	410	395	970	x
1121	9/15/2015	SMB	Tournament	Unknown	363	345	610	
1122	9/15/2015	SMB	Tournament	Unknown	325	312	430	x
1123	9/16/2015	SMB	Tournament	Unknown	393	374	900	x
1124	9/16/2015	SMB	Tournament	Unknown	347	331	580	x
1125	9/16/2015	SMB	Tournament	Unknown	382	365	790	x
1126	9/16/2015	SMB	Tournament	Unknown	430	410	900	x
1127	9/16/2015	SMB	Tournament	Unknown	395	370	790	x
1128	9/16/2015	SMB	Tournament	Unknown	395	378	830	x
1129	9/16/2015	SMB	Tournament	Unknown	328	312	420	x
1130	9/16/2015	SMB	Tournament	Unknown	430	405	970	x

Envelope Number	Date	Species	Survey type	Area caught	TL mm	FL mm	Weight g	Otolith
1131	9/16/2015	SMB	Tournament	Unknown	362	345	570	x
1132	9/16/2015	SMB	Tournament	Unknown	335	319	520	x
1133	9/16/2015	SMB	Tournament	Unknown	390	367	720	x
1134	9/16/2015	SMB	Tournament	Unknown	393	373	890	x
1135	9/16/2015	SMB	Tournament	Unknown	338	321	510	x
1136	9/16/2015	SMB	Tournament	Unknown	345	325	550	x
1137	9/16/2015	SMB	Tournament	Unknown	324	306	480	x
1138	9/16/2015	SMB	Tournament	Unknown	338	322	450	x
1139	9/16/2015	SMB	Tournament	Unknown	331	315	430	x
1140	9/16/2015	SMB	Tournament	Unknown	325	312	490	x
1141	9/16/2015	SMB	Tournament	Unknown	352	332	560	x
1142	9/16/2015	SMB	Tournament	Unknown	392	376	770	x
1143	9/16/2015	SMB	Tournament	Unknown	411	392	880	x
1144	9/16/2015	SMB	Tournament	Unknown	375	358	680	x
1145	9/16/2015	SMB	Tournament	Unknown	336	320	470	x
1146	9/23/2015	SB	Creel	Las Vegas Bay	375	346	550	x
1147	9/23/2015	SB	Creel	Las Vegas Bay	394	370	640	x
1148	9/23/2015	SB	Creel	Las Vegas Bay	315	294	320	x
1149	9/23/2015	SB	Creel	Las Vegas Bay	392	365	620	x
1150	9/23/2015	SB	Creel	Las Vegas Bay	540	500	1220	x
1151	9/23/2015	SB	Creel	Las Vegas Bay	398	370	600	x
1152	9/23/2015	SB	Creel	Las Vegas Bay	299	278	290	x
1153	9/23/2015	SB	Creel	Las Vegas Bay	382	352	510	x
1154	10/2/2015	LMB	Tournament	Unknown	357	344	410	x
1155	10/2/2015	SMB	Tournament	Unknown	388	368	700	x
1156	10/2/2015	SMB	Tournament	Unknown	340	324	560	x
1157	10/2/2015	SMB	Tournament	Unknown	435	417	1060	x
1158	10/2/2015	SMB	Tournament	Unknown	425	410	1030	x
1159	10/2/2015	SMB	Tournament	Unknown	420	409	1070	x
1160	10/2/2015	SMB	Tournament	Unknown	386	368	820	x
1161	10/2/2015	SMB	Tournament	Unknown	359	342	560	x
1162	10/19/2015	SB	Gill Netting	The Cliffs	494	459	1150	
1163	10/5/2015	SB	Gill Netting	Black Island	400	378	670	x
1164	10/5/2015	SMB	Gill Netting	Black Island	237	228	160	x
1165	10/5/2015	SMB	Gill Netting	Black Island	270	260	240	
1166	10/5/2015	SMB	Gill Netting	Roadrunner	403	381	860	
1167	10/5/2015	SMB	Gill Netting	Roadrunner	420	400	1040	
1168	10/5/2015	SMB	Gill Netting	Roadrunner	418	402	940	x
1169	10/5/2015	SB	Gill Netting	Swallow Bay	390	364	520	x
1170	10/5/2015	SB	Gill Netting	Swallow Bay	372	348	480	x
1171	10/5/2015	SB	Gill Netting	Swallow Bay	448	422	830	x
1172	10/5/2015	SB	Gill Netting	Swallow Bay	384	358	490	x
1173	10/6/2015	SB	Gill Netting	Rogers Bay	374	350	520	x

Envelope Number	Date	Species	Survey type	Area caught	TL mm	FL mm	Weight g	Otolith
1174	10/6/2015	LMB	Gill Netting	Rogers Bay	221	210	130	x
1175	10/6/2015	LMB	Gill Netting	Rogers Bay	200	193	100	x
1176	10/6/2015	SB	Gill Netting	Twin Peaks	172	160	20	x
1177	10/6/2015	LMB	Gill Netting	Calico Bay	216	209	150	
1178	10/6/2015	SB	Gill Netting	Echo Bay	426	397	720	x
1179	10/6/2015	SB	Gill Netting	Echo Bay	360	339	500	x
1180	10/6/2015	SB	Gill Netting	Echo Bay	488	455	1130	x
1181	10/6/2015	SB	Gill Netting	Echo Bay	417	389	730	
1182	10/6/2015	LMB	Gill Netting	Echo Bay	568	530	2730	
1183	10/7/2015	LMB	Gill Netting	Cathedral Cove	255	245	200	
1184	10/7/2015	LMB	Gill Netting	Gunsight	194	186	80	x
1185	10/7/2015	SMB	Gill Netting	Gunsight	425	405	1060	x
1186	10/7/2015	SB	Gill Netting	Gunsight	325	303	320	x
1187	10/7/2015	SMB	Gill Netting	Quail Bay	213	204	130	x
1189	10/7/2015	SMB	Gill Netting	Quail Bay	299	283	350	x
1190	10/12/2015	SMB	Gill Netting	Battleship Rock	330	315	460	x
1191	10/12/2015	SB	Gill Netting	Battleship Rock	214	200	60	x
1192	10/12/2015	SB	Gill Netting	Battleship Rock	508	469	880	x
1193	10/12/2015	SB	Gill Netting	Water Barge	338	314	430	x
1194	10/12/2015	SMB	Gill Netting	Water Barge	291	278	330	
1195	10/12/2015	SMB	Gill Netting	Water Barge	400	380	750	
1196	10/12/2015	SMB	Gill Netting	Water Barge	296	280	380	x
1197	10/12/2015	SB	Gill Netting	Lovers Cove	390	360	530	x
1198	10/19/2015	SB	Gill Netting	The Cliffs	440	412	750	x
1199	10/19/2015	SB	Gill Netting	The Cliffs	480	450	990	x
1200	10/19/2015	SB	Gill Netting	The Cliffs	503	470	1120	x
1201	10/19/2015	SB	Gill Netting	The Cliffs	444	416	890	x
1202	10/19/2015	SB	Gill Netting	The Cliffs	465	439	830	x
1203	10/19/2015	SB	Gill Netting	The Cliffs	464	432	860	x
1204	10/19/2015	LMB	Gill Netting	Horsepower	397	382	860	
1205	10/19/2015	SB	Gill Netting	Horsepower	523	490	1460	x
1206	10/19/2015	SB	Gill Netting	Horsepower	350	329	450	x
1207	10/19/2015	SB	Gill Netting	Horsepower	548	515	1480	x
1208	10/19/2015	SB	Gill Netting	Horsepower	335	316	420	x
1209	10/19/2015	SB	Gill Netting	The Cliffs	480	455	990	x
1212	10/19/2015	SB	Gill Netting	Horsepower	341	320	420	x
1213	10/19/2015	SB	Gill Netting	Horsepower	358	335	460	x
1214	10/22/2015	SB	Gill Netting	Gov't Wash	325	315	300	x
1215	10/22/2015	LMB	Gill Netting	Gov't Wash	229	220	150	
1216	10/22/2015	SB	Gill Netting	Gov't Wash	398	371	670	x
1217	10/22/2015	LMB	Gill Netting	Indian Canyon	296	283	340	
1218	10/22/2015	SMB	Gill Netting	Indian Canyon	302	288	380	
1219	10/26/2015	SB	Gill Netting	Stewarts Bay	430	405	740	

Envelope Number	Date	Species	Survey type	Area caught	TL mm	FL mm	Weight g	Otolith
1220	10/26/2015	SB	Gill Netting	Stewarts Bay	369	348	520	
1221	10/26/2015	SB	Gill Netting	Stewarts Bay	207	196	104	x
1222	10/26/2015	SB	Gill Netting	Stewarts Bay	327	310	360	x
1223	10/26/2015	SB	Gill Netting	Stewarts Bay	343	324	440	x
1224	10/22/2015	SB	Gill Netting	Gov't Wash	403	378	670	x
1225	10/22/2015	SB	Gill Netting	Gov't Wash	120	112	10	
1226	10/22/2015	SB	Gill Netting	Gov't Wash	405	376	610	x
1227	10/22/2015	SB	Gill Netting	Gov't Wash	230	215	110	x
1228	10/22/2015	SB	Gill Netting	Gov't Wash	376	353	540	x
1229	10/22/2015	SB	Gill Netting	Gov't Wash	354	330	450	x
1230	10/22/2015	SB	Gill Netting	Gov't Wash	234	218	130	x
1231	10/22/2015	SB	Gill Netting	Gov't Wash	385	364	540	x
1232	10/22/2015	SB	Gill Netting	Gov't Wash	405	377	650	x
1233	10/22/2015	SB	Gill Netting	Gov't Wash	409	382	670	x
1234	10/22/2015	SB	Gill Netting	Gov't Wash	233	217	150	x
1235	10/22/2015	SB	Gill Netting	Gov't Wash	494	461	1200	x
1236	10/22/2015	SB	Gill Netting	Gov't Wash	231	221	130	x
1237	10/22/2015	SB	Gill Netting	Gov't Wash	230	215	130	x
1238	10/22/2015	LMB	Gill Netting	Indian Canyon	217	210	130	x
1239	10/22/2015	LMB	Gill Netting	Indian Canyon	397	385	930	x
1240	10/26/2015	SB	Gill Netting	Stewarts Bay	355	336	480	x
1241	10/26/2015	SB	Gill Netting	Stewarts Bay	317	300	340	x
1242	10/26/2015	SB	Gill Netting	Stewarts Bay	353	338	480	x
1243	10/26/2015	SB	Gill Netting	Stewarts Bay	210	199	106	x
1244	10/26/2015	SB	Gill Netting	Stewarts Bay	182	170	61	x
1245	10/26/2015	LMB	Gill Netting	Stewarts Bay	205	198	100	x
1246	10/26/2015	SB	Gill Netting	Stewarts Bay	226	212	138	x
1247	10/26/2015	LMB	Gill Netting	Bluepoint Bay	258	250	210	
1248	10/26/2015	LMB	Gill Netting	Bluepoint Bay	209	199	105	
1249	10/26/2015	LMB	Gill Netting	Bluepoint Bay	226	218	145	
1250	10/22/2015	LMB	Gill Netting	Indian Canyon	298	294	370	x
1251	10/22/2015	SMB	Gill Netting	Indian Canyon	370	354	680	x
1252	10/26/2015	SMB	Gill Netting	Cottonwood	400	380	770	
1253	10/26/2015	SMB	Gill Netting	Cottonwood	155	146	44	
1254	10/26/2015	LMB	Gill Netting	Cottonwood	254	244	230	
1255	10/26/2015	SMB	Gill Netting	Cottonwood	200	192	103	
1256	10/26/2015	LMB	Gill Netting	Cottonwood	234	225	170	x
1257	10/26/2015	SMB	Gill Netting	Cottonwood	290	278	310	x
1258	10/26/2015	SMB	Gill Netting	S-Cove	401	380	910	
1259	10/26/2015	LMB	Gill Netting	S-Cove	339	325	520	
1260	10/26/2015	SMB	Gill Netting	S-Cove	300	285	330	
1261	10/26/2015	SMB	Gill Netting	S-Cove	300	287	380	
1262	12/5/2015	SMB	Tournament	Unknown	375	359	640	

Envelope Number	Date	Species	Survey type	Area caught	TL mm	FL mm	Weight g	Otolith
1263	12/13/2015	SB	Tournament	Unknown	515	486	1157	
1264	12/13/2015	SB	Tournament	Unknown	570	533	1474	
1265	12/13/2015	SB	Tournament	Unknown	547	514	1520	
1266	12/13/2015	SB	Tournament	Unknown	515	486	1338	
1268	12/13/2015	SB	Tournament	Unknown	510	474	1225	
1269	12/13/2015	SB	Tournament	Unknown	512	478	1270	
1270	12/13/2015	SB	Tournament	Unknown	525	493	1225	
1271	12/13/2015	SB	Tournament	Unknown	509	477	1089	
1272	12/13/2015	SB	Tournament	Unknown	506	470	1270	
1273	12/13/2015	SB	Tournament	Unknown	515	485	1429	
1274	12/13/2015	SB	Tournament	Unknown	523	493	1202	
1276	12/13/2015	SB	Tournament	Unknown	543	510	1497	
1277	12/13/2015	SB	Tournament	Unknown	547	519	1474	
1278	12/13/2015	SB	Tournament	Unknown	520	495	1293	
1279	12/13/2015	SB	Tournament	Unknown	517	486	1338	
1280	12/13/2015	SB	Tournament	Unknown	520	495	1293	
1281	12/13/2015	SB	Tournament	Unknown	518	488	1225	
3001	10/6/2015	SMB	Gill Netting	James Bay	331	318	450	
3002	10/5/2015	SMB	Gill Netting	James Bay	250	236	180	
3003	10/6/2015	LMB	Gill Netting	Bearing Cove	170	150	60	
3004	10/6/2015	LMB	Gill Netting	Hamblin Bay	450	400	1410	
3005	10/6/2015	LMB	Gill Netting	Hamblin Bay	400	350	690	
3006	10/7/2015	LMB	Gill Netting	South Beach	322	309	420	
1300	3/23/2016	SMB	Trammel net	Echo Bay	396	377	818	
1301	3/23/2016	LMB	Trammel net	Overton Arm	301	285	248	
1302	3/24/2016	LMB	Trammel net	The Meadows	204	198	---	
1303	3/24/2016	LMB	Trammel net	The Meadows	204	198	96	
1304	3/24/2016	LMB	Trammel net	The Meadows	264	251	---	
1305	3/24/2016	LMB	Trammel net	The Meadows	208	199	---	
1306	3/24/2016	LMB	Trammel net	The Meadows	268	256	---	
1307	3/24/2016	LMB	Trammel net	The Meadows	251	243	194	
1308	3/24/2016	LMB	Trammel net	The Meadows	236	228	130	
1309	3/23/2016	LMB	Electroshocking	The Meadows	515	412	480	
1310	3/23/2016	LMB	Electroshocking	The Meadows	209	---	140	
1311	3/23/2016	LMB	Electroshocking	The Meadows	406	382	890	
1312	3/24/2016	LMB	Trammel net	The Meadows	331	320	415	
1314	3/24/2016	LMB	Trammel net	The Meadows	365	352	685	
1315	3/24/2016	LMB	Trammel net	The Meadows	375	360	670	
1316	3/23/2016	SMB	Trammel net	Echo Bay	231	221	142	
1317	3/22/2016	LMB	Trammel net	Echo Bay	426	410	998	
1318	3/22/2016	SMB	Trammel net	Echo Bay	313	296	308	
1319	3/22/2016	SMB	Trammel net	Echo Bay	377	356	898	
1320	3/22/2016	SMB	Trammel net	Echo Bay	295	282	320	

Envelope Number	Date	Species	Survey type	Area caught	TL mm	FL mm	Weight g	Otolith
1321	3/22/2016	SMB	Trammel net	Echo Bay	364	349	558	
1322	4/3/2016	LMB	Tournament	Unknown	428	415	1020	x
1323	4/3/2016	SMB	Tournament	Unknown	389	370	720	
1324	4/8/2016	LMB	Tournament	Unknown	428	410	1040	x
1325	4/8/2016	SMB	Tournament	Unknown	446	425	1090	x
1326	4/8/2016	LMB	Tournament	Unknown	344	327	520	x
1327	4/8/2016	LMB	Tournament	Unknown	450	436	1520	x
1328	4/8/2016	SMB	Tournament	Unknown	384	360	780	x
1329	4/8/2016	LMB	Tournament	Unknown	476	461	1690	x
1330	4/8/2016	SMB	Tournament	Unknown	406	380	1000	x
1331	4/8/2016	SMB	Tournament	Unknown	428	408	---	x
1332	4/8/2016	LMB	Tournament	Unknown	496	475	2120	x
1333	4/8/2016	LMB	Tournament	Unknown	392	375	720	x
1334	4/8/2016	SMB	Tournament	Unknown	382	362	780	x
1335	4/8/2016	LMB	Tournament	Unknown	430	412	1050	x
1336	4/8/2016	LMB	Tournament	Unknown	354	340	550	x
1337	4/8/2016	LMB	Tournament	Unknown	441	428	1300	
1338	4/9/2016	SMB	Tournament	Unknown	399	385	880	x
1339	4/9/2016	SMB	Tournament	Unknown	335	320	570	x
1340	4/4/2016	SMB	Tournament	Unknown	366	352	670	x
1341	4/4/2016	SMB	Tournament	Unknown	376	358	640	x
1342	4/4/2016	LMB	Tournament	Unknown	390	388	940	x
1343	4/4/2016	SMB	Tournament	Unknown	352	336	600	x
1344	5/9/2016	SB	Creel	Hatchery Cove	630	595	2030	x
1345	5/9/2016	SB	Creel	Hatchery Cove	390	364	510	x
1346	5/9/2016	SB	Creel	Hatchery Cove	367	341	450	x
1347	5/9/2016	SB	Creel	Hatchery Cove	428	399	640	x
1348	5/9/2016	SB	Creel	Hatchery Cove	518	476	1270	x
1349	5/9/2016	SB	Creel	Hatchery Cove	375	345	460	x
1350	5/9/2016	SB	Creel	Hatchery Cove	478	440	870	x
1351	5/9/2016	SB	Creel	Hatchery Cove	495	455	960	x
1352	6/12/2016	SB	Tournament	Unknown	522	485	1089	
1353	6/12/2016	SB	Tournament	S. Overton Arm	484	460	952.5	x
1354	6/12/2016	SB	Tournament	S. Overton Arm	500	458	975.2	x
1355	6/12/2016	SB	Tournament	S. Overton Arm	518	479	1089	x
1356	6/12/2016	SB	Tournament	S. Overton Arm	465	434	839	x
1357	6/12/2016	SB	Tournament	S. Overton Arm	507	470	1134	x
1358	6/12/2016	SB	Tournament	S. Overton Arm	495	460	930	x
1359	6/12/2016	SB	Tournament	S. Overton Arm	504	470	1111	x
1360	6/12/2016	SB	Tournament	Overton Arm	500	462	1043	x
1361	6/12/2016	SB	Tournament	Overton Arm	494	455	998	x
1362	6/12/2016	SB	Tournament	Overton Arm	490	450	2000	x
1363	6/12/2016	SB	Tournament	Unknown	525	488	1111	x

Envelope Number	Date	Species	Survey type	Area caught	TL mm	FL mm	Weight g	Otolith
1364	6/12/2016	SB	Tournament	Unknown	515	478	1066	x
1365	6/12/2016	SB	Tournament	Unknown	541	505	1247	x
1366	6/12/2016	SB	Tournament	Unknown	485	445	930	
1367	6/12/2016	SB	Tournament	Unknown	500	470	1021	x
1368	6/12/2016	SB	Tournament	Unknown	560	520	1293	
1369	6/12/2016	SB	Tournament	Unknown	600	553	1542	x
1370	6/12/2016	SB	Tournament	Unknown	505	463	1021	x
1371	6/12/2016	SB	Tournament	Boulder Basin	518	480	1111	
1372	6/12/2016	SB	Tournament	Boulder Basin	515	480	1111	x
1373	6/12/2016	SB	Tournament	Boulder Basin	510	470	998	x
1374	6/12/2016	SB	Tournament	Unknown	520	480	998	
1375	6/12/2016	SB	Tournament	Unknown	550	507	1111	x
1376	6/25/2016	SMB	Tournament	Unknown	430	410	1020	x
1377	6/25/2016	SMB	Tournament	Unknown	430	410	950	x
1378	6/25/2016	SMB	Tournament	Unknown	422	400	900	x
1379	6/25/2016	SMB	Tournament	Unknown	392	371	780	x
1380	6/25/2016	SMB	Tournament	Unknown	432	408	850	x
1381	6/25/2016	SMB	Tournament	Unknown	470	445	1410	x
1382	6/25/2016	SMB	Tournament	Unknown	382	362	670	x
1383	6/25/2016	SMB	Tournament	Unknown	409	390	930	x
1384	6/25/2016	SMB	Tournament	Unknown	428	408	840	x
1385	6/25/2016	SMB	Tournament	Unknown	379	358	740	x
1386	6/25/2016	SMB	Tournament	Unknown	420	399	880	x
1387	6/25/2016	SMB	Tournament	Unknown	361	345	670	x
1388	6/25/2016	SMB	Tournament	Unknown	445	425	1080	x
1389	6/25/2016	SMB	Tournament	Unknown	393	375	710	x
1390	6/25/2016	SMB	Tournament	Unknown	395	375	780	x
1391	6/25/2016	SMB	Tournament	Unknown	395	375	760	x
1392	6/25/2016	SMB	Tournament	Unknown	386	368	660	x
1393	6/25/2016	LMB	Tournament	Unknown	422	405	910	x
1394	6/25/2016	LMB	Tournament	Unknown	432	416	1040	x
1395	6/26/2016	LMB	Tournament	Unknown	415	396	900	x
1396	6/26/2016	LMB	Tournament	Unknown	500	475	1640	x
1397	6/26/2016	LMB	Tournament	Unknown	374	362	640	x
1398	6/26/2016	LMB	Tournament	Unknown	412	397	800	x
1399	6/26/2016	SMB	Tournament	Unknown	385	365	810	x
1400	6/26/2016	SMB	Tournament	Unknown	423	402	660	x
1401	6/26/2016	SMB	Tournament	Unknown	430	411	920	x
1402	6/26/2016	SMB	Tournament	Unknown	357	340	540	x
1403	6/26/2016	SMB	Tournament	Unknown	458	433	1150	x
1404	6/26/2016	SMB	Tournament	Unknown	420	402	860	x
1405	6/26/2016	SMB	Tournament	Unknown	388	370	620	x
1406	6/26/2016	SMB	Tournament	Unknown	398	378	840	x

Envelope Number	Date	Species	Survey type	Area caught	TL mm	FL mm	Weight g	Otolith
1407	6/26/2016	SMB	Tournament	Unknown	414	394	920	x
1408	6/26/2016	SMB	Tournament	Unknown	422	400	940	x
1409	6/26/2016	SMB	Tournament	Unknown	360	341	610	x
1410	6/26/2016	SMB	Tournament	Unknown	338	321	510	x
1411	9/12/2016	LMB	Tournament	Unknown	410	395	1020	x
1412	9/12/2016	LMB	Tournament	Unknown	350	339	570	x
1413	9/12/2016	LMB	Tournament	Unknown	385	369	640	x
1414	9/12/2016	SMB	Tournament	Unknown	430	406	1060	x
1415	9/12/2016	SMB	Tournament	Unknown	342	325	510	x
1416	9/12/2016	SMB	Tournament	Unknown	353	335	530	x
1417	9/12/2016	SMB	Tournament	Unknown	398	380	740	x
1418	9/12/2016	SMB	Tournament	Unknown	339	325	500	x
1419	9/12/2016	SMB	Tournament	Unknown	350	338	650	x
1420	9/12/2016	SMB	Tournament	Unknown	419	399	970	x
1421	9/12/2016	SMB	Tournament	Unknown	351	336	540	x
1422	9/12/2016	SMB	Tournament	Unknown	468	451	1380	x
1423	9/12/2016	SMB	Tournament	Unknown	340	328	490	x
1424	9/12/2016	SMB	Tournament	Unknown	330	321	360	x
1425	9/13/2016	LMB	Tournament	Unknown	480	463	1460	x
1426	9/13/2016	LMB	Tournament	Unknown	355	340	590	x
1427	9/13/2016	SMB	Tournament	Unknown	390	370	760	x
1428	9/13/2016	SMB	Tournament	Unknown	415	393	930	x
1429	9/13/2016	SMB	Tournament	Unknown	347	333	590	x
1430	9/13/2016	SMB	Tournament	Unknown	414	400	730	x
1431	9/13/2016	SMB	Tournament	Unknown	357	339	590	x
1432	9/13/2016	SMB	Tournament	Unknown	330	315	490	x
1433	9/13/2016	SMB	Tournament	Unknown	403	384	810	x
1434	9/13/2016	SMB	Tournament	Unknown	388	365	730	x
1435	9/13/2016	SMB	Tournament	Unknown	384	364	770	x
1436	9/13/2016	SMB	Tournament	Unknown	396	378	800	x
1437	9/13/2016	SMB	Tournament	Unknown	340	325	510	x
1438	9/13/2016	SMB	Tournament	Unknown	387	365	760	x
1439	9/13/2016	SMB	Tournament	Unknown	349	331	520	x
1440	9/13/2016	SMB	Tournament	Unknown	352	333	550	x
1441	9/13/2016	SMB	Tournament	Unknown	338	321	480	x
1442	9/13/2016	SMB	Tournament	Unknown	340	326	490	x
1443	9/13/2016	SMB	Tournament	Unknown	330	311	450	x
1444	9/14/2016	LMB	Tournament	Unknown	399	380	760	x
1445	9/14/2016	LMB	Tournament	Unknown	380	369	700	x
1446	9/14/2016	SMB	Tournament	Unknown	334	320	430	x
1447	9/14/2016	SMB	Tournament	Unknown	349	334	540	x
1448	9/14/2016	SMB	Tournament	Unknown	337	318	460	x
1449	9/14/2016	SMB	Tournament	Unknown	327	309	430	x

Envelope Number	Date	Species	Survey type	Area caught	TL mm	FL mm	Weight g	Otolith
1450	9/14/2016	SMB	Tournament	Unknown	327	311	390	x
1451	9/14/2016	SMB	Tournament	Unknown	379	363	610	x
1452	9/14/2016	SMB	Tournament	Unknown	424	398	950	x
1453	9/14/2016	SMB	Tournament	Unknown	374	358	650	x
1454	9/14/2016	SMB	Tournament	Unknown	349	333	570	x
1455	9/14/2016	SMB	Tournament	Unknown	337	319	460	
1456	9/14/2016	SMB	Tournament	Unknown	410	386	980	x
1457	9/14/2016	SMB	Tournament	Unknown	343	331	520	x
1458	9/14/2016	SMB	Tournament	Unknown	363	345	610	x
1459	10/4/2016	SB	Gill Netting	Anchor Cove	450	420	860	x
1460	10/4/2016	SB	Gill Netting	Anchor Cove	465	437	900	
1461	10/4/2016	SB	Gill Netting	Anchor Cove	132	116	130	x
1462	10/4/2016	SMB	Gill Netting	Anchor Cove	468	447	1690	x
1463	10/4/2016	SMB	Gill Netting	Anchor Cove	485	465	1410	
1464	10/4/2016	SB	Gill Netting	Calico Bay	473	442	950	x
1465	10/4/2016	SB	Gill Netting	Calico Bay	460	430	720	x
1466	10/4/2016	SB	Gill Netting	Echo Bay	448	423	760	
1467	10/4/2016	SB	Gill Netting	Echo Bay	463	434	680	x
1468	10/4/2016	SB	Gill Netting	Echo Bay	494	473	570	x
1469	10/4/2016	SB	Gill Netting	Echo Bay	413	384	600	x
1470	10/4/2016	SB	Gill Netting	Echo Bay	501	468	1060	x
1471	10/4/2016	SB	Gill Netting	Echo Bay	443	425	670	x
1472	10/4/2016	SB	Gill Netting	Echo Bay	403	380	610	x
1473	10/4/2016	SB	Gill Netting	Echo Bay	440	410	790	x
1474	10/4/2016	SB	Gill Netting	Echo Bay	402	379	640	x
1475	10/4/2016	SB	Gill Netting	Echo Bay	337	310	390	x
1476	10/4/2016	SB	Gill Netting	Echo Bay	373	349	480	x
1477	10/4/2016	SB	Gill Netting	Echo Bay	339	319	410	x
1478	10/4/2016	SB	Gill Netting	Echo Bay	445	419	850	x
1479	10/4/2016	SB	Gill Netting	Echo Bay	435	408	780	x
1480	10/4/2016	SB	Gill Netting	Echo Bay	405	378	620	x
1481	10/4/2016	SB	Gill Netting	Echo Bay	428	401	740	x
1482	10/4/2016	SB	Gill Netting	Echo Bay	465	436	840	x
1483	10/4/2016	SB	Gill Netting	Echo Bay	434	410	530	x
1484	10/4/2016	SB	Gill Netting	Echo Bay	383	361	550	x
1485	10/4/2016	SB	Gill Netting	Echo Bay	425	398	600	x
1486	10/4/2016	SB	Gill Netting	Echo Bay	382	359	550	x
1487	10/4/2016	SB	Gill Netting	Echo Bay	344	321	410	x
1488	10/4/2016	SB	Gill Netting	Echo Bay	162	153	50	x
1489	10/4/2016	SMB	Gill Netting	Echo Bay	358	345	580	x
1490	10/5/2016	LMB	Gill Netting	Black Point	310	300	340	
1491	10/5/2016	LMB	Gill Netting	Black Point	299	290	370	
1492	10/5/2016	LMB	Gill Netting	Black Point	275	262	260	x

Envelope Number	Date	Species	Survey type	Area caught	TL mm	FL mm	Weight g	Otolith
1493	10/5/2016	LMB	Gill Netting	Black Point	175	165	---	x
1494	10/5/2016	SB	Gill Netting	Black Point	310	304	370	
1495	10/5/2016	LMB	Gill Netting	Bluepoint Bay	374	365	810	x
1496	10/5/2016	LMB	Gill Netting	Bluepoint Bay	330	316	540	x
1497	10/5/2016	LMB	Gill Netting	Bluepoint Bay	428	415	1120	x
1498	10/5/2016	SB	Gill Netting	Bluepoint Bay	345	318	360	x
1499	10/5/2016	SB	Gill Netting	Bluepoint Bay	475	440	1010	x
1500	10/5/2016	SMB	Gill Netting	Cottonwood	400	380	800	
1501	10/5/2016	SB	Gill Netting	Cottonwood	455	422	560	x
1502	10/5/2016	SB	Gill Netting	Cottonwood	465	428	660	x
1504	10/5/2016	SB	Gill Netting	Stewarts Bay	229	217	120	x
1505	10/6/2016	SMB	Gill Netting	Cathedral Cove	494	469	1590	
1506	10/6/2016	SB	Gill Netting	Cathedral Cove	466	432	600	x
1507	10/6/2016	SB	Gill Netting	Ramshead	440	410	460	x
1508	10/6/2016	SB	Gill Netting	Ramshead	435	404	640	x
1509	10/6/2016	SB	Gill Netting	Ramshead	410	384	520	x
1510	10/6/2016	SB	Gill Netting	Preachers Cove	457	429	550	x
1511	10/6/2016	SB	Gill Netting	Preachers Cove	474	434	760	x
1512	10/6/2016	SB	Gill Netting	Preachers Cove	410	377	630	x
1513	10/6/2016	SB	Gill Netting	Preachers Cove	367	337	410	x
1514	10/13/2016	SMB	Gill Netting	James Bay	298	282	300	
1515	10/13/2016	LMB	Gill Netting	Sidewinder	322	310	410	
1516	10/13/2016	SMB	Gill Netting	Sidewinder	147	140	20	x
1517	10/13/2016	SB	Gill Netting	Sidewinder	485	452	720	x
1518	10/13/2016	LMB	Gill Netting	Bearing Point	312	298	380	
1519	10/13/2016	LMB	Gill Netting	Bearing Point	311	299	390	
1520	10/13/2016	SMB	Gill Netting	Bearing Point	328	324	490	x
1521	10/13/2016	SMB	Gill Netting	Bearing Point	327	316	520	x
1522	10/13/2016	BG	Gill Netting	Bearing Point	107	---	30	x
1523	10/13/2016	LMB	Gill Netting	Auxiliary Point	389	372	680	
1524	10/13/2016	SMB	Gill Netting	Auxiliary Point	234	225	150	x
1525	10/17/2016	LMB	Electroshocking	Last Chance	386	---	---	
1526	10/21/2016	LMB	Gill Netting	Hideaway Cove	212	204	80	x
1527	10/21/2016	SMB	Gill Netting	Hideaway Cove	235	225	110	
1528	10/21/2016	SMB	Gill Netting	Hideaway Cove	209	201	80	x
1529	10/21/2016	SB	Gill Netting	Hideaway Cove	460	431	630	
1530	10/21/2016	SMB	Gill Netting	Callville Wash	370	356	710	x
1531	10/21/2016	SB	Gill Netting	Callville Wash	524	495	1380	
1532	10/21/2016	SB	Gill Netting	Callville Bay	404	378	560	x
1533	10/21/2016	SB	Gill Netting	Callville Bay	478	447	670	x
1534	10/25/2016	SB	Gill Netting	Pyramid Island	486	463	660	x
1535	10/25/2016	SB	Gill Netting	Pyramid Island	305	293	280	x
1536	10/25/2016	SB	Gill Netting	Pyramid Island	165	153	40	x

Envelope Number	Date	Species	Survey type	Area caught	TL mm	FL mm	Weight g	Otolith
1537	10/25/2016	SB	Gill Netting	Pyramid Island	181	170	40	x
1538	10/25/2016	SB	Gill Netting	Pyramid Island	471	436	580	x
1539	10/25/2016	SB	Gill Netting	Pyramid Island	409	380	590	x
1540	10/25/2016	LMB	Gill Netting	Saddle Cove	327	311	460	
1541	10/21/2016	SB	Gill Netting	Lovers Cove	460	431	630	x
1600	3/12/2017	SB	Tournament	Unknown	448	420	794	
1601	3/12/2017	SB	Tournament	Unknown	655	610	2200	x
1602	3/12/2017	SB	Tournament	Unknown	567	530	1293	
1603	3/12/2017	SB	Tournament	Unknown	450	415	612	
1604	3/12/2017	SB	Tournament	Unknown	486	450	907	
1605	3/12/2017	SB	Tournament	Unknown	447	415	748	
1606	3/12/2017	SB	Tournament	Unknown	506	470	1134	
1607	3/12/2017	SB	Tournament	Unknown	295	272	249	
1608	3/12/2017	SB	Tournament	Unknown	465	430	930	
1609	4/1/2017	LMB	Tournament	Unknown	478	457	1220	x
1610	4/15/2017	SMB	Tournament	Unknown	427	406	1030	x
1611	4/15/2017	SMB	Tournament	Unknown	450	425	1200	x
1612	4/15/2017	SMB	Tournament	Unknown	439	419	1120	x
1613	9/8/2017	SMB	Tournament	Unknown	324	310	400	x
1614	9/8/2017	SMB	Tournament	Unknown	410	390	910	x
1615	9/8/2017	SMB	Tournament	Unknown	435	415	1030	x
1616	9/8/2017	SMB	Tournament	Unknown	340	325	500	x
1617	9/8/2017	SMB	Tournament	Unknown	342	325	500	x
1618	9/8/2017	SMB	Tournament	Unknown	440	418	1110	x
1619	9/8/2017	SMB	Tournament	Unknown	356	336	660	x
1620	9/8/2017	SMB	Tournament	Unknown	392	375	780	x
1621	9/8/2017	SMB	Tournament	Unknown	430	407	1080	x
1622	9/8/2017	SMB	Tournament	Unknown	354	336	600	x
1623	9/8/2017	SMB	Tournament	Unknown	393	374	850	x
1624	9/8/2017	LMB	Tournament	Unknown	555	530	3070	x
1625	9/8/2017	SMB	Tournament	Unknown	465	440	1370	x
1626	9/8/2017	SMB	Tournament	Unknown	405	382	850	x
1627	9/8/2017	SMB	Tournament	Unknown	325	310	420	x
1628	9/8/2017	SMB	Tournament	Unknown	415	395	970	x
1629	9/8/2017	LMB	Tournament	Unknown	367	350	590	x
1630	9/8/2017	SMB	Tournament	Unknown	357	338	580	x
1631	9/8/2017	SMB	Tournament	Unknown	377	361	670	x
1632	9/8/2017	SMB	Tournament	Unknown	383	360	720	x
1633	9/8/2017	SMB	Tournament	Unknown	360	338	610	x
1634	9/8/2017	SMB	Tournament	Unknown	417	397	960	x
1635	9/8/2017	SMB	Tournament	Unknown	342	322	500	x
1636	9/8/2017	SMB	Tournament	Unknown	412	387	920	x
1637	9/8/2017	SMB	Tournament	Unknown	398	375	810	x

Envelope Number	Date	Species	Survey type	Area caught	TL mm	FL mm	Weight g	Otolith
1638	9/8/2017	SMB	Tournament	Unknown	364	346	640	x
1639	9/8/2017	SMB	Tournament	Unknown	330	312	470	x
1640	9/8/2017	SMB	Tournament	Unknown	346	330	490	x
1641	9/9/2017	SMB	Tournament	Unknown	400	478	840	x
1642	9/9/2017	SMB	Tournament	Unknown	334	315	460	x
1643	9/9/2017	SMB	Tournament	Unknown	353	334	590	x
1644	9/9/2017	SMB	Tournament	Unknown	405	384	980	x
1645	9/9/2017	SMB	Tournament	Unknown	346	331	570	x
1646	9/9/2017	SMB	Tournament	Unknown	440	423	1200	x
1647	9/9/2017	SMB	Tournament	Unknown	495	470	740	x
1648	9/9/2017	SMB	Tournament	Unknown	335	320	430	x
1649	9/9/2017	SMB	Tournament	Unknown	460	440	1440	x
1650	9/9/2017	SMB	Tournament	Unknown	328	311	460	x
1651	9/9/2017	SMB	Tournament	Unknown	365	348	640	x
1652	9/9/2017	SMB	Tournament	Unknown	317	302	440	x
1653	9/9/2017	SMB	Tournament	Unknown	402	379	840	x
1654	9/9/2017	LMB	Tournament	Unknown	365	350	690	x
1655	9/9/2017	SMB	Tournament	Unknown	333	315	460	x
1656	9/9/2017	SMB	Tournament	Unknown	380	357	730	x
1657	9/9/2017	SMB	Tournament	Unknown	355	334	520	x
1658	9/9/2017	SMB	Tournament	Unknown	348	330	560	x
1659	9/9/2017	SMB	Tournament	Unknown	385	365	710	x
1660	9/9/2017	SMB	Tournament	Unknown	400	378	850	x
1661	9/14/2017	SB	Creel	Vegas Wash	347	320	410	x
1662	9/14/2017	SB	Creel	Vegas Wash	408	377	700	x
1663	9/14/2017	SB	Creel	Vegas Wash	383	357	590	x
1664	9/14/2017	SB	Creel	Vegas Wash	453	418	700	x
1665	9/14/2017	SB	Creel	Vegas Wash	433	401	670	x
1666	9/14/2017	SB	Creel	Vegas Wash	363	335	470	x
1667	9/14/2017	SB	Creel	Vegas Wash	410	380	590	x
1668	9/14/2017	SB	Creel	Vegas Wash	454	426	920	x
1669	9/14/2017	SB	Creel	Vegas Wash	355	329	440	x
1670	9/14/2017	SB	Creel	Vegas Wash	383	354	540	x
1671	9/14/2017	SB	Creel	Vegas Wash	429	397	740	x
1672	9/14/2017	SB	Creel	Vegas Wash	372	343	480	x
1673	10/4/2017	SMB	Gill Netting	Bearing Point	249	226	170	x
1674	10/4/2017	SMB	Gill Netting	Bearing Point	236	225	150	x
1675	10/4/2017	SMB	Gill Netting	Bearing Point	158	149	10	x
1676	10/4/2017	LMB	Gill Netting	Auxiliary	310	295	800	x
1677	10/11/2017	SMB	Gill Netting	Azure Cove	251	243	200	x
1678	10/11/2017	SB	Gill Netting	Azure Cove	431	397	650	x
1679	10/11/2017	SB	Gill Netting	Preachers Cove	351	322	400	x
1680	10/11/2017	SB	Gill Netting	Ramshead	448	416	740	x

Envelope Number	Date	Species	Survey type	Area caught	TL mm	FL mm	Weight g	Otolith
1681	10/11/2017	SB	Gill Netting	Ramshead	346	321	360	x
1682	10/11/2017	SMB	Gill Netting	Ramshead	235	225	140	x
1683	10/12/2017	SB	Gill Netting	Anchor Cove	469	444	720	x
1684	10/12/2017	SB	Gill Netting	Anchor Cove	456	422	680	x
1685	10/12/2017	LMB	Gill Netting	Anchor Cove	164	157	60	x
1686	10/12/2017	LMB	Gill Netting	Anchor Cove	310	302	380	x
1687	10/12/2017	LMB	Gill Netting	Anchor Cove	165	154	60	x
1688	10/12/2017	SMB	Gill Netting	Anchor Cove	182	175	80	x
1689	10/12/2017	SB	Gill Netting	Calico Bay	328	307	300	x
1690	10/12/2017	LMB	Gill Netting	Calico Bay	246	236	160	x
1691	10/12/2017	LMB	Gill Netting	Calico Bay	222	215	120	x
1692	10/12/147	LMB	Gill Netting	Calico Bay	216	200	100	x
1693	10/12/2017	SB	Gill Netting	Rogers Bay	463	427	580	x
1694	10/12/2017	SB	Gill Netting	Rogers Bay	326	309	380	x
1695	10/12/2017	SB	Gill Netting	Whale Rock	216	203	90	x
1696	10/12/2017	SB	Gill Netting	Whale Rock	477	441	930	x
1697	10/12/2017	LMB	Gill Netting	Whale Rock	211	203	100	x
1698	10/12/2017	SB	Gill Netting	Whale Rock	226	209	100	x
1699	10/12/2017	SB	Gill Netting	Whale Rock	196	184	70	x
1700	10/16/2017	SMB	Tournament	Callville Bay	346	329	490	x
1701	10/16/2017	LMB	Tournament	Callville Bay	340	327	520	x
1702	10/16/2017	SMB	Tournament	Callville Bay	334	316	480	x
1703	10/16/2017	SMB	Tournament	Callville Bay	451	427	1180	x
1704	10/16/2017	SMB	Tournament	Callville Bay	321	301	410	x
1705	10/16/2017	LMB	Tournament	Callville Bay	390	372	810	x
1706	10/16/2017	SMB	Tournament	Callville Bay	419	396	950	x
1707	10/16/2017	SMB	Tournament	Callville Bay	338	318	450	x
1708	10/16/2017	SMB	Tournament	Callville Bay	397	380	740	x
1709	10/17/2017	SMB	Tournament	Callville Bay	444	422	970	x
1710	10/17/2017	SMB	Tournament	Callville Bay	332	319	490	
1711	10/17/2017	LMB	Tournament	Callville Bay	379	363	670	x
1712	10/17/2017	LMB	Tournament	Callville Bay	517	504	2090	x
1713	10/18/2017	SMB	Tournament	Callville Bay	406	385	840	x
1714	10/18/2017	SMB	Tournament	Callville Bay	368	354	680	x
1715	10/18/2017	SMB	Tournament	Callville Bay	382	359	720	x
1716	10/18/2017	SMB	Tournament	Callville Bay	422	403	1050	x
1717	10/18/2017	SMB	Tournament	Callville Bay	336	321	440	x
1718	10/18/2017	SMB	Tournament	Callville Bay	379	365	690	x
1719	10/19/2017	SB	Gill Netting	Black Point	239	222	130	x
1720	10/19/2017	SB	Gill Netting	Black Point	214	199	110	x
1721	10/19/2017	SB	Gill Netting	Black Point	224	208	120	x
1722	10/19/2017	SB	Gill Netting	Black Point	231	218	140	x
1723	10/19/2017	SB	Gill Netting	Black Point	355	327	430	x

Envelope Number	Date	Species	Survey type	Area caught	TL mm	FL mm	Weight g	Otolith
1724	10/19/2017	SB	Gill Netting	Black Point	466	438	610	x
1725	10/19/2017	SB	Gill Netting	Black Point	234	220	140	x
1726	10/19/2017	SB	Gill Netting	Black Point	599	552	1220	x
1727	10/19/2017	SMB	Gill Netting	Black Point	227	219	150	x
1728	10/19/2017	SB	Gill Netting	Bluepoint Bay	421	392	660	x
1729	10/19/2017	SB	Gill Netting	Bluepoint Bay	487	449	820	x
1730	10/19/2017	SB	Gill Netting	Bluepoint Bay	341	315	350	x
1731	10/19/2017	SB	Gill Netting	Bluepoint Bay	400	367	540	x
1732	10/19/2017	SB	Gill Netting	Bluepoint Bay	311	286	210	x
1733	10/19/2017	SB	Gill Netting	Stewarts Bay	478	443	970	x
1734	Unknown	SB	Gill Netting	Lime Cove	229	214	130	x
1735	10/4/2017	SB	Gill Netting	James Bay	303	282	310	x
1736	10/4/2017	SB	Gill Netting	James Bay	394	367	630	x
1737	10/4/2017	SB	Gill Netting	James Bay	366	339	500	x
1738	10/4/2017	SB	Gill Netting	James Bay	365	338	470	x
1739	10/4/2017	SB	Gill Netting	James Bay	362	335	470	x
1740	10/4/2017	SB	Gill Netting	James Bay	412	381	680	x
1741	10/4/2017	SMB	Gill Netting	James Bay	290	278	300	
1742	10/4/2017	SMB	Gill Netting	James Bay	176	168	60	
1743	10/4/2017	SMB	Gill Netting	James Bay	307	293	350	x
1744	11/14/2017	SB	Gill Netting	Catclaw Cove	71	58	30	x

Appendix 2. Floy tagged smallmouth bass (SMB), largemouth bass (LMB), and striped bass (SB), 2017.

Tag number	Date	Species	Capture site	TL mm	FL mm	WT g
40403	3/23/2016	SB	Overton Arm	477	450	905
40404	3/23/2016	SB	Overton Arm	490	456	870
5457	3/23/2016	LMB	N. of The Meadows	515	412	480
5458	3/23/2016	LMB	N. of The Meadows	405	394	850
5459	3/23/2016	LMB	N. of The Meadows	383	375	810
5461	3/23/2016	LMB	N. of The Meadows	235	215	130
5462	3/23/2016	LMB	N. of The Meadows	219	208	130
5463	3/23/2016	LMB	N. of The Meadows	221	212	130
5464	3/23/2016	LMB	N. of The Meadows	360	342	560
5465	3/23/2016	LMB	N. of The Meadows	209	196	140
5466	3/23/2016	LMB	N. of The Meadows	406	382	890
5468	3/24/2016	LMB	Overton Arm	335	325	475
5469	3/24/2016	LMB	Overton Arm	375	360	670
5475	3/24/2016	SB	Overton Arm	526	485	1170
5468	3/24/2016	LMB	The Meadows	335	325	475
5469	3/24/2016	LMB	The Meadows	375	360	670
5475	3/24/2016	SB	The Meadows	526	485	1170
5546	10/3/2016	SB	Echo Bay	433	400	780
5547	10/3/2016	SB	Echo Bay	448	423	760
7652	10/4/2016	SB	Black Point	310	304	370
5548	10/4/2016	SMB	Cottonwood Cove	400	380	800
5549	10/5/2016	SMB	Cathedral Cove	494	469	1590
5550	10/12/2016	SMB	James Bay	298	282	300
7700	10/12/2016	LMB	Sidewinder Cove	322	310	410
7699	10/12/2016	SMB	Bearing Point	327	316	520
7698	10/12/2016	LMB	Auxiliary Point	389	372	680
7696	10/20/2016	SMB	Hideaway Cove	235	225	110
7695	10/20/2016	SB	Callville Wash	524	495	1380
7694	10/24/2016	LMB	Saddle Cove	327	311	460
5648	3/21/2017	SMB	Echo Bay	344	325	510
5649	3/21/2017	LMB	Echo Bay	440	421	1140
5650	3/21/2017	SMB	Echo Bay	310	295	330
5627	10/4/2017	SMB	Bearing Point	231	219	130
5401	10/4/2017	SMB	Bearing Point	161	155	40
5628	10/4/2017	LMB	Bearing Point	302	290	400
5630	10/4/2017	SB	Bearing Point	330	309	390
5626	10/4/2017	LMB	Bearing Point	260	249	240
5403	10/4/2017	SMB	Bearing Cove	306	291	370
5402	10/4/2017	LMB	Bearing Cove	296	281	320
5407	10/4/2017	SMB	Auxiliary Cove	321	301	920
5408	10/4/2017	SMB	Auxiliary Cove	345	326	500
5409	10/4/2017	SMB	Auxiliary Cove	256	245	240

Tag number	Date	Species	Capture site	TL mm	FL mm	WT g
5410	10/4/2017	SMB	Auxiliary Cove	422	399	840
5416	10/10/2017	LMB	Painters Cove	483	460	1710
5417	10/10/2017	SMB	Painters Cove	167	161	60
5418	10/10/2017	SMB	Painters Cove	144	137	40
5421	10/10/2017	LMB	Rock Island	268	255	5421
5422	10/10/2017	LMB	Boulder Island	449	421	940
5423	10/10/2017	SMB	Boulder Island	261	254	210
5424	10/10/2017	LMB	Boulder Island	332	317	500
5426	10/11/2017	SMB	Cathedral Cove	241	---	170
5427	10/11/2017	SB	Ramshead Island	510	472	670
5428	10/11/2017	SB	Preachers Cove	479	441	830
5429	10/11/2017	SMB	Preachers Cove	436	418	1360
5430	10/11/2017	SMB	Preachers Cove	299	286	310
5431	10/11/2017	SMB	Preachers Cove	330	314	430
5432	10/11/2017	SMB	Cottonwood Cove	200	193	120
5433	10/11/2017	LMB	Cottonwood Cove	278	268	250
5434	10/11/2017	LMB	Cottonwood Cove	188	180	70
5435	10/11/2017	LMB	Cottonwood Cove	236	232	140
5437	10/12/2017	SMB	Calico Cove	176	167	50
5438	10/12/2017	SMB	Calico Cove	309	296	300
5439	10/12/2017	SMB	Calico Cove	190	184	60
5440	10/12/2017	SMB	Calico Cove	348	329	500
5441	10/12/2017	LMB	Anchor Cove	210	204	110
5444	10/12/2017	LMB	Anchor Cove	293	284	360
5445	10/12/2017	LMB	Anchor Cove	364	347	500
5446	10/12/2017	LMB	Anchor Cove	300	287	340
5447	11/21/2017	LMB	Whale Rock	522	---	2110
5448	11/21/2017	LMB	Whale Rock	335	---	180
5449	10/21/2017	SB	Quail Bay	300	---	240
5450	11/21/2017	LMB	Heron Island	251	---	180
5436	10/12/2017	SMB	Whale Rock	286	271	260
7693	11/14/2017	SB	Twin Springs Cove	473	437	680
7692	11/14/2017	SB	Twin Springs Cove	420	390	400
7691	11/14/2017	SMB	Twin Springs Cove	342	328	500