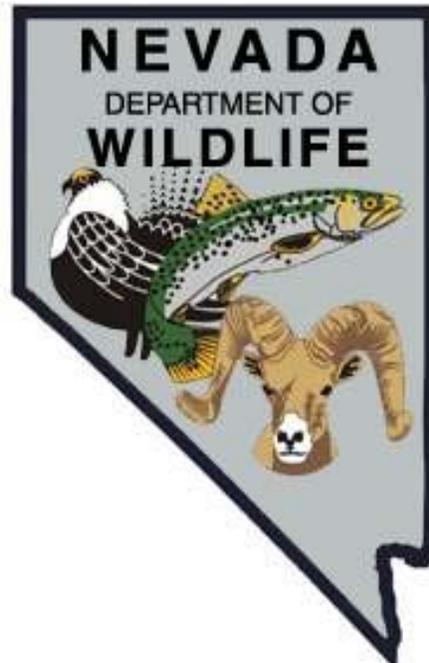


NEVADA DEPARTMENT OF WILDLIFE
STATEWIDE FISHERIES MANAGEMENT



FEDERAL AID JOB PROGRESS REPORT
F-20-53
2017

LAKE MOHAVE
SOUTHERN REGION



**NEVADA DEPARTMENT OF WILDLIFE, FISHERIES DIVISION
JOB PROGRESS REPORT**

Table of Contents

<u>Contents</u>	<u>Page</u>
SUMMARY	1
BACKGROUND	2
OBJECTIVES and APPROACHES	3
PROCEDURES	4
FINDINGS	5
MANAGEMENT REVIEW	19
RECOMMENDATIONS	19

**NEVADA DEPARTMENT OF WILDLIFE, FISHERIES DIVISION
ANNUAL PROGRESS REPORT**

State: Nevada
Project Title: Statewide Fisheries Program
Job Title: Lake Mohave
Period Covered: January 1, 2017 through December 31, 2017

SUMMARY

Contact creel surveys at Lake Mohave occurred during 41 days in 2017. Surveys included 24 days at Willow Beach, 13 at Cottonwood Cove, and 4 at Katherine Landing, and accounted for 267 creel surveys. Volunteer angler drop-boxes were maintained at Willow Beach and Cottonwood Cove. Anglers completed 26 forms at Willow Beach and 14 at Cottonwood Cove.

A cooperative effort between Nevada Department of Wildlife (NDOW), Arizona Game and Fish Department (AZGFD), and United States Bureau of Reclamation (USBR) completed 50 net-nights of gill netting in April 2017. There were 231 fish captured. Species composition included channel catfish *Ictalurus punctatus* (24.7%; $n = 57$), common carp *Cyprinus carpio* (24.2%; $n = 56$), striped bass *Morone saxatilis* (15.1%; $n = 35$), smallmouth bass *Micropterus dolomieu* (8.7%; $n = 20$), gizzard shad *Dorosoma cepedianum* (8.2%; $n = 19$), largemouth bass *Micropterus salmoides* (7.4%; $n = 17$), razorback sucker *Xyrauchen texanus* (5.2%; $n = 12$), green sunfish *Lepomis cyanellus* (4.8%; $n = 11$), and yellow bullhead *Ameiurus natalis* (1.7%; $n = 4$).

An electroshocking survey was conducted on Lake Mohave in April 2017. The survey consisted of 10 randomly selected coves and 5 fixed reference coves along Lake Mohave shoreline. A total of 187 fish were captured, which resulted in an average catch per unit effort (CPUE) of 12.5 fish per station. Species composition consisted of seven species; green sunfish (46.5%; $n = 87$), common carp (16.6%; $n = 31$), bluegill *L. macrochirus* (15.5%; $n = 29$), smallmouth bass (11.2%; $n = 21$), largemouth bass (5.9%; $n = 11$), channel catfish (2.1%; $n = 4$), yellow bullhead (1.6%; $n = 3$), and striped bass (0.5%; $n = 1$).

In Shoshone, Princess, Carp, and Solicitor coves, 22 artificial habitat structures were constructed and deployed. Nine SCUBA surveys were conducted in 2017 in coves with artificial habitat and similar coves with no artificial habitat. Electroshocking surveys were completed at five coves with artificial habitat and five coves without artificial habitat during the spring of 2017. High winds prevented electroshocking surveys from being completed in fall 2017. Six largemouth bass were implanted with internal Sonotronics 36-month, coded sonic tracking tags the week of November 13, 2017. Three fish were caught, tagged, and released in Solicitor Cove and three in Carp Cove. All but two of these fish have been consistently found near the site of release in subsequent tracking efforts. Two of the fish, one from each experimental cove, have not been found since their release.

BACKGROUND

Sixty-seven miles downstream from Hoover Dam, the USBR constructed Davis Dam on the Colorado River in 1951. By May of that year, the new reservoir had backed up to the tailrace of Hoover Dam, which was considered full. The purpose of this impoundment is to meet irrigation requirements, regulate erratic water releases from Hoover Dam, and produce hydroelectric power. The reservoir is subject to fluctuating water levels and exchange flows. The upper 20 miles of the reservoir is confined within the narrow walls of Black Canyon and alternates between lotic or lentic environments depending on water elevation and Hoover Dam releases. The constant cold-water releases from Hoover Dam permit the upper regions of Lake Mohave to be managed as a year round coldwater fishery.

The Colorado River sport fishery is supported by striped bass, stocked rainbow trout, largemouth bass, smallmouth bass, bluegill, green sunfish, channel catfish, and yellow bullhead. Nongame species present include threadfin shad *Dorosoma petenense*, gizzard shad, common carp, bonytail chub *Gila elegans*, and razorback sucker.

The upper region of the lake has historically been stocked year round with catchable rainbow trout, except during October 2013 to February 2017 when hatchery issues halted rearing of rainbow trout. Striped bass were first documented in Lake Mohave in the early 1980s, and they have since become a major component of the sport fishery. Striped bass reproduce in the seasonally warm reaches of the reservoir and move into the coldwater areas as they become larger and eventually prey on stocked rainbow trout. The impact that striped bass has had on the stocked rainbow trout fishery has become significant and in later years has resulted in modifications to the trout-stocking program. The major forage species present in Lake Mohave other than rainbow trout are threadfin shad, gizzard shad, bluegill, green sunfish, and crayfish. Large striped bass are also known to prey on common carp and razorback suckers. Populations of all the forage species have remained relatively abundant with the exception of shad. Predation by striped bass, among other factors, reduced the shad population to a point where it was difficult to detect.

In January 2007, the invasive quagga mussel *Dreissena bugensis* was discovered in the lower Colorado River system including Lake Mohave. Subsequently, the Lake Mead Fish Hatchery was closed due to quagga mussel contamination and a low lake elevation supplying that supplied warm water to the hatchery. The Lake Mead Fish Hatchery provided a significant portion of the rainbow trout stocked into Lake Mohave. The changes this invasive species brings to the Lake Mohave fishery continue to evolve.

Present native fishes, razorback sucker and bonytail chub, within Lake Mohave are listed as endangered under the Endangered Species Act of 1973, as amended. The razorback sucker population has most recently been estimated at less than 5,000 individuals, which is a significant decline from previous estimates of 60,000 in the late

1980s. Once abundant throughout the Colorado River Basin, the species is now extirpated from much of its former range. Nonetheless, Lake Mohave contains one of the largest and most genetically diverse remaining populations of razorback suckers. Bonytail chub exists currently in low numbers in Lake Mohave. Efforts to insure that these species do not disappear precipitated the formation of the Native Fish Work Group. The Native Fish Work Group is an association of private, state, and federal biologists who have responsibilities for the management of Lake Mohave and other main-stem Colorado River reservoirs. The Colorado pikeminnow *Ptychocheilus lucius* is another endangered species native to the historic Colorado River, including the stretch now inundated by Lake Mohave. It is considered extirpated from Lake Mohave.

OBJECTIVES and APPROACHES

General Management

Objectives: To monitor angler use, catch rates and fish population dynamics, and maximize the availability and return of stocked rainbow trout to anglers in Lake Mohave.

Approaches:

- Measure angler use and harvest by conducting three days of contact creel surveys per month at Willow Beach and one day of surveys per month at Cottonwood Cove.
- Utilize creel survey and monitoring data to assess sport fishery performance and changes to estimate sport fish availability and condition.
- Maintain volunteer, angler survey drop-boxes at Willow Beach and Cottonwood Cove.
- Monitor fish population dynamics through a minimum of 50 net-nights of gill netting surveys and up to 20 electroshocking sites in the spring, implemented cooperatively with AZGFD and USBR.
- Coordinate with National Park Service (NPS), AZGFD, and other cooperators on sport fish management needs and cooperative monitoring activities.
- Cooperate with agencies on implementing long-term monitoring of quagga mussel distribution.

Habitat Enhancement Study

Objectives: To enhance angler success through the placement of constructed underwater habitat and to provide areas of persistent underwater habitat that concentrate game fish species in locations accessible to anglers.

Approaches:

- Construct and install up to 100 underwater habitat structures at selected locations on Lake Mohave, including PVC and cut vegetation structures.
- Coordinate with the NPS for harvest and use of shoreline invasive tamarisk used for the brush element of the habitat structures.
- Work with the NPS, AZGFD, and volunteers to assist with construction and

placement of habitat structures.

- Utilize the NDOW fish habitat barge for habitat deployment.
- Survey habitat sites monthly using underwater SCUBA dive transects.
- Survey habitat sites annually by gill or trammel netting, and electroshocking.
- Evaluate angler success and use at habitat improvements sites through data and questionnaires collected through the established general fisheries creel survey program.

PROCEDURES

Angler Use and Harvest

Angler survey activities were conducted at Willow Beach using a stratified access-point survey method. The primary sampling unit was a 12-hour day from 0600 to 1800 hours, with a secondary 4-hour survey block. Surveys days were stratified into high angler use days (Friday through Sunday) and low angler use days (Monday through Thursday) and conducted throughout the year. Angler contact surveys at Cottonwood Cove were conducted opportunistically one to two days per month at the boat ramp.

Creel survey information collected included hours fished, total anglers per party, angler target species preference, angler origin (Nevada, Arizona, California, or "other"), species caught, number of fish harvested and released, length and weight of catch (when harvested), number of anglers in the party, area and cove fished, and awareness of Lake Mohave habitat enhancement program.

Voluntary angler creel drop-boxes with survey forms were found at shaded fish cleaning stations at Willow Beach and Cottonwood Cove. A copy of the creel form is presented in Appendix 1.

Gill Netting

This was the 14th year utilizing AZGFD gill netting and electroshocking protocols. Gill nets were set from Davis Dam north to mile 41. Sampling was completed with 150 ft x 8 ft six panel experimental gill nets. Nets were set in April 2017 at 42 randomized sites and 8 fixed reference sites selected by AZGFD following reservoir survey protocols.

Electroshocking

Nevada Department of Wildlife staff completed the annual spring electroshocking survey along the northern half of Lake Mohave on the nights of April 19, 20, and 26. The AZGFD completed the southern portion of the lake on April 4 and 5. The electroshocking boat was equipped with a Coffelt VVP-15B control box with an electrode array. Ten randomly selected and five fixed reference stations (15 min of electroshocking conducted per station) were surveyed and all fish captured were

identified to species, counted, measured, weighed, and then released back to the lake.

Habitat Improvement

Artificial aquatic habitat structures were constructed of brush and PVC pipe with snow fencing and plastic lattice. Tamarisk was used for the brush component of the habitat and was cut on site. Habitat units were constructed on the deck of the NDOW habitat barge or on shore, weighted with sand bags, and then deployed in the lake above the 620 ft contour. Agencies involved included the NPS, AZGFD, NDOW, Arizona Department of Corrections, and volunteers. Fish use of artificial habitat was monitored via SCUBA surveying, gill or trammel netting, and electroshocking. SCUBA transects were conducted by circling habitat and counting all fish present. Divers recorded habitat type, survey time, depth, and species present. Electroshocking artificial habitat and non-habitat coves coincided with regular annual electroshocking surveys and utilized the same protocol.

Two 150 ft trammel nets were set in each Solicitor and Carp coves for two hours in the early morning to capture largemouth bass for sonic telemetry. The short netting time was done to minimize contact time and fish stress. Due to tag weight, largemouth bass had to be a minimum of 2.5 lbs to be implanted with a tag. A surgical and anesthesia station was setup on the shore of each cove. Each fish was anesthetized in a cooler of lake water with dissolved carbon dioxide to achieve a level of light sedation (lying on one side, only slight reaction to external stimuli, high opercular rate). At the time of surgery, each fish was placed in a cradle with the head in an anesthetic solution, with the surgical field dry and sterilized. Each tag was inserted in to an approximately a 1.5 inch incision made slightly to the left of the midline on the abdomen. The incision was closed with absorbable silk sutures. Each fish was moved to a cooler of aerated lake water and released.

FINDINGS

Angler Use and Harvest

A total of 41 days of access point, contact creel surveys were conducted on Lake Mohave resulting in 267 individual creel surveys. The surveyor spent 24 days at Willow Beach, 13 at Cottonwood Cove, and 4 at Katherine Landing. A total of 208 individual contact surveys were completed at Willow Beach, 27 at Cottonwood Cove, and 32 at Katherine Landing.

The 208 surveys at Willow Beach interviewed 339 anglers (some anglers fished in parties) that fished for 1,153.5 hours (h) and represented mostly Nevada anglers (Table 1). Shoreline anglers ($n = 252$) made up 74.3% of those contacted and boat anglers ($n = 87$) were only 25.7% of those interviewed. These numbers were drastically up from the creel numbers in 2016. In 38 interviews from 2016, 77 anglers fished for 393.8 h. Boat anglers ($n = 62$) were 80.5% of those surveyed and 19.5% ($n = 15$) were from shore (Table 2). This increase in shoreline anglers was exclusively due to rainbow

trout stocking that resumed at Willow Beach in early 2017.

TABLE 1. Origin for individuals interviewed at Willow Beach, February-December 2017.

Reported home state	% of Anglers	Number of anglers
Nevada	85.0	288
Arizona	11.0	38
California	3.0	10
Other	1.0	3

TABLE 2. Species preference by anglers (percent of anglers targeting a species) at Willow Beach, 2017.

Target species	Boat anglers (n=87)	Shore anglers (n=252)	Total (n=339)
Rainbow Trout	9.0%	57.8%	44.7%
Striped Bass	94.6%	32.8%	49.5%
Black Bass	1.7%	2.0%	2.0%
Channel Catfish	1.7%	5.2%	4.3%
No particular species	3.5%	14.4%	11.5%

*Percentages do not equal 100 because anglers could target more than one species

Anglers contacted at Willow Beach targeted rainbow trout 44.7% of the time for a total of 460.7 h of fishing, 49.5% targeted striped bass for 654.5 h, black bass was targeted 2% of the time for 11.8 h, channel catfish for 4.3% for 28 h, and 11.5% of anglers spent 125.8 h fishing for no specific species (Table 2). Of the anglers who were contacted, 31% showed success at a rate of 0.19 fish/hour (Table 3). Three channel catfish were caught by two anglers in boats and three smallmouth bass were caught and released by two anglers in boats. No other species were reported.

TABLE 3. Angler catch rates (fish/hour) at Willow Beach for rainbow trout and striped bass from 2017 creel census.

Species	Catch rates from boat	Catch rates from shore	Total catch rates
Rainbow Trout	0.29	0.33	152/460.7=0.33
Striped Bass	0.11	0.02	48/654.5=0.07
All species*	0.21	0.14	215/1153.45=0.19

*Includes a total of six smallmouth bass and channel catfish.

The 27 surveys at Cottonwood Cove had 34 anglers (31 from Nevada, one from Arizona, and three from other states) that reported fishing for 144.7 h. The catch rate came to 0.3 fish/hour (Figure 1). This was almost half of what it was in 2016. Of the anglers surveyed at Cottonwood Cove, 71% (Figure 2) were successful and caught 4 largemouth bass, 32 smallmouth bass, 18 striped bass, and 2 channel catfish. Sixty-five percent of the anglers targeted black bass for 95.5 h, 24% targeted striped bass for 32.7 h, and 11.5% targeted nothing specific for 16.5 h (Table 4).

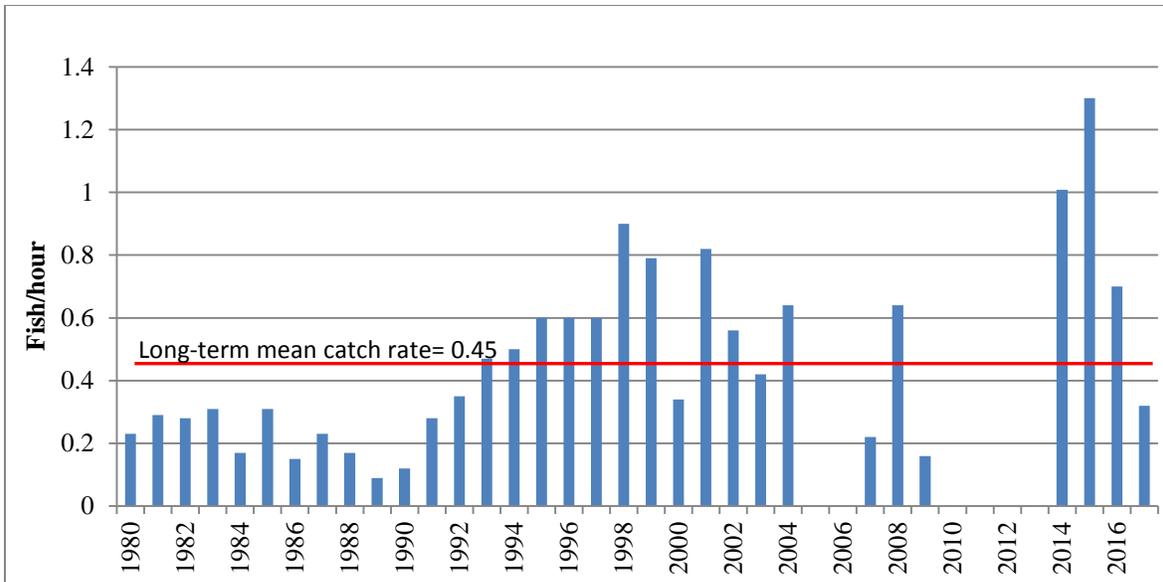


FIGURE 1. Angler catch rates (fish/hour) from contact creel surveys at Cottonwood Cove, Lake Mohave, 1980-2017.

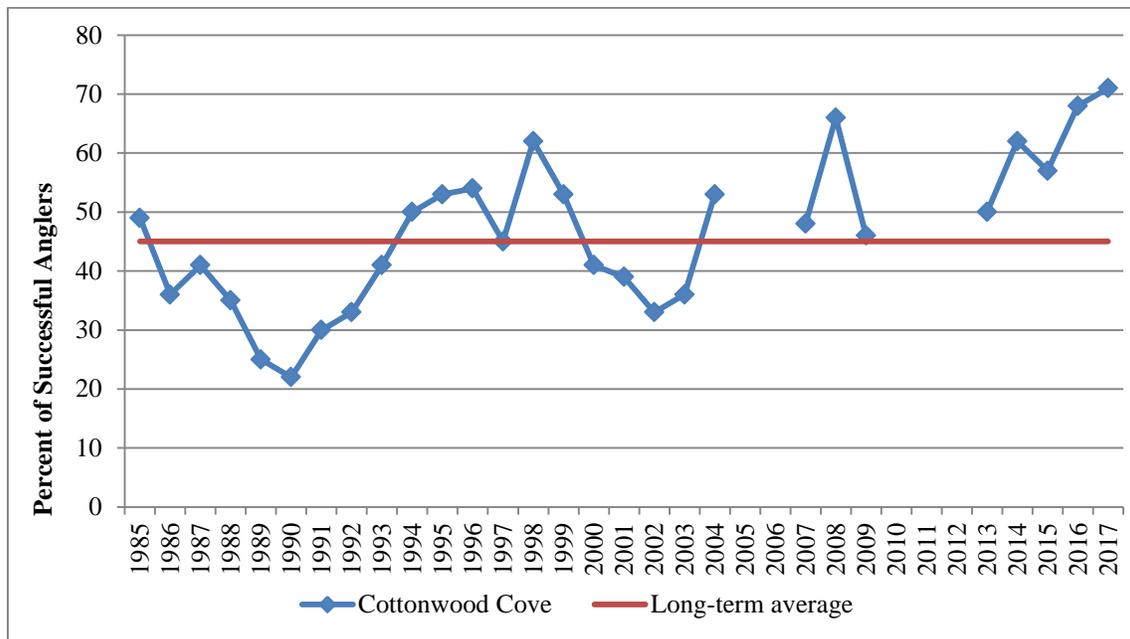


FIGURE 2. Successful anglers (% of all anglers surveyed) from contact creel surveys at Cottonwood Cove, Lake Mohave, 1985-2017.

TABLE 4. Species preference (percent of anglers targeting a species) by anglers at Cottonwood Cove, 2017.

Target species	Boat anglers (n=30)	Shore anglers (n=4)	Total anglers (n=34)
Black Bass	66.7%	50%	64.7%
Striped Bass	23.3%	25%	23.5%
No particular species	10%	25%	11.8%

Contact creel surveys were conducted six days at Katherine Landing, contacting 57 anglers (35 from Arizona, 7 from Nevada, 4 from California, 7 from other states, and 4 from Canada). These anglers fished for 232 h and caught 43 smallmouth bass and 9 striped bass, for a catch rate of 0.2 fish/hour. These anglers had a success rate of 23%.

The drop-box at Willow Beach collected 26 angler questionnaires between February and November 2017. Anglers showed a 95.8% success rate (23 out of 24 anglers caught fish). Anglers reported catching 118 fish in 150.25 h of effort, for a catch rate of 0.79 fish/hour. Species caught included striped bass ($n = 76$), rainbow trout ($n = 26$), smallmouth bass ($n = 10$), channel catfish ($n = 4$), largemouth bass ($n = 1$), bluegill ($n = 1$). Striped bass was consistently caught all year. All but three rainbow trout were caught in February. Black bass, channel catfish, and bluegill were caught during the summer from late June to mid-September. Most rainbow trout were reported to be 15 to 20 in, and 31 striped bass were reported to be 15 to 20 in and 25 were over 20 in.

Fourteen volunteer drop-box surveys were completed in 2017 at Cottonwood Cove by 12 anglers from Nevada, 1 from Arizona, and 1 from an undisclosed location. Anglers reported fishing for 93 h and 92.9% caught fish at an average rate of 0.4 fish/hour. Anglers caught 29 striped bass, 2 smallmouth bass, 3 channel catfish, and 3 largemouth bass.

Nearly all anglers participating in the volunteer drop-box creel surveys reported success at Willow Beach and Cottonwood Cove. This high success was likely attributed to unsuccessful anglers failing to submit information or possibly not knowing there was an option, as they may not have visited the fish cleaning station. Even though the fewest anglers (34) were interviewed during the Cottonwood Cove creel surveys, they had the highest angler success rate (71%) and a higher overall angler catch rate (0.4 fish/hour). Cottonwood Cove was the farthest location away from a metropolitan area and had the least accessible shoreline fishing opportunity than either Willow Beach or Katherine Landing, but anglers that did fish there were more successful.

Gill Netting

Results from 50 net-nights of gill netting during the spring yielded 231 fish that represented nine species caught (Table 5). Nonnative fish accounted for 94.8% of the catch, with 62.3% of those fish considered sport fish (Table 6). Nonnative fish species captured included common carp, green sunfish, bluegill, striped bass, largemouth bass, smallmouth bass, gizzard shad, yellow bullhead, and channel catfish. The only native species captured was razorback sucker. The most numerous game species captured was channel catfish and the total length ranged from 14.6 to 28.0 in, with a mean of 21.3 in. Weight ranged from 1.2 to 10.4 lbs, with a mean of 4.1 lbs. Species composition, and average lengths and weights of all fish captured are presented in Table 5.

TABLE 5. Minimum, maximum, and mean total length and weight of fish captured during spring gill net surveys at Lake Mohave, 2017.

Species	Total length (in)			Weight (lbs.)		
	Min.	Max.	Mean	Min.	Max.	Mean
Channel Catfish	14.6	28.0	21.3	1.2	10.4	4.1
Common Carp	13.3	29.7	24.4	1.4	14.9	8.5
Striped Bass	17.9	36.2	21.0	1.7	16.1	3.3
Smallmouth Bass	11.6	19.7	16.6	0.8	3.8	2.4
Gizzard Shad	17.3	25.6	18.8	2.1	3.6	2.8
Largemouth Bass	11.5	22.7	17.9	0.7	6.4	3.5
Razorback Sucker	22.0	28.4	24.4	4.3	9.2	6.2
Green Sunfish	3.0	5.6	4.6	0.01	0.1	0.06
Yellow Bullhead	5.6	13.6	9.8	0.8	1.5	0.7

Total CPUE decreased from 6.18 fish/net-night in 2016 to 4.62 fish/net-night in 2017. Catch rates declined this year for smallmouth bass, channel catfish, green sunfish, yellow bullhead, gizzard shad, razorback sucker, and common carp, however, catch rates increased slightly for striped bass and largemouth bass (Figure 3).

The striped bass catch rate in 2017 was 0.70 fish/net-night. This was up from 2016 and was very close to the 10-year average catch rate of 0.73, which was probably skewed from a high catch rate in 2015. This is still well below some historical high peaks of 10.88, 7.67, and 7.94 fish/net night in 1994, 1998, and 2002, respectively. It is not entirely clear what caused the striped bass population to crash in the mid-2000s, but it was likely caused by several factors. Very limited numbers of threadfin shad *Dorosoma petenense* were observed during these years and stocking of rainbow trout had been reduced. The invasive quagga mussel was also found in the Colorado River during this period. It is likely that the striped bass forage base had been severely depleted. However, the relatively recent introduction of gizzard shad should provide some additional forage for striped bass.

Table 6. Relative species composition (percent of total catch) and catch rates (CPUE) from 2017 gill netting on Lake Mohave.

Species	Number	Composition (% of total catch)	CPUE (fish/net-night)
Channel Catfish	57	24.7	1.14
Common Carp	56	24.2	1.12
Striped Bass	35	15.1	0.70
Smallmouth Bass	20	8.7	0.40
Gizzard Shad	19	8.2	0.38
Largemouth Bass	17	7.4	0.33
Razorback Sucker	12	5.2	0.24
Green Sunfish	11	4.8	0.22
Yellow Bullhead	4	1.7	0.08

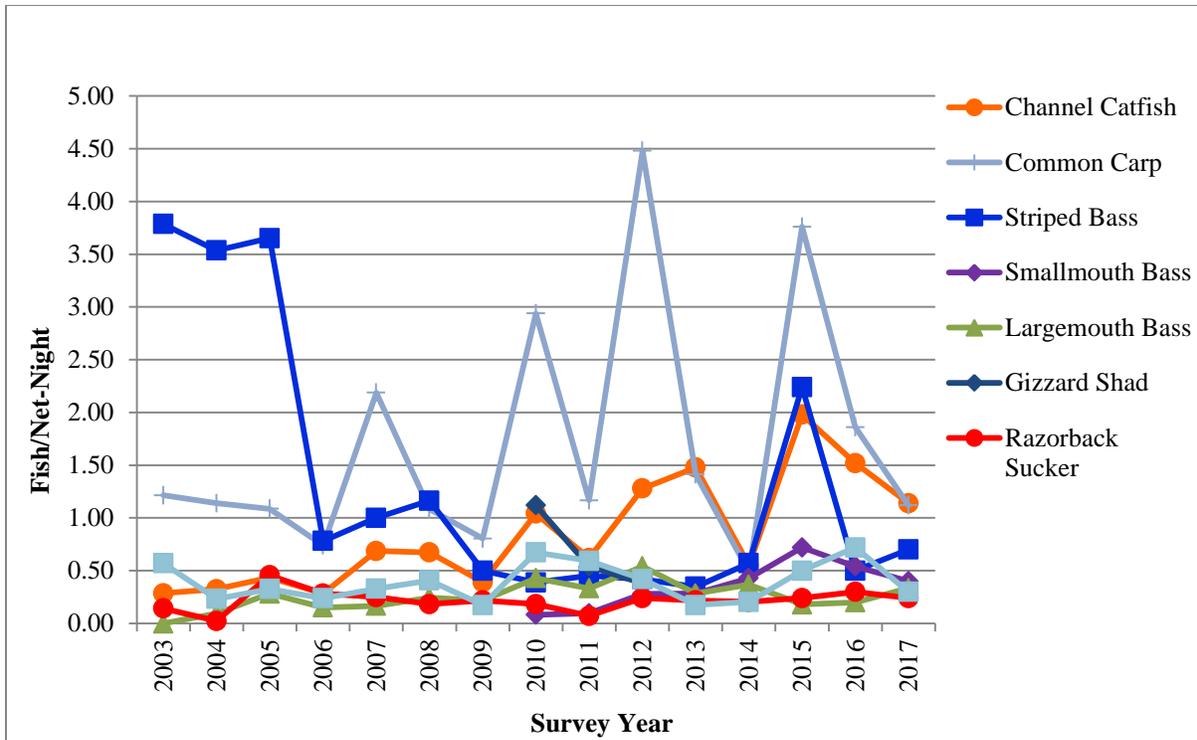


FIGURE 3. Total catch rates from spring gill netting on Lake Mohave, 2003-2017.

Channel catfish and common carp catch rates have decreased annually since 2016 (Figure 4). In 2016, channel catfish catch rate was 1.52 fish/net-night, but dropped to 1.14 fish/net night in 2017. However, the catch rate in 2017 remained higher than the 10-year average of 1.07 fish/net night. Threadfin shad historically have been the main source of forage for striped bass, but they have been only captured during gill netting surveys at very low rates three times in the last 31 years.

Smallmouth bass catch rates from gill netting (Figure 4 and 5) increased every year since their detection in 2010, but declined for the second year in a row to a catch rate of 0.40 fish/net night. However, the smallmouth bass catch rate was still higher this year than the largemouth bass catch rate of 0.33 fish/net night, which increased from 2016. The razorback sucker catch rate was 0.24 fish/net night, which was consistent with the long-term mean of 0.29 fish/net night. Sunfish numbers have increased from a low in 2013 and appeared to fluctuate naturally.

The percentage of striped bass greater than or equal to 15 in was 100% in 2017 (Figure 6). The percentage of striped bass greater than 15 in drastically increased in 2006 and stayed high until 2014. A high percentage of larger individuals may indicate low recruitment of juvenile striped bass into the adult population, and, in recent years, large fish make up the majority of the population.

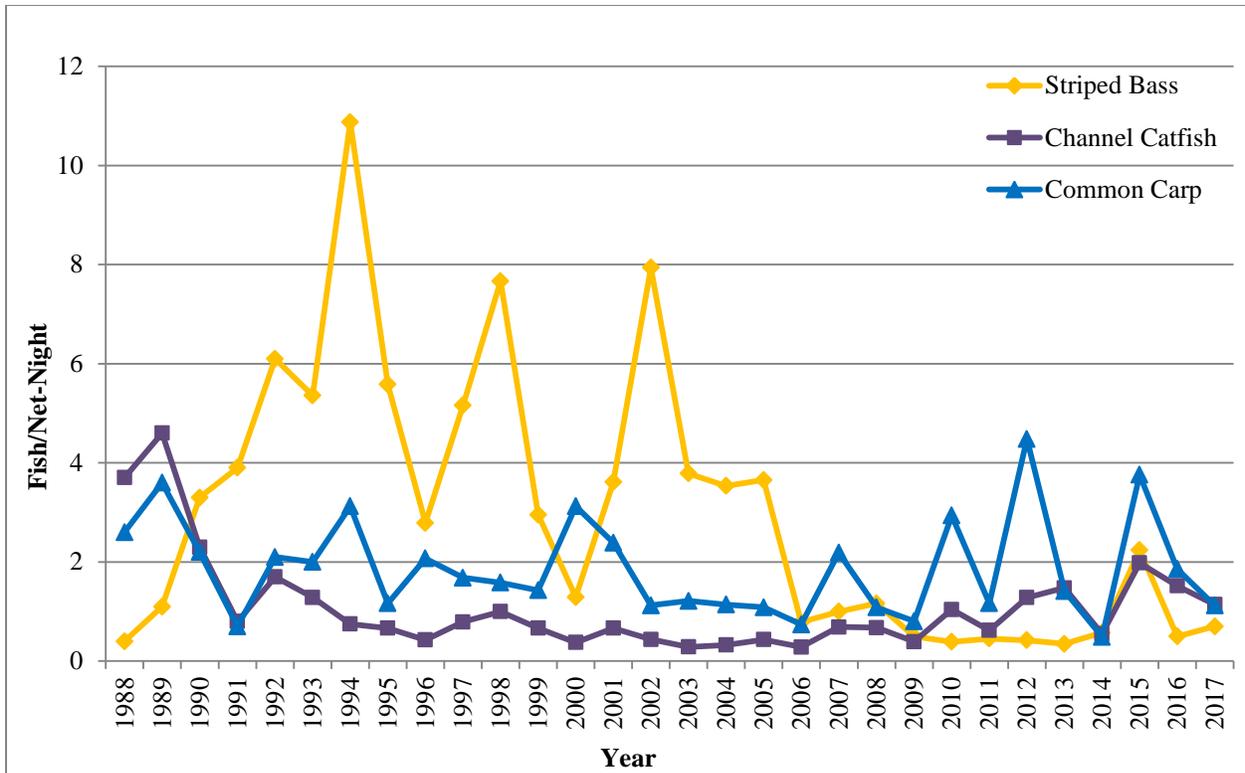


FIGURE 4. Long-term total catch rates for the three most commonly caught species from gill netting surveys on Lake Mohave, 1988-2017.

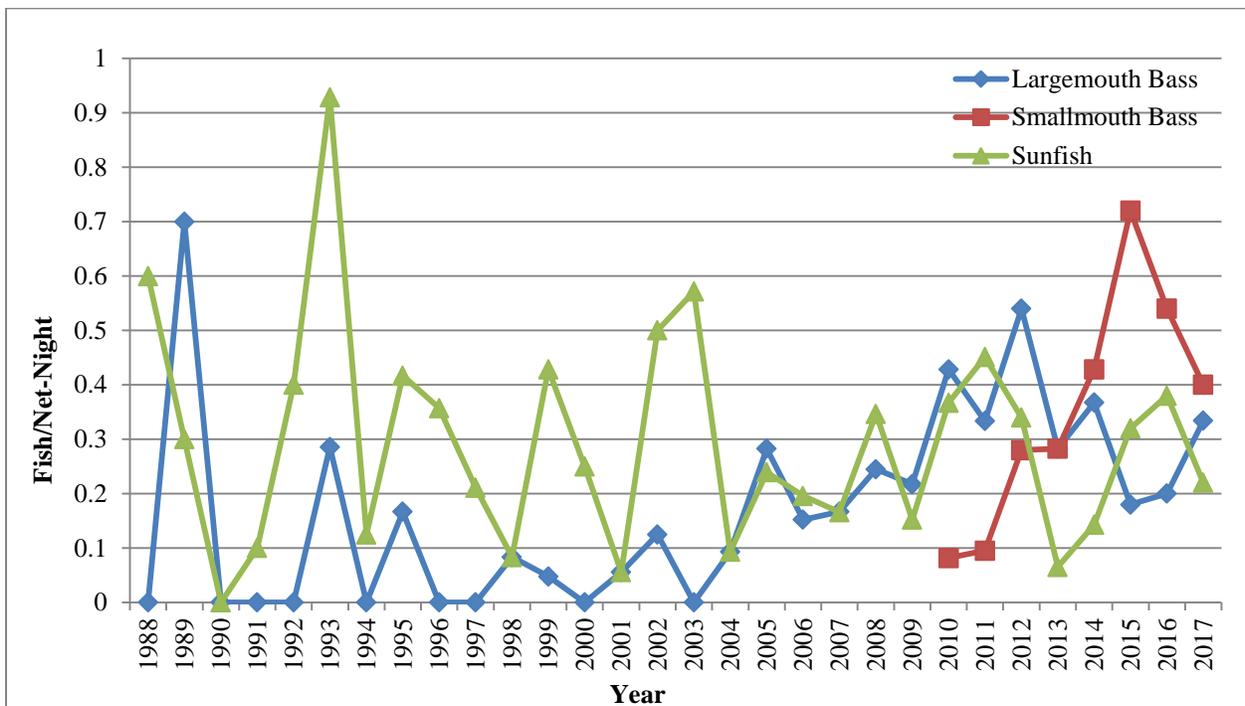


FIGURE 5. Long-term catch rates for largemouth bass, smallmouth bass, and sunfish from gill netting surveys on Lake Mohave, 1988-2017.

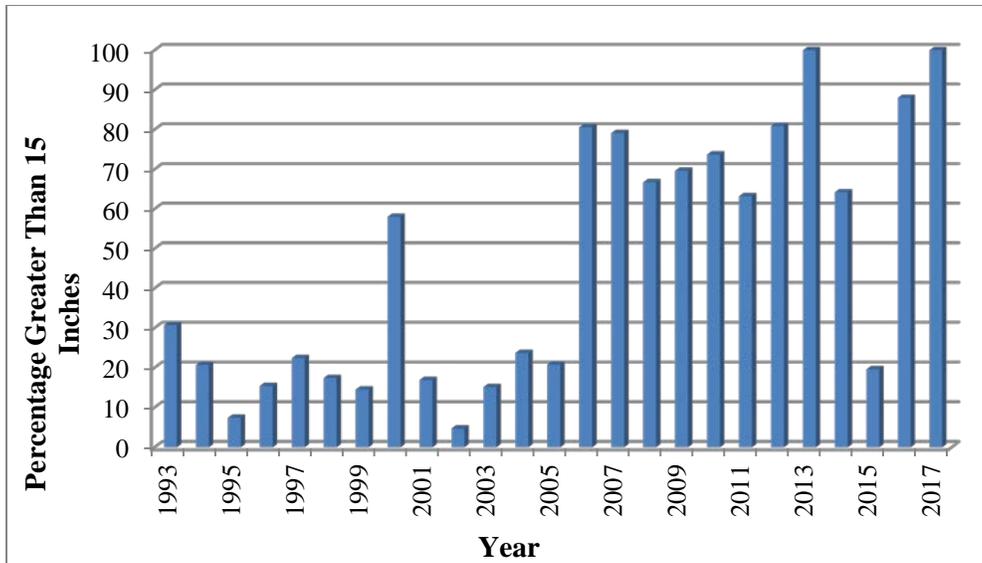


FIGURE 6. Percent of striped bass captured during Lake Mohave gill net surveys that were 15 in or larger, 1993 -2017.

Proportional size distribution (PSD) values can provide insight into population dynamics. In general, populations with PSD values below 30 typically have fewer large fish than small fish, and values above 70 typically suggest there are more large fish in a population. Balanced populations typically have PSD values in the range of 30 to 70. PSD values for striped bass (Figure 7) showed a large increase in 2007 and again in 2008. In 2010, the PSD reached the maximum of 100, and then dropped back to 37 in 2011. High and low values and wide variations in PSD from year to year may indicate the population has issues with recruitment and growth of juvenile striped bass. Proportional size distribution in 2017 was 35.

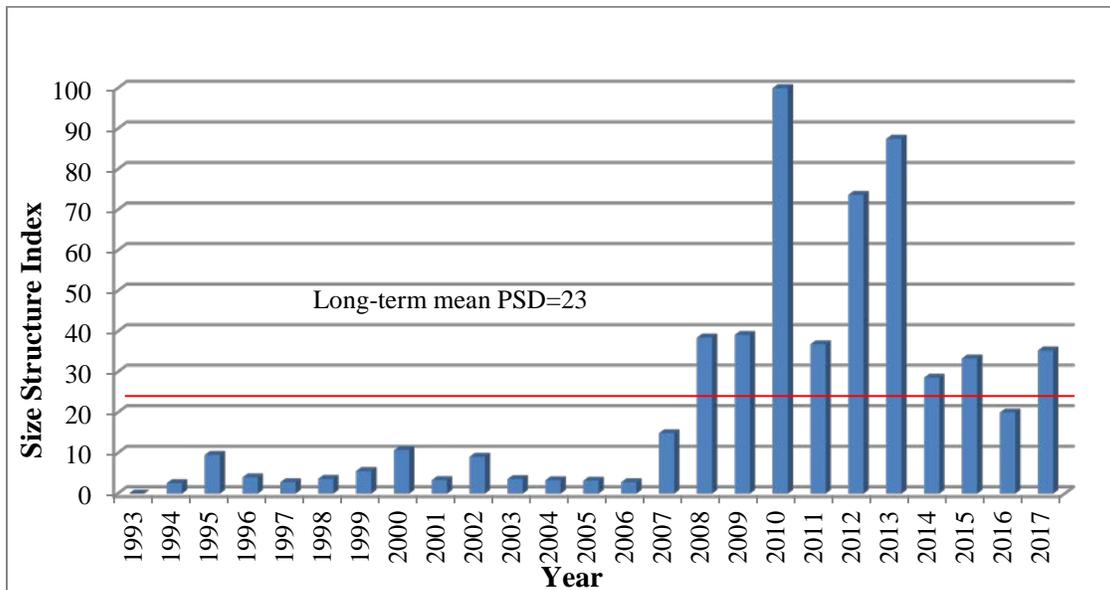


FIGURE 7. Proportional Size Distribution of striped bass from gill netting surveys on Lake Mohave, 1993-2017.

Electroshocking Surveys

A total of 225 min of electroshocking time was expended in 2017, averaging 15 min/site, and 187 fish were caught. Species composition included 87 green sunfish, 29 bluegill, 21 smallmouth bass, 11 largemouth bass, and 4 channel catfish (Table 7). Surveys from 1997 to 2002 and 2009 to 2011 occurred as fall electroshocking surveys, while 2004 to 2007 and 2012 to 2017 occurred as spring surveys. Electroshocking surveys were not conducted in 2001, 2003, and 2008. The 2017 largemouth bass catch rates were similar to other spring sampling surveys for (Figure 8). Smallmouth bass were first captured in electroshocking surveys in the fall 2009 survey and have been caught every year since. A single striped bass was captured in 2017, which was the first time since 2011. Sunfish catch rates increased slightly this year (Figure 8).

TABLE 7. Relative species composition (percent of total catch) and CPUE (fish/min) from spring 2017 electroshocking surveys on Lake Mohave.

Species	Number	Composition (%)	CPUE (fish/min)
Green Sunfish	87	46.5	5.8
Common Carp	31	16.7	2.1
Bluegill	29	15.5	1.9
Smallmouth Bass	21	11.2	1.4
Largemouth Bass	11	5.9	0.7
Channel Catfish	4	2.1	0.3
Yellow Bullhead	3	1.6	0.2
Striped Bass	1	0.5	0.1
Total	187	100	12.5

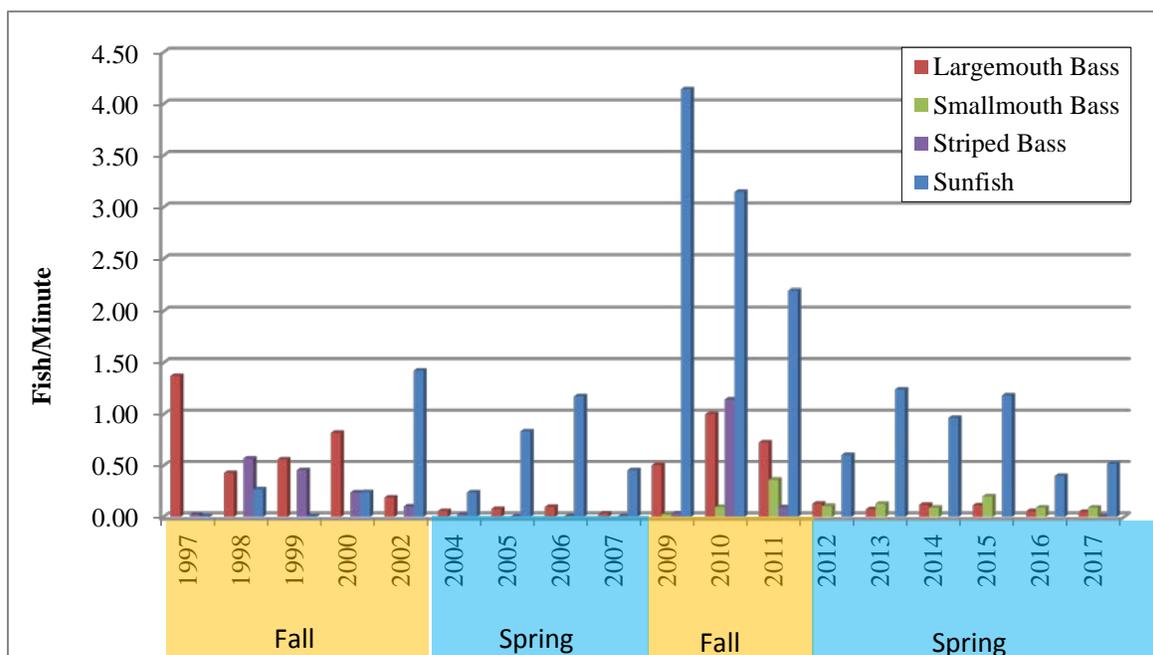


FIGURE 8. Catch rates (fish/minute of electroshocking) for largemouth bass, smallmouth bass, striped bass, and sunfish from electroshocking surveys, 1997-2017.

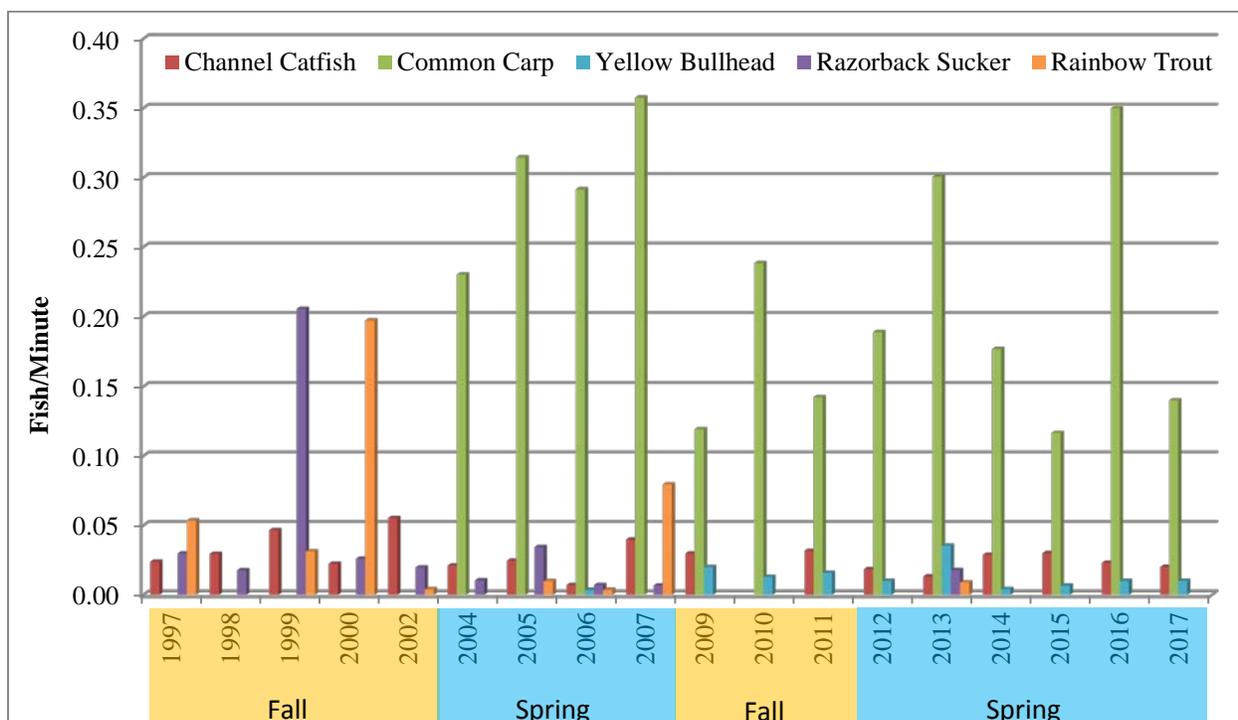


FIGURE 9. Catch rates (fish/minute of electroshocking) for channel catfish, common carp, razorback sucker, yellow bullhead, and rainbow trout captured during electroshocking surveys on Lake Mohave, 1997-2017.

Habitat Improvement

A total of 22 artificial habitat structures (constructed of PVC cubes) and 10 brush bundles were constructed and deployed into Shoshone, Princess, Carp, Box, and Solicitor coves. Cubes were constructed from 1.5 inch PVC and the basic unit was a 5 ft x 5 ft. Structures were then attached together with heavy-duty (175-pound test) zip ties. Snow fencing and/or plastic lattice and brush were attached to each unit. The structures were placed in the lake between the 620 and 630 ft elevation. By the end of 2017, the total amount of habitat placed to date included:

- 148 PVC, snow fence, and brush structures;
- 211 assorted brush bundles;
- 24 poly shrubs;
- 88 pallet and brush A-frames;
- 24 pallet structures; and
- 25 barge loads of Christmas trees (approximately 625 trees).

Habitat Effectiveness Evaluation – SCUBA Monitoring

In 2017, nine SCUBA surveys were conducted in coves with artificial habitat and coves with no artificial habitat treatment. SCUBA surveys were used to evaluate the

effectiveness of habitat in attracting fish and to compare habitat sites with untreated sites. More fish were observed in coves with artificial habitat than in those without during the 2017 surveys. Overall, numbers of fish observed had decreased in both habitat and non-habitat coves compared to 2016, but followed similar observation rates as most previous years (Figure 10).

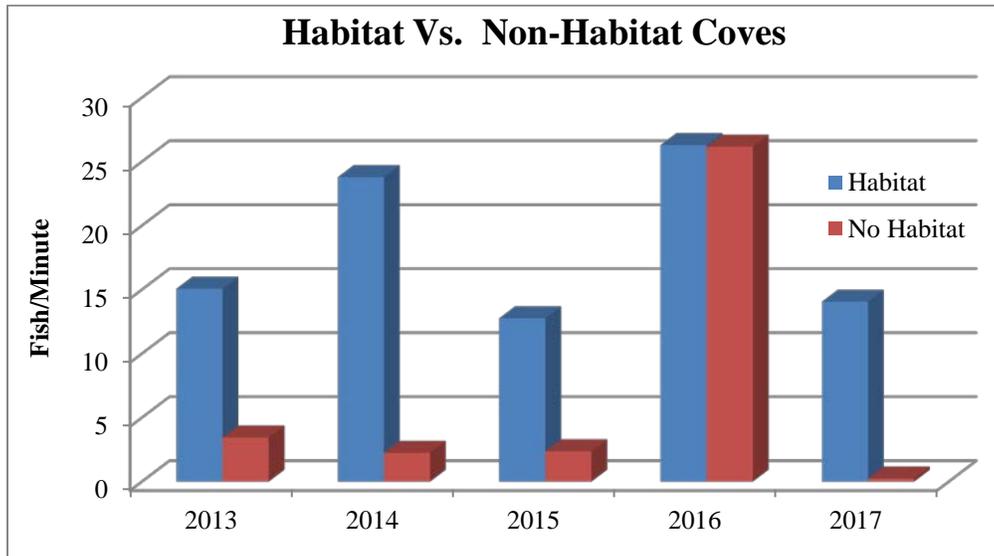


FIGURE 10. Comparison of fish observed in habitat and non-habitat coves from SCUBA surveys on Lake Mohave, 2013-2017. Data includes all species except threadfin shad.

Sunfish, particularly bluegill, were the most abundant species attracted to habitat structures, followed by largemouth bass. Use of habitat by sunfish increased, while black bass use decreased in 2017 (Figure 11). Channel catfish have never been observed in high numbers, but they decrease this year. All fish were observed at a higher rate in coves with habitat than without.

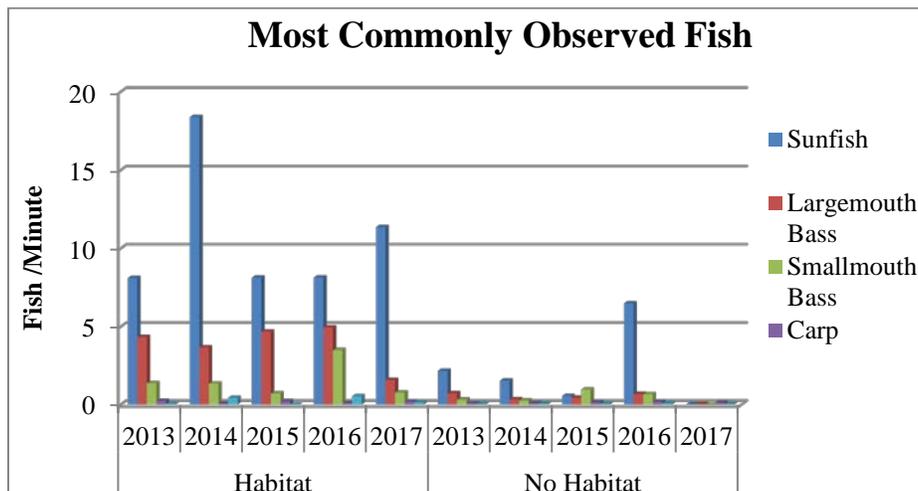


FIGURE 11. Comparison of the most commonly observed fish in habitat and non-habitat coves from SCUBA surveys on Lake Mohave, 2013-2017.

Habitat Effectiveness Evaluation - Electroshocking Comparison

Electroshocking surveys were completed at five coves with artificial habitat and five coves without artificial habitat during the spring of 2017. Catch data was taken from annual spring survey data (summarized above). Covs analyzed for non-habitat data were a randomly chosen subset of all surveyed covs for consistent comparison of effort. High winds prevented electroshocking surveys in fall 2017.

Species diversity was slightly higher in covs without habitat, but composition only included two yellow bullhead, two red shiners *Cyprinella lutrensis*, and one striped bass. Even though there were differences in species composition (Figure 12), overall numbers of fish were similar in the different cove types, with habitat covs producing more fish than non-habitat covs (Table 8).

Table 8. Total number of fish caught during electroshocking on habitat and non-habitat covs, spring 2017.

Species	Number captured	
	Habitat	Non-habitat
green sunfish	24	14
common carp	4	15
bluegill	10	1
smallmouth bass	9	4
largemouth bass	3	4
channel catfish	2	1
yellow bullhead	0	2
Red Shiner	0	2
striped bass	0	1
Total	52	44

It is difficult to assess population characteristics and results between habitat vs non-habitat covs with minimal catch numbers. Electroshocking may not be the best survey method to measure the effectiveness of the habitat improvement program because electroshocking is unable to sample habitat structures effectively at depth. Electroshocking is, instead, more useful at sampling the upper few feet of the water column along the shoreline. Catch rates for all fish were lower this year than previous years (Figure 13), but the highest catch rates were for green sunfish and common carp. They occur in shallow habitats and are an easily target during electroshocking.

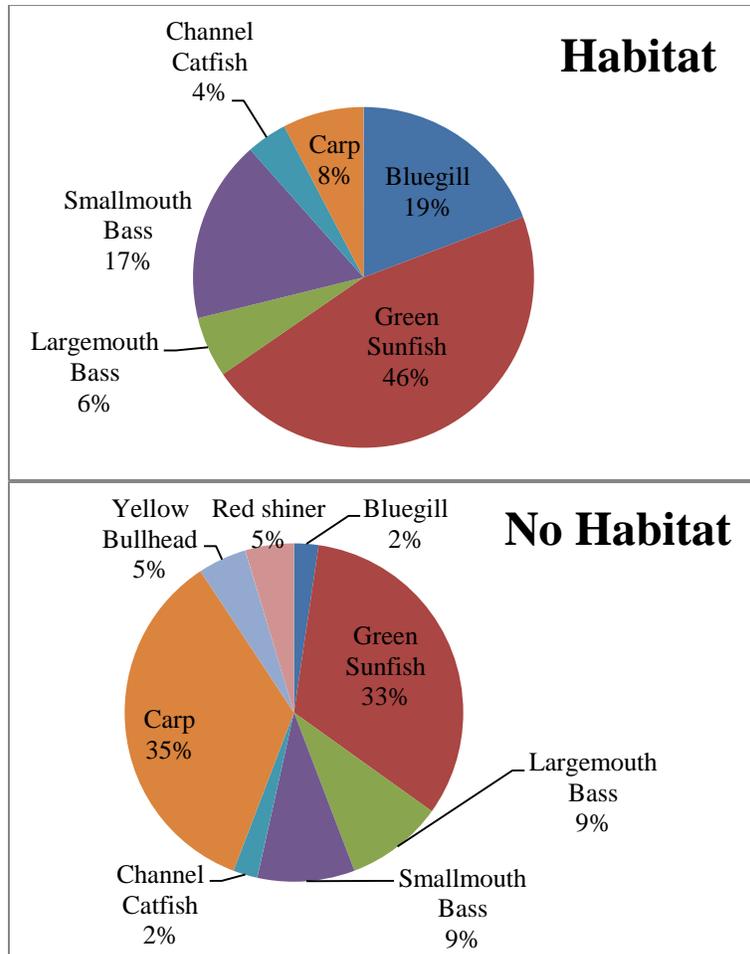


FIGURE 12. Comparison of relative species composition caught during electroshocking surveys on coves with and without artificial habitat, spring 2017.

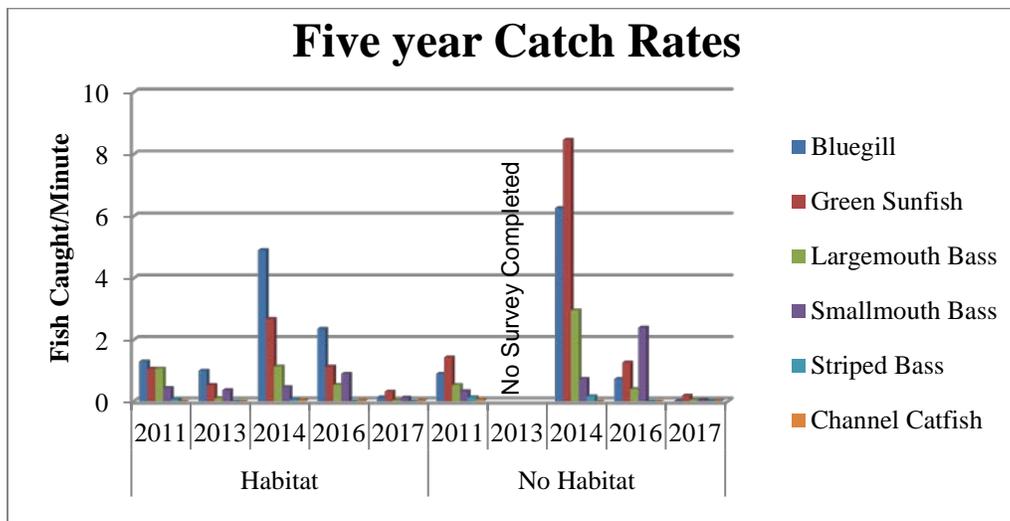


Figure 13. Electroshocking catch rates (fish/minute) of the most common sport fish encountered in habitat coves and non-habitat coves in the most recent five years of surveys.

Habitat Effectiveness Evaluation – largemouth bass Movement Study

SCUBA surveys have been conducted since 2008 to compare fish use of artificial habitats to areas without artificial habitat. Results show that there are more fish in areas with artificial habitat than those without artificial habitat, but fish numbers vary depending on time of year. The number of adult fish observed on artificial habitat structures is highest during the fall and lowest during the summer. The summer months are also when natural vegetation is most abundant and water clarity is at its poorest, likely spreading fish out since they do not need to be concentrated on the artificial habitat structures for cover. Tracking adult black bass through sonic telemetry will identify how black bass utilize artificial habitat seasonally and diurnally compared to natural habitat.

Two 150 ft trammel nets were set in each of Solicitor and Carp coves for two hours in the early morning. In four hours of netting effort, 23 largemouth bass, 14 smallmouth bass, and 1 common carp were caught (Table 9). The short netting time minimized contact time and fish stress. Due to tag weight, largemouth bass had to be a minimum of 2.5 lbs before implanting with a tag. All fish were released at the location of capture.

Table 9. Lengths and weights of Largemouth and smallmouth bass caught during targeted trammel netting on Solicitor and Carp coves, November 2017.

Species	Total Length (in)			Weight (lbs)		
	Min.	Max.	Mean	Min.	Max.	Mean
Largemouth Bass	11.26	21.85	15.55	0.73	6.57	2.35
Smallmouth Bass	10.87	18.03	14.44	0.56	3.45	1.75

Table 10. Largemouth bass tagged with a Sonotronics radio telemetry tag at Solicitor and Carp coves, November 2017.

Fish Number	Total Length (mm)	Weight (g)	Location
333	467	1,510	Solicitor Cove
334	438	1,390	Solicitor Cove
447	511	1,875	Solicitor Cove
365	555	2,980	Carp Cove
366	488	1,805	Carp Cove
448	506	2,225	Carp Cove

Largemouth bass were tracked once before the end of 2017 and only four of six were located in relatively the same location as release. The directional hydrophone only pinpoints tags to within a 50 ft x50 ft (2500 ft²) area suggesting fish could have been moving in a small area within each cove. Additional tracking during different times of the day and night, passive tracking systems, and underwater diver tracking efforts will be included in the work plan for 2018.

MANAGEMENT REVIEW

The Lake Mohave striped bass fishery remains limited from low recruitment of juvenile age-classes into the adult population. As agencies collect more water quality data, a better understanding of the Lake Mohave ecosystem may help further explain the decline in the striped bass fishery. Lake Mohave water quality data collected by other agencies have shown there to be changes to water temperatures in recent years, which is likely due to changes in Lake Mead water elevation and increased ambient air temperatures during winter months.

Lake Mohave remains a reservoir known for larger striped bass. The fishery was built on limited abundances of younger life stages, permitting recruitment into the larger size-classes. However, abundant recruitment lead to a sudden and large increase in the striped bass population quickly eliminated a limited forage base, resulting in fewer trophy fish. There are still trophy-sized striped bass in Lake Mohave; however, the traditional “hot spots” for striped bass have changed, as rainbow trout were not stocked for several years, forcing striped bass to disperse in the lake in search of other prey. With the return of stocked rainbow trout, the upper riverine portion of Lake Mohave and the area around Willow Beach will likely begin producing larger striped bass.

The habitat enhancement project will continue in 2018 and into the foreseeable future. Largemouth bass, smallmouth bass, bluegill, channel catfish, and common carp utilize these structures. Abundance of most fish species is generally higher on the constructed habitat compared to areas without artificial habitat.

RECOMMENDATIONS

- Maintain present angling regulations.
- Continue fish population monitoring through gill netting and SCUBA surveys.
- Continue to track movement of black bass by employing Floy tags and then monitor by using angler catch/harvest and SCUBA survey data.
- Continue participating with the Lake Mead National Recreation Area Fisheries Management Team.
- Continue developing and implementing the Lake Mohave Habitat Enhancement project by installing artificial habitat structures.
- Continue to participate in the Lake Mohave Native Fish Work Group and associated native fish restoration projects.
- Maintain volunteer angler drop-boxes and continue contact creel surveys.

Prepared by: Lisa Ozborn
Biologist III, Southern Region

Date: June 20, 2018

**Lake Mohave & Colorado River
Angler Drop-Box**

The Nevada Division of Wildlife asks for your help in evaluating this fishery. Please fill out a form only for **ONE PERSON** for **EACH DAY** you fished.

Date you fished; _____ Zip Code: _____
Time Started _____ Time Ended _____

What type of gear you used: **Artificial** _____ **Live/powerbait** _____

TOTAL Number of **Trout** Caught _____ Number Released _____
TOTAL Number of **Striped Bass** Caught _____ Number Released _____
TOTAL Number of **Largemouth Bass** Caught _____ Number Released _____
TOTAL Number Of **Smallmouth Bass** Caught _____ Number Released _____
TOTAL Number of _____ Caught _____ Number Released _____
 Fill in Species

SIZE OF FISH

Enter **Number of Fish** you caught in each size category below (**Include Released Fish**)

Species	Under 10"	10"-15"	15"-20"	over 20"
Striped Bass.....	_____	_____	_____	_____
Largemouth Bass..	_____	_____	_____	_____
Smallmouth Bass..	_____	_____	_____	_____
Rainbow Trout.....	_____	_____	_____	_____
Channel Catfish....	_____	_____	_____	_____
Sunfish.....	_____	_____	_____	_____
Other	_____	_____	_____	_____

ANGLER SATISFACTION

Please indicate satisfaction with your fishing trip by **CIRCLING** a number below that closely reflects your feelings.

	<u>Not Satisfied</u>			<u>Satisfied</u>	
Today's fishing experience	1	2	3	4	5
Number of fish	1	2	3	4	5
Size of fish	1	2	3	4	5

*** Thank you for supporting us in managing this fishery ***