LOUISIANA DEPARTMENT OF WILDLIFE & FISHERIES

OFFICE OF FISHERIES
INLAND FISHERIES SECTION

PART VI -B

WATERBODY MANAGEMENT PLAN SERIES

LAKE MARTIN

WATERBODY EVALUATION &
RECOMMENDATIONS

CHRONOLOGY

DOCUMENT SCHEDULED TO BE UPDATED EVERY FOUR YEARS

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January 2020 – Updated by
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WATERBODY EVALUATION

STRATEGY STATEMENT

Recreational

Largemouth Bass are managed to provide the opportunity to catch fish of greater than average size. Other sportfish species are managed to provide a sustainable population while providing anglers the opportunity to catch or harvest numbers of fish adequate to maintain angler interest.

Commercial

Lake Martin has always been open to commercial fishing except during drawdowns, but there has been very little commercial activity.

Species of special concern

No threatened or endangered species have been observed in Lake Martin.

SPECIES EVALUATION

Recreational

Largemouth Bass are targeted for evaluation since they are a species indicative of the overall fish population due to their high position in the food chain. Electrofishing is the best indicator of Largemouth Bass abundance and size distribution, with the exception of large fish (i.e.,> 5 lbs.). Sampling with gill nets provides better assessment of large bass and other large-bodied fish species (e.g., Bowfin or carp). Shoreline seining has been used in the past to collect information related to fish reproductive success and forage availability.

Largemouth Bass CPUE and Length Frequency

Electrofishing sampling is conducted during nighttime hours. Shock time for each sample lasts approximately 900 seconds. The number of sample sites is determined by the total acres of a waterbody. Three electrofishing samples are conducted on Lake Martin at locations representative of available habitat. The catch-per-unit-of-effort (CPUE) of Largemouth Bass collected from Lake Martin by electrofishing from 1993 to 2011 is reported in Figure 1. The CPUE has mostly increased in all indicated size groups over time from 2000 – 2018, with the exception of 2009 when values fell below the long term average. As indicated in Figure 1, no bass were collected in 1997. The decline in CPUE for bass in 1997 may be directly related to an abundance of submersed aquatic plants, especially hydrilla (*Hydrilla verticillata*), which greatly limited sampling efforts. Herbicide applications and triploid grass carp stockings in 1997 and 1998 have reduced hydrilla coverage. Largemouth Bass CPUE began an upward trend from 2000 – 2006 in all size groups (Figure 1). The indicated trend is a likely result of improved recruitment (i.e., better survival of juveniles to stock size) and reduced aquatic vegetation allowing increased access for sampling. A graphical result of the Largemouth Bass size distribution [total length (TL) groups in inches] from the 2011 and 2013 electrofishing samples for Lake Martin is shown in Figure 2. In 2013, catch rates of stock and quality size fish were consistent with the previous years' results. Adequate young-of-the-year (YOY) Largemouth Bass in the 3-6 inch groups are indicated in 2011, but low numbers in 2013. The decrease in number per hour in 2013 may be related to the resurgence of hydrilla throughout the lake. In 2016 and 2018 a big increase in stock and quality size fish is shown in figure 1. This increase in YOY is due to reduction in submersed vegetation allowing improved sampling

success. Also high water events during 2016-2018 increased forage base for Largemouth Bass. Recruitment to age 1+ fish will enhance stock-size Largemouth Bass populations in Lake Martin, which is necessary to continue and maintain a healthy bass population.

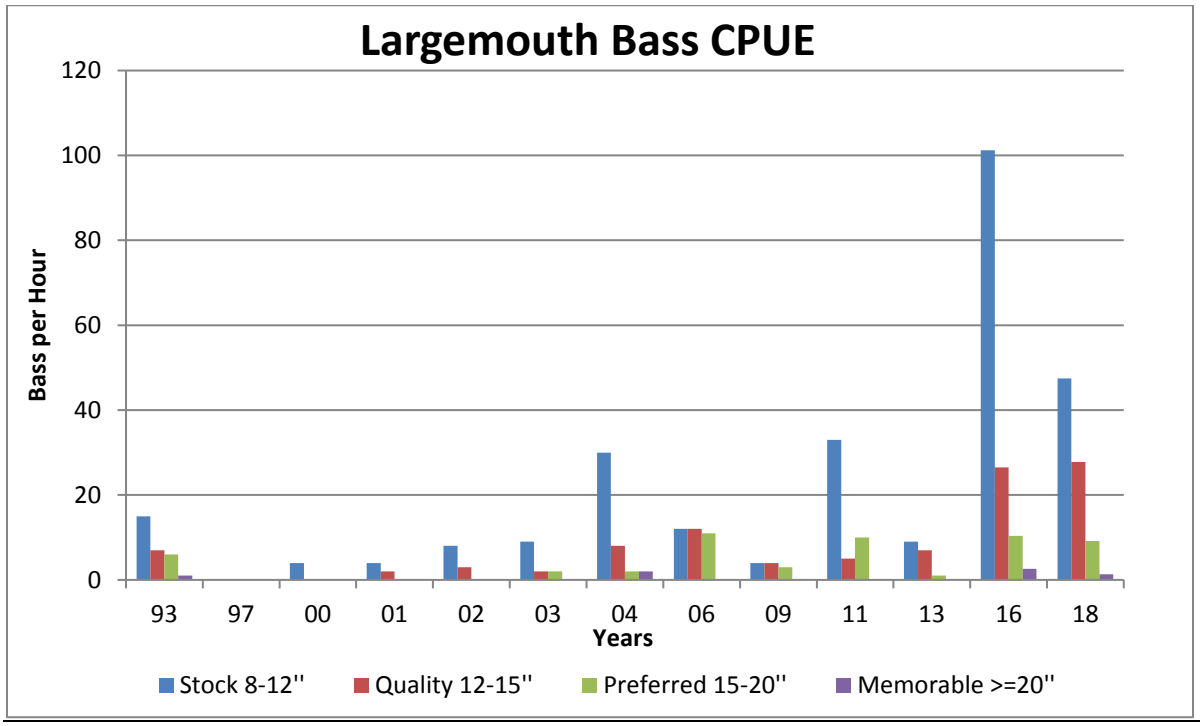

Figure 1. Spring electrofishing Catch-Per-Unit-of-Effort (CPUE: number per hour) for Largemouth Bass of stock-, quality-, preferred-, and memorable-size fish sampled at Lake Martin, LA, from years 1993-2018.

Largemouth Bass recruitment of YOY has been sporadic in past years (Figure 3 & 4). Numbers of bass exceeding 12 inches in total length are low in all five years reported. This is due to an increase in submersed vegetation, causing sampling efficiency to decrease. A slight increase in fish over 12 inches in 2016 and 2018 was observed, but an increase in recruitment is shown in Figure 4, which is due to a good forage base.

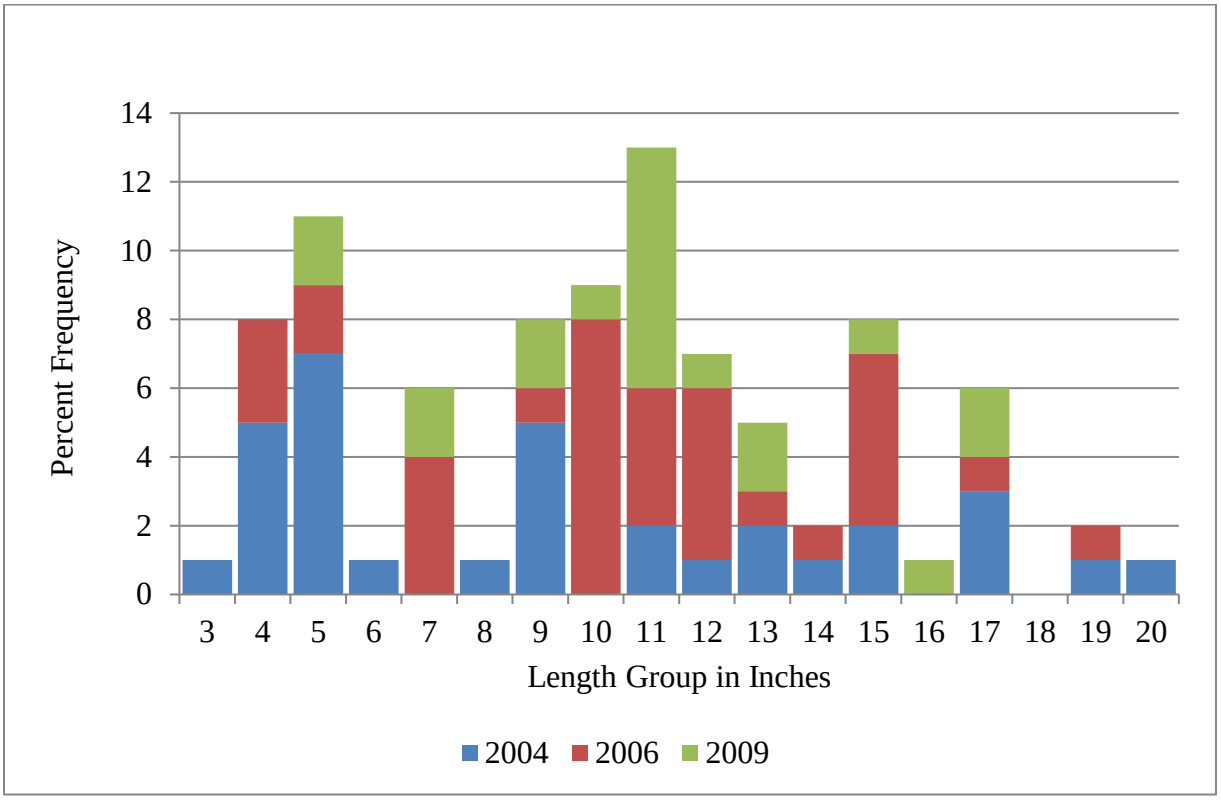

Figure 2. Largemouth Bass size distribution (inch groups) from spring electrofishing samples taken on Lake Martin, Louisiana for 2004, 2006, and 2009.

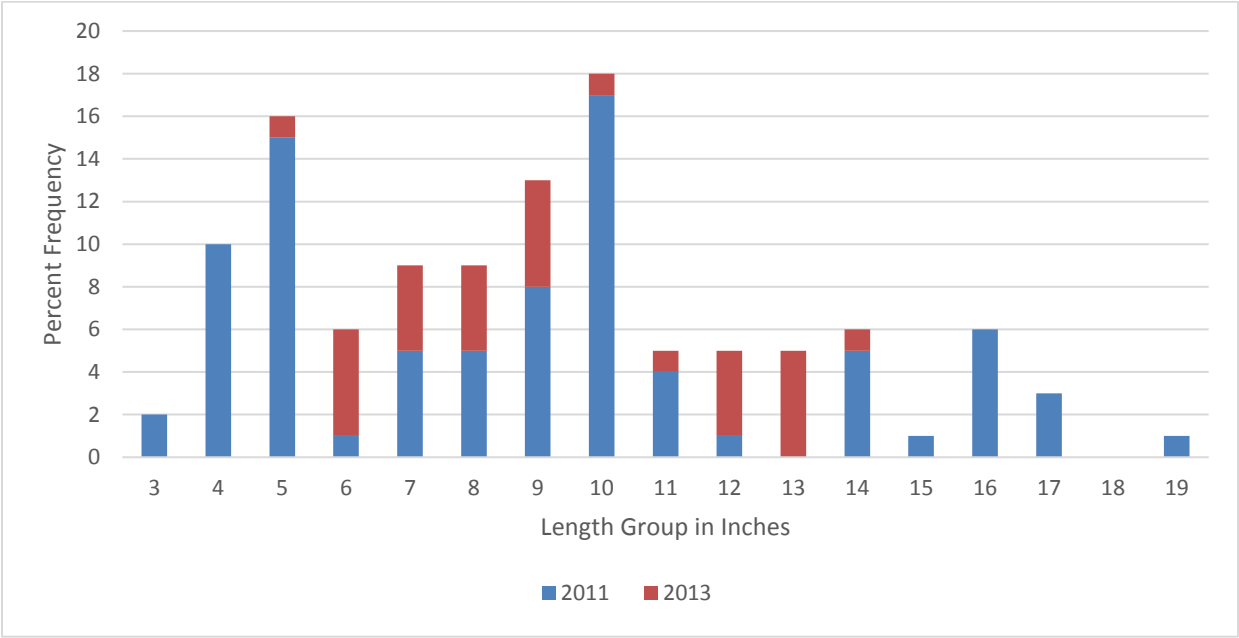

Figure 3. Largemouth Bass size distribution (inch groups) from spring electrofishing samples taken on Lake Martin, Louisiana for 2011 and 2013.

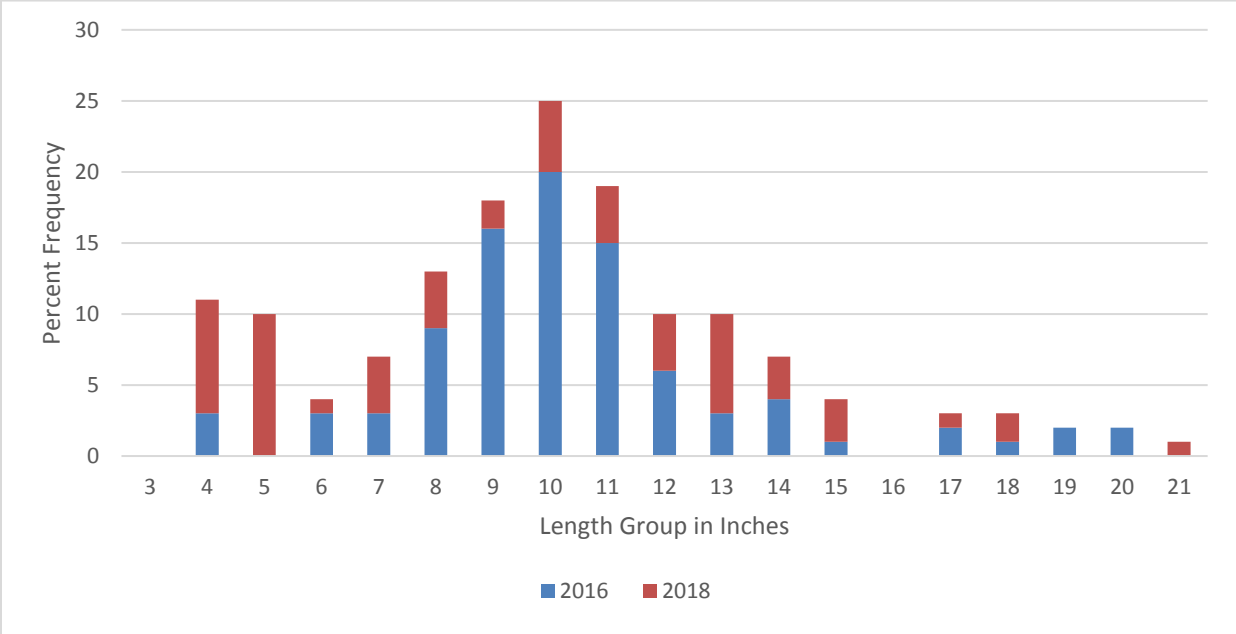

Figure 4. Largemouth Bass size distribution (inch groups) from spring electrofishing samples (number sampled per hour) taken on Lake Martin, Louisiana for 2016 and 2018.

Largemouth Bass Genetics

The majority of Largemouth Bass collected for genome determination are taken during the fall standardized electrofishing samples. Five bass per inch group, beginning at eight inches and above, are sacrificed and brought back to the district office for measurement and tissue collection. Total length and weight is recorded for each specimen, otoliths (ear bones) and liver tissue are removed for age/growth and genetic analysis. Liver tissues are sent to the Louisiana State University genetics laboratory for starch gel electrophoresis analyses. Genetic results for the Lake Martin Largemouth Bass population is presented in Table 1. While the total number of Florida Largemouth Bass stocked into Lake Martin has only been 34,755 fingerlings, the Florida genome influence has ranged from 16 – 25% over the last 10 years.

Table 1. Largemouth Bass stocking and genetic results for Lake Martin, Louisiana, 2001-2017.

YEAR	FLMB STOCKINGS	GENETIC SAMPLING RESULTS				
		N	NLMB	FLMB	F_X	TOTAL FLORIDA INFLUENCE
2000	14,607					
2001	8,016	28	75%	2%	23%	25%
2002						
2003						
2004						
2005						
2006		25	82%	7%	11%	18%
2007	8,234					

2008						
2009		32	84%	3%	13%	16%
2010	3,898					
2011						
2012						
2013	8,000					
2014	8,235					
2017	8,056					

Forage

Sunfish and shad (Gizzard and Threadfin) have been identified as primary bass forage species in Lake Martin. During fall standardized electrofishing samples, a 450-second sample is conducted to determine forage relative abundance. Shoreline seine sampling, conducted each summer, is also used to determine young-of-the-year (YOY) sport and forage fish production. However, there is a difference between forage abundance and availability. If there is an overabundance of aquatic vegetation, visual barriers created by the vegetation preclude effective feeding by predators (bass). Largemouth Bass body conditions are analyzed to determine effective utilization/conversion of available forage. Relative weight (Wr) is a measure of fish "plumpness" and is the ratio of fish weight to that of a determined standard. The Wr is calculated by dividing the weight of individual fish by the standard weight for fish of the same length, and multiplying the quotient by 100. Largemouth Bass relative weights below 80 may indicate a potential problem with forage availability. Lake Martin Largemouth Bass average near 97 Wr in all size groups, indicating a healthy bass population with abundant and available forage.

Table 2. The percent by number of fish species that are $\leq$ five inches in total length from forage electrofishing samples from 2000 – 2018 in Lake Martin, Louisiana.

Forage – Electrofishing Samples									
Year	Bluegill	Redear Sunfish	Longear Sunfish	Silver sides	Gizzard Shad	Threadfin Shad	Golden Shiner	Yellow Bass	Warmouth
2000	9.0%				21.4%				5.4%
2001	51.6%	2.2%			1.1%				1.1%
2002	42.4%				39.2%	7.9%			2.6%
2003	46.8%				0.8%	9.0%			0.8%
2006	39.1%	3.1%			5.1%	3.1%	3.1%	2.1%	4.1%
2009	15.6%	0.4%	1.9%	1.5%	42.6%	16%	0.4%	2.6%	2.3%
2013	15%	0.5%		15%	5%	61%	2%	0.5%	1%
2016	30.2%	4.9%		4.2%		27.2%			0.7%
2018	29.1%	5.1%		0.8%	21.7%	25.6%		0.4%	2.4%

Bluegill comprised the highest percentage of available forage from 2000 – 2006 (Table 2). By 2009, Gizzard and Threadfin Shads were the predominant forage fishes available. The conversion of submersed aquatic plant growth to open water areas by the TGC is probably a

contributing factor to the expansion of shad as a forage base. In 2013, Threadfin Shad was the dominate forage fish, exhibiting an increase of approximately 40%, available to predatory fishes. Bluegill made up the next highest percentage of forage availability. In 2016 and 2018, Bluegill and Threadfin Shad made up the highest percent of available forage.

Shoreline seine sampling was conducted in the summer months of June – August. All samples were conducted at night from one-half hour after sunset until one –half hour before sunrise. A one quadrant haul sample was taken at each station using a 25 -oot long seine, six feet deep, fitted centrally with a 6' x 6' x 6' bag and consisting of 3/16 inch Ace® nylon mesh. A total of three seine hauls were conducted each year at the three boat ramps, one haul per ramp. The quadrant haul was conducted by anchoring one end of the seine at the shoreline and the other stretched perpendicular to the shoreline. The distal end was then swung around back to the shoreline, keeping the lead line tight and on the bottom. After the seine haul is completed, all fish are removed from the seine and placed into a properly marked plastic bag, which is then placed on ice. In the laboratory, fish specimens are sorted to species, enumerated, and total lengths measured in inch groups by total number. Species collected in Lake Martin consisted of Bluegill, Largemouth Bass, shad, silversides and Golden Shiners. Bluegills were the predominant forage species collected in seine hauls (Table 3).

Table 3. Total numbers of all fish species $\leq$ 5 inches in total length captured by seine hauls from Lake Martin, LA, 1990 – 2010.

Total Number By Species					
Year	Bluegill	Silversides	Golden Shiners	Gizzard Shad	Yellow Bass
1990	321	11	7	0	0
2001	256	0	3	0	0
2007	66	82	0	0	6
2010	40	9	5	0	41

Crappie

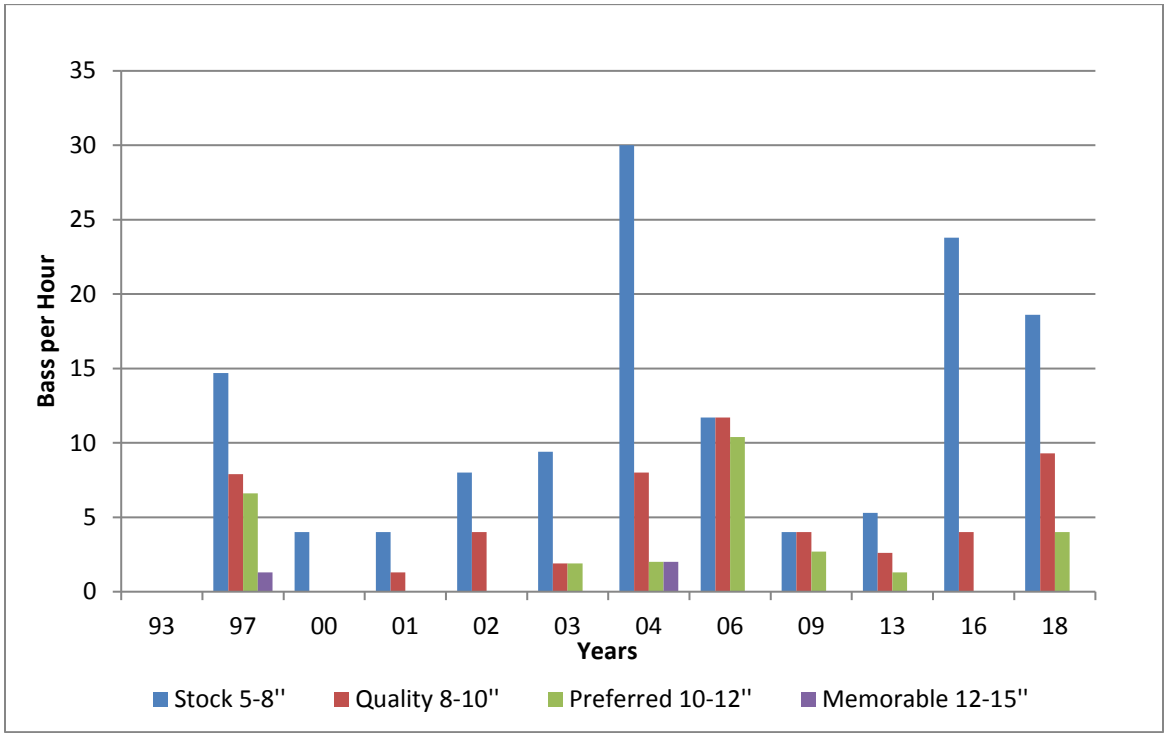

Figure 5. Fall Electrofishing Catch-Per-Unit-of-Effort (CPUE: number per hour) for crappie of stock-, quality-, preferred-, and memorable-size fish sampled at Lake Martin, LA, for the years 1993-2018.

Crappie CPUE remained low from 2000 – 2003, then increased sharply in 2004 (Figure 5). It is believed that crappie recruitment increased due to improved habitat conditions during spring of 2004. In 2006, quality and preferred size classes of white crappie increased, improving opportunities for anglers to harvest larger sized crappie. In 2016 and 2018 a spike in stock and quality size crappie in shown in figure 5. This could be related to the August flood of 2016 increasing recruitment in the lake. Majority of the fish collected were black crappie, with only four white crappie captured in 2016 and 2018, combined.

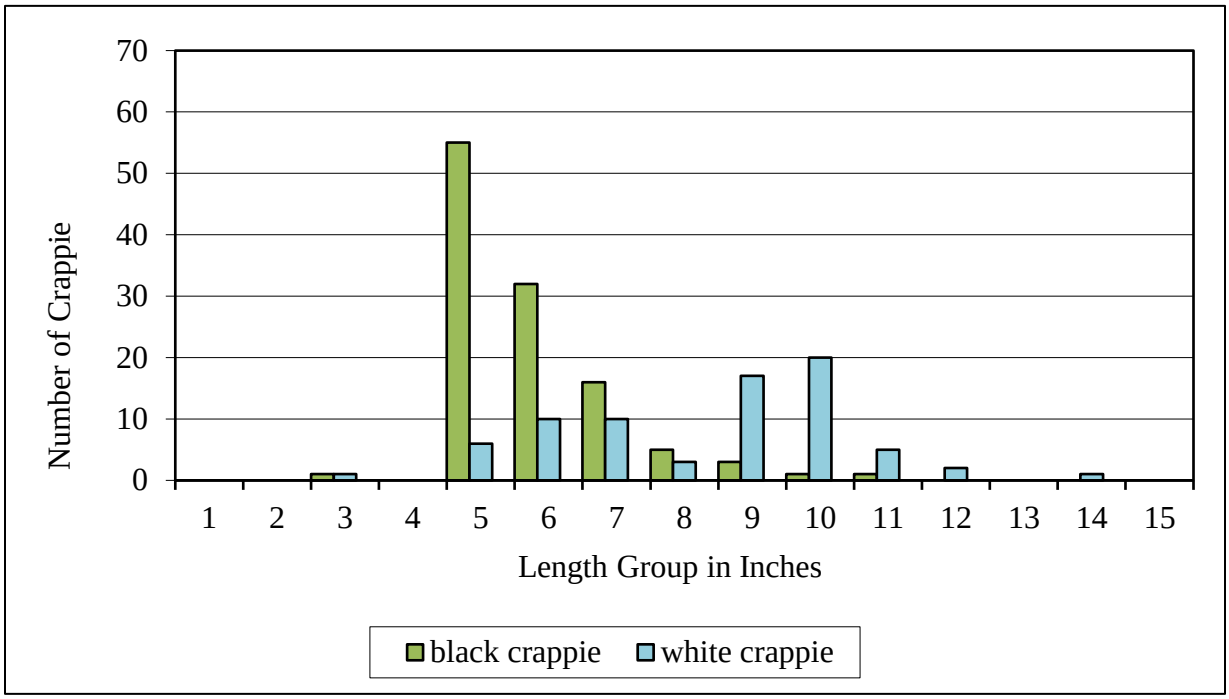

Figure 6. Total number and size distribution by inch group of black crappie and white crappie captured in lead nets for Lake Martin, LA, for 2010.

The crappie population of Lake Martin was sampled with lead nets in the fall of 2010. Abundant crappies in the 5 – 7 inch groups indicate good fingerling production during the previous spring. While the Lake Martin crappie populations consist primarily of black crappie, white crappie in the 9-14 inch groups, were also collected.

Commercial

Commercial fishing in Lake Martin is non-existent. Commercial species such as Common Carp, buffalo, and Freshwater Drum are present, but abundance of these species remains low (Table 4).

Table 4. Total number of species captured per year with monofilament gill nets fished on Lake Martin, LA during 2000 – 2016.

Species	1990	1999	2002	2007	2009	2012	2016
LMB	3	11	8	9	16	9	4
Crappie	1	54	1	2		9	0
C. Carp	8	44	4	0	1	0	5
Bullhead	7	19	5	4	6	4	3
B. Buffalo			12	2	6	4	22
F. Drum				5	26	2	1
Y. Bass				0	1	2	0
Bowfin	6	12	33	11	13	6	3
Spot Gar		15		3	5	2	0
G. Shad	20	102	9	19	87	68	21
C. Catfish		1		1	10	3	19
G. Carp		64	3	10	33	20	9
SM Buffalo							3
Spotted Sucker							1
Blue Catfish							7

Monofilament gill nets of 2.5 inches, 3.0 inches, 3.5 inches and 4.0 inches are fished between December 1 and February 28. The minimum number of net sets is determined by the surface area of the impoundment. A net-set consists of four, 100-yard nets of the specified mesh sizes. Gill nets are set within one hour of sunset, and retrieved as soon as possible after sunrise the following morning. All fish captured are individually measured to total length (millimeters) and weight (grams).

The most common species captured were Gizzard Shad and Bowfin. Other species noted were the triploid Grass Carp (TGC), which were stocked in Lake Martin in 1997 and 1998 and from 2014-2018 to control the spread of hydrilla. In 2016 other species were captured such as Spotted Sucker, Smallmouth Buffalo and Blue Catfish. This was likely due to the August flood of 2016. (Table 4).

Creel Surveys

Largemouth Bass Anglers

Access point creel surveys are conducted on water bodies to collect fishery dependent data from anglers including: fishing pressure, catch rates, harvest, and size structure of harvested fishes, angling success and species preference. Bass fishing trips to Lake Martin averaged 1.89 anglers per boat (Table 5).

Table 5. Average number of Largemouth Bass anglers interviewed, time fished, and distanced traveled to Lake Martin, LA during the 2007 creel survey.

BASS ANGLERS State regulations – no minimum/10fish creel			
Year	Mean no. of anglers in party	Mean trip length (hours)	Mean one-way distance traveled to ramp
2007	1.89	3.68	15.36

Bass anglers on Lake Martin averaged almost four hours per trip fishing after having driven approximately 15 miles to the ramp where they launched their boat. Participation by local Largemouth Bass anglers made up the majority of fishermen interviewed during 2007. Their residences included St. Martin, Lafayette, and St. Landry parishes.

Table 6, below, reports the number of Largemouth Bass caught, released and harvested per trip by month during 2007. Catch rates were found to be the highest in the month of September. Additionally, catch rates were high in March and May, likely due to Largemouth Bass nesting activities. Number of bass harvested (130) is slightly below number of bass released (139). This difference may be attributed to bass fishermen catching smaller bass and releasing them. The average weight of a Largemouth Bass harvested in the 2007 creel survey was 1.77 pounds.

Table 6. Largemouth Bass caught, released, and harvested per trip by anglers on Lake Martin, LA, during the 2007 creel survey.

State regulations – no minimum length/10 fish creel				
Month	**LMB caught per trip**	**LMB released per trip**	**LMB harvested per trip**	**LMB Ave. weight**
1	0.71	0.06	0.65	0.61
2	0.21	0.11	0.11	2.61
3	1.45	0.95	0.50	1.81
4	0.85	0.38	0.47	2.02
5	1.57	1.01	0.56	1.67
6	0.83	0.49	0.34	2.62
7	1.04	0.58	0.46	1.72
8	0.83	0.70	0.67	1.10
9	1.93	1.33	0.66	1.86
10	0.50	0.23	0.27	1.67
11	0.50	0.50	0	0
12	0.36	0.36	0	0

Although Largemouth Bass only averaged 6% of the total fish harvested for Lake Martin, Largemouth Bass is one of the most desired fish pursued by Lake Martin fishermen. During 2007, bluegill and crappie were the most abundant species harvested by anglers (Figure 6).

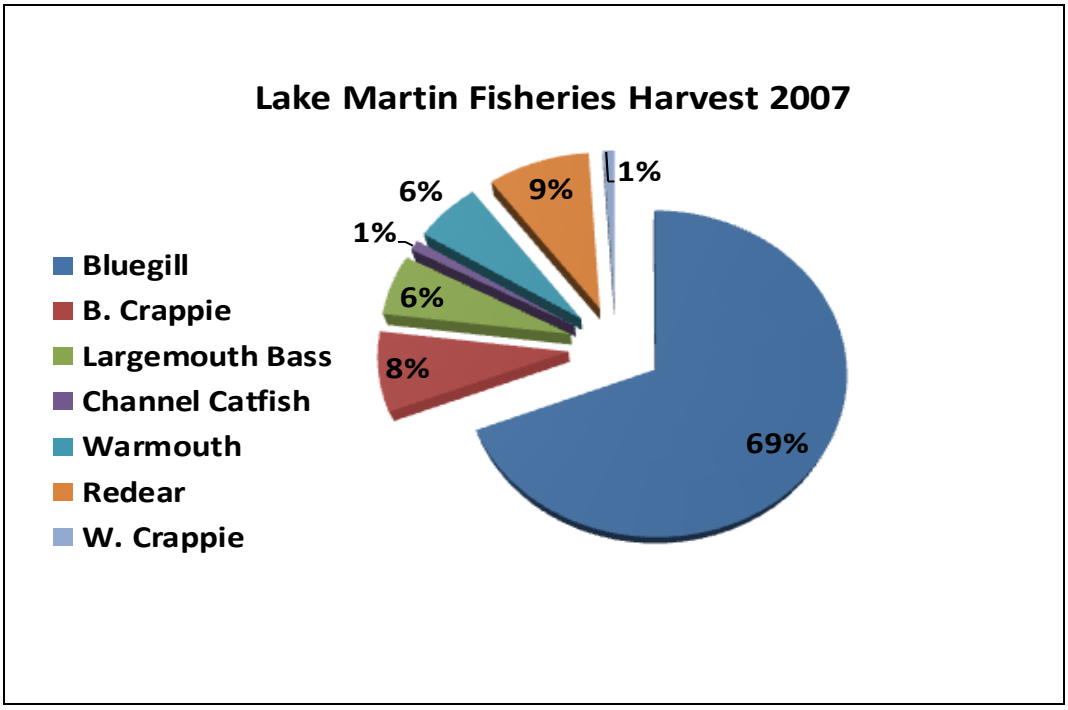

Figure 7. Percent (%) by number of total fish species harvested by anglers from Lake Martin, LA during the 2007 creel survey.

During Lake Martin creel survey interviews in 2007, anglers were asked their opinion of current bass regulations. If the angler expressed disagreement with the regulation, they were asked to provide suggestions for change.

Table 7 below shows the results of those opinion questions. These results were compiled from Largemouth Bass anglers and all anglers. Amongst Largemouth Bass anglers, approval of current regulations made up the majority of responses (80%). Anglers who did not primarily pursue bass also responded with high approval of the current regulations. The majority of fishermen agreed with current Largemouth Bass regulations.

Table 7. Results of an angler opinion survey taken at boat ramp access points on Lake Martin, LA during the 2007 creel survey.

Angler Opinion Survey Results		
Preference	Bass Anglers	All Anglers
	2007 (n=227)	2007 (n=754)
No length restriction	80 %	75.7 %
14” minimum	5.3 %	5.3 %
12” minimum	4.8 %	2.0 %
No opinion	3.5 %	13.3 %
14-17 slot limit	3.5%	1.3%
Other Slot	1.3 %	0.93 %
Other regulation	0.88 %	0.66 %
Other minimum	0.88 %	0.53 %

Sunfish Anglers

Sunfishes made up the greatest percentage of species harvested in Lake Martin during 2007(Table 8). Bluegill, by far, makes up the majority of sunfish harvested in Lake Martin, followed by Warmouth and Redear Sunfish. The best chance to harvest these sunfish is during the months of May and June, when they are spawning.

Table 8. Percent by number of common sunfish species harvested by anglers on Lake Martin, LA, during the 2007 creel survey.

2007	Bluegill	Redear Sunfish	Warmouth	Orange spotted sunfish	Longear sunfish
Percent	78%	3%	4%	0.001%	0.001%

Crappie Anglers

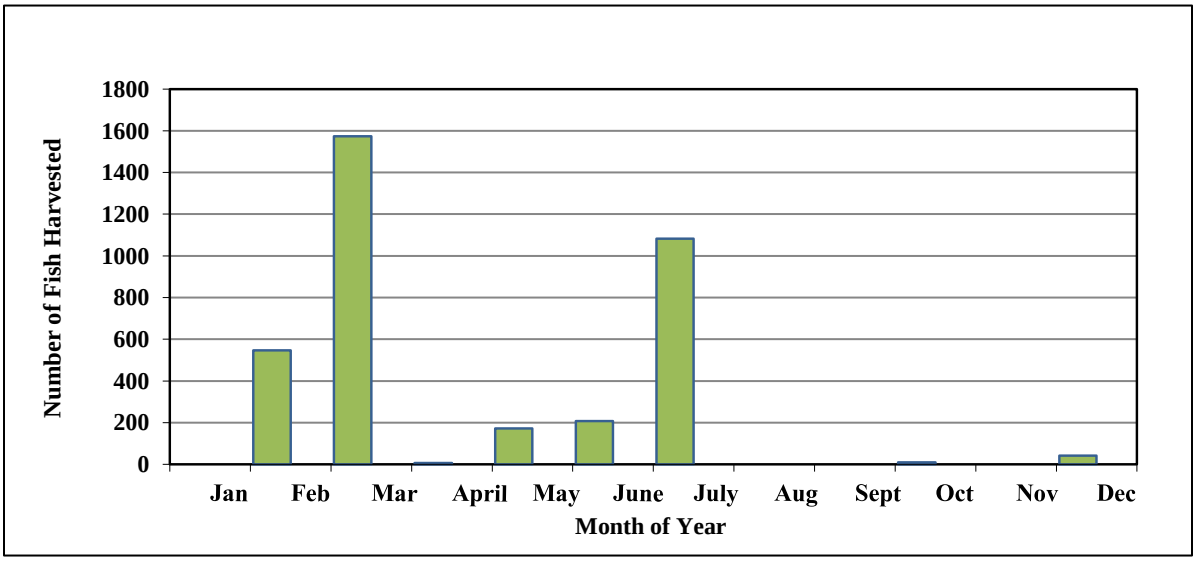

Figure 8. Total estimated number of crappie harvested by anglers on Lake Martin, LA, during the 2007 creel survey.

Large numbers of crappie were harvested from Lake Martin (Figure 8) in the months of March and July. With only one boat ramp at Lake Martin, trailer counts accounted for 473 boat trailers between the months of January – June during the access creel survey. These high numbers are due to increased fishing participation in this lake. Hurricane Rita in 2005 caused fish kills in the surrounding water-bodies, such as Henderson Lake, therefore increasing fishing pressure on Lake Martin. In later months of the creel survey, crappie harvest was very minimal.

<u>Species of Greatest Conservation Need</u>

American Eel (*Anguilla rostrata*) is the only aquatic species of concern in Lake Martin

Water Quality

Water quality parameters such as dissolved oxygen, temperature, pH, conductivity and depth were taken during standardized samples, drawdown events and monthly site visits. As shown in the Figure 9 below, dissolved oxygen (DO) levels often fell below 2.0 mg/l during the summer months from 1998 – 2002. This was due to excessive nutrient loading caused by a large bird rookery located on the southeast end of the lake. Additionally, heavy infestations of hydrilla were found throughout the rest of the lake. Infestations of hydrilla in the lake were eventually controlled by herbicidal treatments and stocking of TGC in 1997 and 1998. At present, hydrilla remains under control. To improve water quality parameters throughout the lake, drawdowns were recommended to expose, dry, and oxidize the organic matter accumulated around the rookery. The original plan was to utilize the control structure on the north end of lake for the drawdowns, but this would bring hypoxic water from the rookery across the lake, and may have caused fish kills. Subsequently a new water control structure was placed in the perimeter levee near the rookery in August 2001. Drawdowns were implemented from 2002 -2006 during the fall of each year to improve water quality conditions. Sampling trends indicate coincident improvement in Lake Martin water quality (Figure 9).

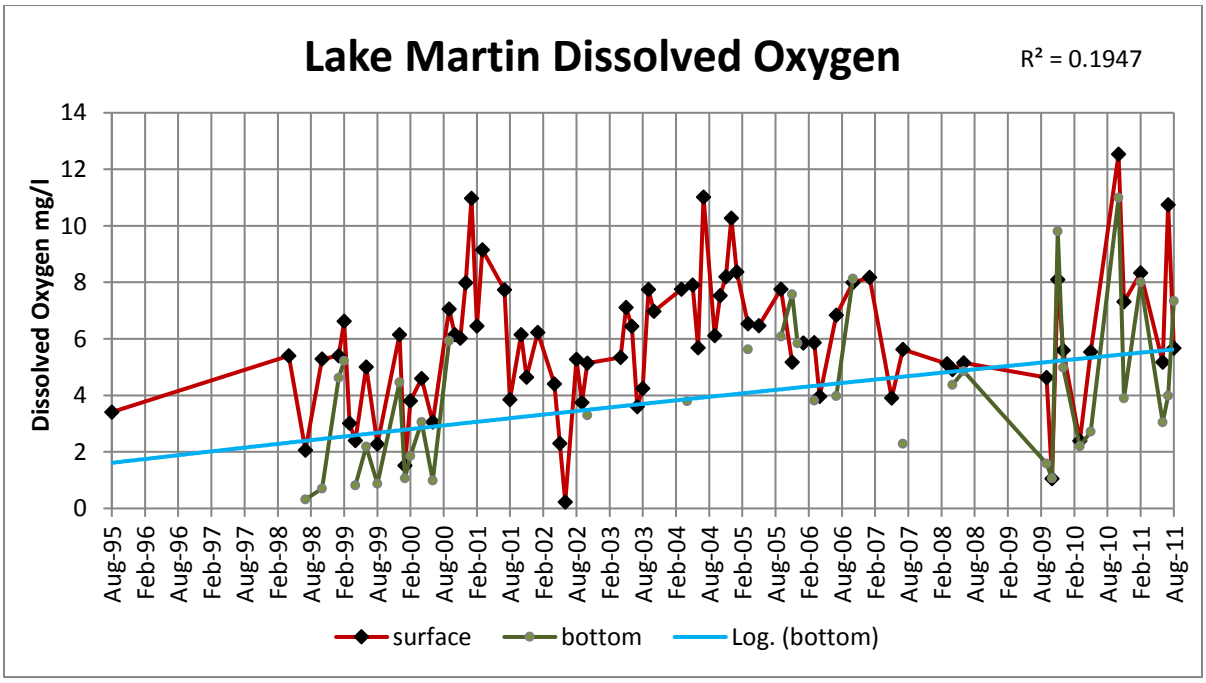

Figure 9. Dissolved oxygen measurements taken during standardized fisheries and random sampling events from Lake Martin, Louisiana, during the years 1995 – 2011.

In 2018, monthly water quality parameters, such as depth, temperature, dissolved oxygen, pH, turbidity, and conductivity, were taken in two locations in the lake, near the dam and at the upper end in the deepest part of the lake. These readings were taken at 1-meter intervals beginning just below the surface to just above the bottom (Figures 10 and 11)

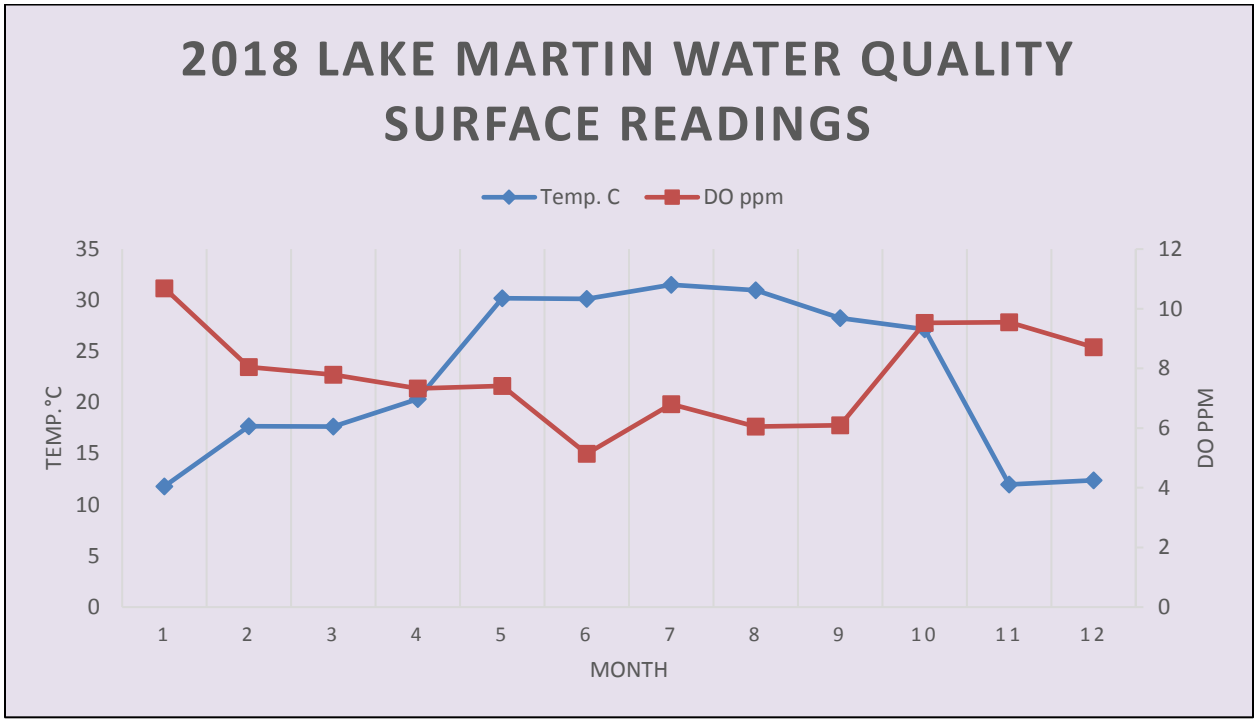

Figure 10. Lake Martin water quality surface readings of temperature and dissolved oxygen.

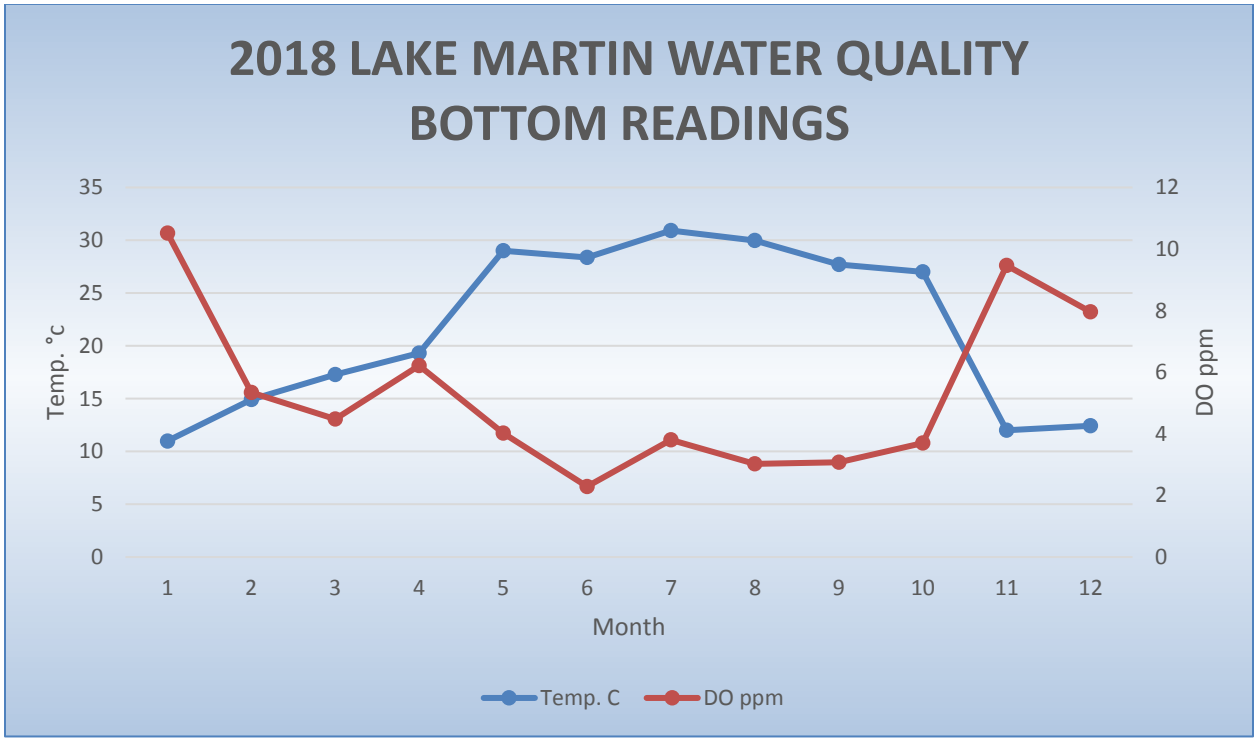

Figure 11. Lake Martin water quality bottom readings of temperature and dissolved oxygen.

Table 9. Monthly water quality results taken on Lake Martin, LA during 2018 sampling. Parameters taken included depth, temperature, dissolved oxygen, pH, Turbidity and conductivity.

Lake Martin Water Quality 2018

Jan. 22, 2018	Depth (m)	Temp. °C	D.O. ppm	PH	Turb. NTU	Conduct.
Station 1	0.095	12.73	10.79	8.34	13.8	0.05
Spillway	0.976	12.24	10.63	8.23	13.8	0.049
	1.601	11.1	10.31	8.09	14.4	0.046
Station 2	0.086	10.89	10.59	8.3	14.1	0.044
SW Duck Blind	0.903	10.89	10.35	8.26	16.7	0.044
	1.432	10.89	10.74	8.3	13.6	0.044
Feb. 15, 2018						
Station 1	0.108	18.19	7.55	8.11	11.1	0.05
	0.983	17.79	5.71	8.08	11.4	0.05
	1.901	15.18	3.76	8.05	16.2	0.057
Station 2	0.229	17.2	8.56	7.86	10.6	0.049
	1.015	15.35	7.57	7.83	11.1	0.049
	1.516	14.63	6.93	7.88	16.2	0.051
Mar. 9, 2018						
Station 1	0.208	17.27	6.82	7.29	15.55	0.054
	1.101	16.61	4.96	7.35	22.6	0.054
	2.049	16.85	2.39	7.63	35.4	0.065
Station 2	0.179	18.02	8.76	6.88	17.3	0.054
	1.026	17.87	7.82	6.96	18.3	0.054
	1.46	17.74	6.57	6.94	25.8	0.054
Apr. 12, 2018						
Station 1	0.163	20.42	7.02	7.8	11	0.049
	1.015	19.87	5.79	7.82	10.5	0.049
	2.05	18.62	4.59	7.83	15.1	0.051
Station 2	0.201	20.26	7.65	7.64	13.2	0.05
	0.994	20.12	7.84	7.69	12.6	0.05
	1.333	20.01	7.85	7.66	12.8	0.049
May 18, 2018						
Station 1	0.09	29.85	6.41	6.86	21.8	0.06
	0.738	28.9	4.2	6.9	15	0.06
	1.409	28.46	2.38	7.05	24.2	0.061
Station 2	0.02	30.53	8.41	6.96	20.8	0.061
	0.538	29.73	6.69	6.92	20.8	0.06
	1.117	29.56	5.67	6.97	20.8	0.061
June 14, 2018						
Station 1	0.154	30.74	3.93	6.94	15.4	0.067
	1.009	28.62	1.26	7.1	10.1	0.067
	1.816	28.37	1.52	7.36	16.3	0.071
Station 2	0.517	29.51	6.35	6.99	25.2	0.067
	0.8	28.58	3.31	6.99	35.3	0.067
	1.197	28.37	3.07	6.99	25.7	0.068

July 18, 2018	Depth (m)	Temp. °C	D.O. ppm	PH	Turb. NTU	Conduct.
Station 1	0.051	31.08	5.18	6.58	10.93	0.068
	1.109	30.8	3.18	6.57	12.32	0.069
	1.685	30.63	1.17	6.73	13.58	0.072
Station 2	0.063	31.94	8.42	6.54	16.7	0.071
	0.981	31.29	6.84	6.54	18.4	0.071
	1.219	31.21	6.43	6.55	20.1	0.071
Aug. 20, 2018						
Station 1	0.08	30.86	5.99	7.66	10.7	0.073
	0.96	30.01	3.02	7.78	7.4	0.074
	1.384	29.83	2.43	7.94	8.2	0.074
Station 2	0.052	31.1	6.12	7.36	11.9	0.074
	0.964	30.27	4.6	7.42	13.2	0.074
	1.203	30.16	3.61	7.43	16.1	0.073
Sept. 12, 2018						
Station 1	0.05	28.37	5.5	6.64	10.8	0.079
	0.96	27.77	2.6	6.69	10.2	0.079
	1.456	27.68	1.93	6.95	13.3	0.079
Station 2	0.117	28.17	6.68	6.38	11.9	0.076
	0.991	27.84	5.15	6.38	13.4	0.077
	1.335	27.72	4.23	6.39	24.9	0.077
Oct. 11, 2018						
Station 1	0.044	27.07	9.41	7.93	12.7	0.067
	0.992	27.05	8.93	8.05	12.9	0.067
	1.79	26.78	6.58	8.37	21.7	0.068
Station 2	0.055	27.25	9.65	7.21	15.2	0.067
	0.937	27.24	9.18	7.23	15.8	0.067
	1.35	27.23	0.83	7.09	16.7	0.067
Nov. 14, 2018						
Station 1	0.273	11.77	8.88	10.22	9.5	0.069
	0.799	11.73	8.81	10.19	9.3	0.07
	1.788	11.74	9.01	10.14	10.9	0.072
Station 2	0.177	12.24	10.23	10.12	12.1	0.068
	0.602	12.25	10.03	10.19	11.7	0.068
	1.653	12.26	9.93	10.12	20.7	0.068
Dec. 14, 2018						
Station 1	0.082	12.7	7.42	6.57	7.3	0.062
	0.89	12.73	7.15	6.54	10.32	0.062
	1.872	12.75	6.04	6.53	12.75	0.062
Station 2	0.016	12.13	10.01	6.61	8.7	0.062
	0.995	12.13	9.98	6.57	11.5	0.062
	1.47	12.13	9.89	6.54	11.9	0.061

HABITAT EVALUATION

Aquatic Vegetation

Lake Martin was drawn down for extended periods of time from the mid-1970s until 1981 due to an overabundance of aquatic vegetation and flooding. A plan to renovate the lake began during this time. During this period, boat lanes were cut through the timber on the northern and western portions of the lake and a central channel was dug to facilitate drainage during future drawdowns. The existing pump and drawdown structure were also refurbished during this time. In 1984, two culverts under the east and southeast levee were removed.

In 1993, the lake was drawn down approximately two feet, and 3,600 feet of perimeter levee on the north and northwest sides were raised to a level equivalent to the lowest point on the levee on the Rookery Road section of the levee (southeastern). A 45-foot spillway set at a height of 10.5 feet MSL was installed on the north levee to reduce hydraulic pressure on the lower sections. Pipe gates were installed on the levee crown to prevent vehicular traffic on the unimproved section of levee.

In 1993, hydrilla was discovered in Lake Martin. The invasive plant species quickly created a serious access problem. Hydrilla coverage exceeded 80% coverage of the lake by the end of the 1996 growing season. In 1997 and 1998, herbicide applications were conducted, and triploid grass carp (TGC) were introduced each year to combat hydrilla. Herbicide applications were made by fixed winged aircraft contracted through Aerial Crop Care based in Port Barre, LA. The herbicide, Aquathol®, was applied in liquid and granular form. A total of approximately 200 acres of submersed vegetation were treated each year. In October of 1997, 1,600 TGC were stocked in Lake Martin. The following spring, a field investigation revealed a substantial re-growth of hydrilla, and an additional 2,400 TGC were stocked into the lake that fall. A total of 4,000 TGC (6.25/vegetated acre) were stocked into Lake Martin and controlled hydrilla infestations during this time. Hydrilla re-growth in 2014 and 2015 prompted additional stockings of TGC, of which an additional 3,180 were added to help control the spread of this invasive aquatic plant.

Over extended periods of time, water quality has suffered due to nitrogen inputs associated with the extensive bird rookery on the south end of the lake. The nutrients have contributed to excessive growth of aquatic vegetation. A water control structure was placed on the southeast end of the lake in 2001. The intended purpose of the structure was to release nutrients from the rookery into the adjacent 6,400 acre Bayou Tortue Swamp.

With the new structure in place, partial drawdowns of 2-3 feet were implemented to improve water quality conditions. Drawdowns were implemented annually from 2002 to 2006. The structure was opened near the middle of September. Full replacement of the water was achieved no later than January 31st of the following year. To facilitate refill, water was pumped in from the Ruth Canal which skirts the north end of the lake. In 2008 and 2013, the lake was drawn down 2 to 3 feet in the fall (September) to build a new board walk and to improve water bird nesting habitat. The lake was refilled in January following each of those drawdowns.

On February 5, 2013, LDWF biologists first discovered giant salvinia (*Salvinia molesta*) in Lake Martin. Approximately 0.5 acres of the plant was found in the southeast portion of the lake. Initial herbicide applications and boat surveys were conducted to slow the spread of the plant to other parts of the lake.

Giant salvinia continued to increase and spread throughout the lake. A total of 92,958 salvinia weevils were stocked in Lake Martin from 2013 – 2016 to control the spread of this plant. Despite salvinia weevil releases and herbicide treatments, the giant salvinia infestation on Lake Martin continued to expand.

On August 11, 2016, a major rain event occurred causing the lake level to rise 6 feet above pool stage. The lake remained inundated for approximately 4 weeks, which in turn removed some submersed and floating aquatic plants from the lake. Giant salvinia had been displaced throughout the lake. In addition, hydrilla was still present and abundant throughout the lake.

A fall drawdown was scheduled for 2016, but due to severe flooding in and around the lake, the drawdown was canceled.

In 2017, salvinia weevils (Brazilian) were released in Lake Martin. Approximately 33,120 adult weevils were released throughout the lake. LDWF collected these weevils from the LSU St. Gabriel Research Station near Baton Rouge.

In 2017, a fall drawdown of approximately 2-2.5 feet helped retard growth of aquatic vegetation throughout the lake. The lake remained down from October 2017 – January 8, 2018.

In November of 2018 a total of 1,374 triploid grass carp, averaging 12 inches in length, were released in the lake to control the spread of submersed vegetation, mainly hydrilla.

Substrate

Lake Martin has a generous canopy of water tupelo (*Nyssa aquatica)* and bald cypress (*Taxodium distichum)*. Annual leaf fall is a primary contributor to organic material on the lake bottom. When the leaves sink into the water, they are subjected to anaerobic instead of the more rapid aerobic decomposition. Accumulations of organic material on the lake bottom are the result. Current drawdown practices have increased desiccation and oxidation of the organic material.

CONDITION IMBALANCE / PROBLEM

1. Submersed aquatic vegetation thrives near the rookery and may spread throughout the lake.
2. Extensive drawdowns are a hindrance to access for anglers and tour boat operators.
3. Spread of invasive aquatic vegetation including common/giant salvinia, hydrilla and water hyacinth.

CORRECTIVE ACTION NEEDED

1. Maintenance of submerged aquatic vegetation in the desired 15 - 30% range.
2. Provide public information outlining the benefits of natural seasonal water fluctuations as a management tool.
3. Determine optimal drawdown level and frequency.

RECOMMENDATIONS

1. An approach of integrated management measures is recommended to control aquatic vegetation in Lake Martin. The advantage of a combined approach is the ability to achieve benefits from several control methods and not be completely dependent on the success of any one approach.
    a. Herbicide applications will continue to be conducted. Contact herbicides will be used to control floating and emergent plants according to the Aquatic Herbicide Application Procedures found in Table 10.
    b. A three-foot drawdown in the fall/winter every 3 to 5 years is recommended.
    c. Efforts to monitor the status of aquatic vegetation and the effects of introduced triploid grass carp will continue.
2. The lake will be drawn down during 2021-2022, barring any extreme conditions in the lake. The control gate will be opened after the Labor Day holiday on September 2021, with a scheduled return to pool elevation by January 31, 2022. Water will be pumped in from Ruth Canal. Filling the lake with water at this time will ensure adequate levels for spring-time spawning.
3. Continue to evaluate the status of Florida Largemouth Bass, introduced to provide the opportunity to catch bass of larger size.
4. Continue standardized sampling with the use of electrofishing, creel surveys, seines and nets to evaluate the condition of fish stocks.
5. Continue to monitor water quality, particularly in the vicinity of the bird rookery.

Table 10. LDWF Aquatic Herbicide Application Procedures.

Plant Species	**Herbicide**	**Surfactant**
Common/Giant Salvinia (April 1 to October 31)	Glyphosate (0.75 gal/acre) + Diquat (0.25 gal/acre) or Clipper (2 oz./acre)	Turbulence (or approved equivalent, 0.25 gal/acre)
Common/Giant Salvinia (November 1 to March 31)	Diquat (0.75 gal/acre)	Nonionic surfactant (0.25 gal/acre)
Water Hyacinth	2, 4-D (0.5 gal/acre)	Nonionic surfactant (1 pint/acre)
Water Hyacinth in waiver areas (March 15 to September 15)	Glyphosate (0.75 gal/acre)	Nonionic surfactant (0.25 gal/acre)
Alligator Weed (undeveloped areas)	Imazapyr (0.5 gal/acre)	Turbulence (or approved equivalent, 0.25 gal/acre)
Alligator Weed (developed areas)	Imazamox (0.5 gal/acre)	Turbulence (or approved equivalent, 0.25 gal/acre)
American Lotus	2, 4-D (0.5 gal/acre)	Nonionic surfactant (1 pint/acre)
American Lotus in waiver areas (March 15 to September 15)	Glyphosate (0.5 gal/acre)	Nonionic surfactant (0.25 gal/acre)
American Lotus in waiver areas with potable water intakes (March 15 to September 15)	Triclopyr (0.5gal/acre)	Turbulence (or approved equivalent, 0.25 gal/acre)
Duckweed	Diquat (1.0 gal/acre)	Nonionic surfactant (0.25 gal/acre)
Cuban Bulrush (*Oxycaryum cubense*)(sedge)	2, 4-D (0.5 gal/acre)	Nonionic surfactant (1 pint/acre)
Cuban Bulrush (sedge) in waiver areas (March 15 to September 15)	Glyphosate (0.75 gal/acre)	Nonionic surfactant (0.25 gal/acre)
Water Lettuce (*Pistia stratiotes*)	Diquat (1.0 gal/acre)	Nonionic surfactant (0.25 gal/acre)