Use of a Female-only Stocking Strategy to Establish a Trophy Largemouth Bass Fishery in a Georgia Small Impoundment

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Abstract: Anglers have become increasingly interested in pursuing trophy largemouth bass (*Micropterus salmoides*), but creating and maintaining such fisheries are often challenging. We used a low-density stocking of female-only largemouth bass in combination with forage species stocking and a catch-and-release regulation to create a trophy fishery in a 43-ha Georgia impoundment. Initial stocking of age-1 female largemouth bass occurred in spring 2005, and the population was dominated by fish ≥457 mm total length (TL) within four years. A total of 180 largemouth bass were collected in 2012; 34.4 % exceeded 3.6 kg and 8.8 % exceeded 4.5 kg. Both angling and electrofishing caught individuals ≥457 mm TL, but electrofishing collected a broader size range of bass including fish ≤237 mm TL. Size structure of largemouth bass was larger in angling than electrofishing samples in spring, but was similar between gears for bass > 457 mm TL. Angler catch rates of trophy largemouth bass were high, taking an average of only 7.35 angler-h to catch a 3.6-kg fish. Growth was fast, as female largemouth bass reached 457 and 508 mm TL in 2.59 and 3.69 years, respectively. Mean relative weight across all size groups was 119. By the end of the study, density of trophy (> 3.6 kg) largemouth bass in the impoundment was estimated to be 1 fish 0.69 ha^{-1}. Also, females still outnumbered males 6.9:1 at the conclusion of this study, despite incidental male introductions through time. Thus, a program designed to stock females exclusively appeared to be a viable option to keep largemouth bass densities low and produce a high number of trophy bass. This strategy accommodates anglers that have a high voluntary release ethic, producing a largemouth bass population with low recruitment and fast growth without requiring high harvest.

Key words: lake management, forage stocking, catch and release, low density, fast growth, (*Micropterus salmoides*)

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Largemouth bass (*Micropterus salmoides*) anglers have become increasingly interested in catching trophy-size fish (Wilson and Dicenzo 2002, Dutterer et al. 2014). Providing these fisheries increases angler satisfaction and may be a motivating factor in retaining and recruiting anglers, paramount concerns of contemporary fisheries management (Eades et al. 2008, Martin et al. 2012). Trophy black bass fisheries can convey substantial economic benefits to surrounding communities; for example, economic value of the trophy largemouth bass fishery in Lake Fork, Texas, was estimated to be US$27.5 million in 1994 (Chen et al. 2003). Creating and maintaining these fisheries, however, can be difficult.

Restrictive size and harvest regulations limiting exploitation have been used by resource managers to increase the chance at creating, enhancing, or maintaining trophy opportunities for anglers (Redmond 1986, Carlson and Isermann 2010). Carlson and Isermann (2010) found adult size structure of largemouth bass populations in Minnesota can significantly benefit from catch and release. Thus, limiting or prohibiting harvest can increase the probability of producing a trophy fishery. However, high release rates can undermine the effectiveness of harvest restrictions to alter size structure of populations (Myers et al. 2008), especially if recruitment is high.

Small impoundments and ponds are often characterized by high rates of largemouth bass reproduction and recruitment, which can limit trophy fish production through density-dependent mechanisms (Aday and Graeb 2012). Compared to larger systems, however, small impoundments offer managers more options and opportunities to use new approaches to create unique fishing opportunities that may attract and retain future anglers (Schramm and Willis 2012). One such technique is stocking exclusively female largemouth bass to produce trophy fish opportunities. This strategy has been implemented in many private ponds throughout the southeastern United States (Willis et al. 2010; G. Grimes, Aquatic Environmental Services, Inc., personal communication). Effectiveness of this strategy can be reduced or eliminated when male fish get stocked into the system, either by misidentification in the hatchery or by anglers, which often results in the population quickly becoming mixed-gender (Wright and Kraft 2012). However, this management option has the potential to overcome the limitations of excessive largemouth bass recruitment and the unwillingness of many anglers to harvest fish.

Ocmulgee Public Fishing Area (PFA) is one of 10 PFAs located in the State of Georgia and all of these small impoundments are intensively managed by GADNR biologists to achieve high productivity (Bonvechio et. al 2013). In reaction to anglers communicating a greater importance on potential opportunities for trophy-size bass (Wilson and Dicenzo 2002, Beardmore et al. 2011), the Georgia Department of Natural Resources Wildlife Resources Division (GADNR) has been proactively searching for more trophy bass opportunities on several of its PFA systems (Bonvechio et al. 2013). To meet this need, Ocmulgee PFA was used to assess the effectiveness of stocking of all female bass, in conjunction with catch-and-release angling, to create a trophy largemouth bass fishery. We found no published study that examined growth and size structure of a female-only trophy largemouth bass population using a combination of angling and electrofishing. The objective of this study was to evaluate the size structure and growth of an all-female largemouth bass population and to estimate the number of trophy bass found in the impoundment eight years following initial stocking.

Methods

Study Area

Ocmulgee PFA is a 43-ha reservoir in central Georgia near the town of Cochran. The reservoir is located within the Ocmulgee Wildlife Management Area and is owned by the GADNR. The reservoir was impounded in 2004, and standing timber was left in 50% of the flooded area to establish complex fish habitat. Mean and maximum depth was 4 m and 9 m, respectively. Fertilizer and lime were added to increase production, and Secchi transparency during summer was maintained at 0.5–0.6 m. The reservoir developed a leak in summer 2011, water levels began steadily falling, and the reservoir was reduced to roughly 26 ha by late February 2012. By November 2012, navigability became a serious issue, and the GADNR was forced to close the reservoir to fishing and drain it for repairs which were accomplished by December. Since impoundment, the largemouth bass population was managed with a catch-and-release regulation. The fishery was monitored by a lake manager with the ability to issue citations which likely increased angler compliance with the catch and release regulation.

Stocking

In 2004 and 2005, F_1 Florida largemouth bass (*Micropterus salmoides floridanus*) x northern largemouth bass (*M. s. salmoides*) procured from American Sportfish Hatchery, Inc. (Montgomery, Alabama) were reared in GADNR hatchery ponds. These bass were recovered from hatchery ponds a year later, and sex was determined by inserting a pipette into the urogenital opening (R. Phelps, School of Fisheries, Aquaculture, and Aquatic Sciences, Auburn Universty, unpublished data). All female largemouth bass were tagged with a passive integrated transponder (PIT) tag for later identification and stocked into Ocmulgee PFA in 2005 and 2006 at a rate of 12.8 fish ha^{-1} (Table 1). Lower numbers of female largemouth bass were tagged and stocked into the impoundment throughout the study using similar methods. Also, any untagged female largemouth bass collected from 2009–2012 were subsequently tagged (Table 1). Sizes and genetics (i.e., origin) of female largemouth bass stocked after 2006 varied by batch and year.

Table 1. Stocking history of female largemouth bass including year-class, age, number, and density (fish ha^{-1}) stocked; genetics of the stocked fish; mean total length (TL) stocked; minimum TL stocked; maximum TL stocked; and brood origin. Genetic strains were: F_1 = Florida largemouth bass crossed with northern largemouth bass, and F_x = Georgia's intergrade largemouth bass (*M. salmoides*) obtained from the Ocmulgee River. Minimum, maximum, and mean total length data for one of the 2009 stocking events were lost.

Year-class	Age	*n* stocked	Density stocked	Genetics	Mean TL	Min TL	Max TL	Brood origin
2005	8	550	12.8	F1	273	141	340	American Sportfish
2006	7	550	12.8	F1	240	185	351	American Sportfish
2008	5	53	1.3	F_1 & F_x	317	227	443	Dodge County (PFA) Flat Creek (PFA)
2009	4	100	2.3	F_x	N/A*	N/A*	N/A*	Dodge County (PFA) Ocmulgee River
	N/A	6		N/A	455	421	480	Ocmulgee PFA Reproduction
2010	3	334	7.8	F_x	204	146	312	Dodge County (PFA) Ocmulgee River
	N/A	7		N/A	441	300	528	Ocmulgee (PFA) Reproduction
2011	N/A	2		N/A	447	410	484	Ocmulgee (PFA) Reproduction
2012	1	81	1.9	F_x	256	229	287	Ocmulgee (PFA) American Sportfish
	N/A	3		N/A	477	390	541	Ocmulgee (PFA) Reproduction

Bluegill (*Lepomis macrochirus*), golden shiners (*Notemigonus crysoleucas*), redear sunfish (*L. microlophus*), and threadfin shad (*Dorosoma petenense*) were stocked in 2004, one year before the first largemouth bass stocking. This was done to allow reproduction and accumulation of forage prior to stocking of largemouth bass. Afterwards, four additional species were stocked as either forage or sportfish (Table 2). Supplemental stockings primarily consisted of goldfish (*Carassius auratus)*, lake chubsuckers *(Erimyzon sucetta)*, and channel catfish (*Ictalurus punctatus*).

Sampling

Ocmulgee PFA was sampled using electrofishing in the spring from 2008 through 2012 to follow the progression of growth and size structure. The largemouth bass population was sampled one time in 2008 and 2011, two times in 2009 and 2010, and five times in 2012; all between 1 March to 30 April using boat electrofishing equipment with a 7500-W generator and a Smith-Root GPP

Table 2. Stocking history of forage including species, years stocked, total number of stockings, mean number, and density stocked (fish ha^{-1}).

Species	Years stocked	Total stockings	n stocked	Density stocked
Bluegill	2004, 2011, 2012	3	100,223	778.7
Channel catfish	2005–2011	4	77,000	448.7
Golden shiners	2005	1	4500	104.9
Goldfish	2004–2011	21	701,121	778.2
Lake chubsuckers	2008–2012	9	117,065	303.2
Redear sunfish	2004, 2011, 2012	3	25,035	194.5
Threadfin shad	2005	1	1500	35
White crappie	2004	1	181	4.2
Totals		41	1, 026,625	583.7

7.5 pulsator (Vancouver, Washington) operated to achieve 5A to 7A of pulsed DC current. The johnboat was equipped for electrofishing with a 60-hp outboard motor. Six electrofishing transects were conducted for 15 min and assessed all available habitat types including open water, shoreline, and open water flooded timber. All largemouth bass collected were measured (total length [TL], mm), weighed (g), and scanned for a PIT tag. Also during spring electrofishing, all bass were visually inspected to determine gender and squeezed to determine the presence or lack thereof male milt. Electrofishing was also utilized in November 2012 in an attempt to remove the remaining bass from the impoundment using similar methods to those mentioned above. Electrofishing catch-per-unit-effort (CPUE) for all samples was calculated as fish h^{-1}. The dewatering event included draining of remaining water from the reservoir, removal of fish via electrofishing, and a chlorine application to complete the renovation. We considered this sample to represent the true structure and abundance of the population.

Obtaining data on trophy-bass populations can be difficult due to the relative scarcity of large fish in electrofishing samples (Reynolds 1996, Bayley and Austen 2002, Wilson and Dicenzo 2002). Angler data has been used as a cost-effective method to estimate fish size structure and population information in systems or situations where it was difficult to obtain reliable, accurate, and sufficient fisheries data with electrofishing (Weiss-Glanz and Stanley 1984, Gabelhouse and Willis 1986, Ebbers 1987). Thus, we used both electrofishing and angling to assess the largemouth bass population on Ocmulgee PFA in spring 2012.

Twenty-one volunteer angler fishing trips were made at Ocmulgee PFA from 15 February to 7 June 2012 (Table 3). Volunteer angler trip length varied from 3–12 h. We used a total of four independent anglers per fishing event, who were accompanied by up to two other anglers for any given trip, so a party size could be as large as three on any one particular event. All volunteer anglers were trained to measure and weigh fish. Each day, volunteers were provided a data sheet, a Biomark (Boise, Idaho) PIT-tag scanner, measuring board, and an International Game Fish Association certified boga-grip that could weigh bass up to 6.8 kg. Cell-phone numbers were exchanged with angling volunteers for coordination, as only one PIT-tag scanner was available. If a bass was caught, the angler was instructed to immediately release the fish back into the water body after recording TL and weight. Angler effort was recorded as total h fished and then multiplied by number of anglers to get total angler effort (angler-h) per trip, and angling CPUE was calculated as fish angler h^{-1}.

Analysis

Length-frequency distributions were compared among the spring 2012 electrofishing, angling, and the fall dewatering electrofishing samples for all sizes of fish and for fish > 457 mm TL. All comparisons were done using a Kolmogorov-Smirnov two-sample test using a Bonferroni adjustment (i.e., $P = 0.05/4 = 0.0125$; SAS

Table 3. Gear used, size categories, number of samples (*n*), mean catch-per-unit-effort (CPUE, fish h^{-1}) and SD, mean total length (TL) and SD, and total number of largemouth bass collected (Total) for each gear and size category in spring 2012.

			CPUE		TL		
Gear	Size category	*n*	Mean	SD	Mean	SD	Total
Angling	All fish	21	0.30	0.27	545	44.7	64
	≥457 mm TL	21	0.29	0.27	551	29.5	62
	>2.27 kg	21	0.28	0.26	554	28.7	59
	>3.6 kg	21	0.14	0.19	572	27.8	29
	>4.5 kg	21	0.03	0.07	599	34.5	4
Electrofishing	All females	30	15.27	7.51	489	106.1	116
	≥457 m TL	30	11.06	5.84	544	38.51	84
	>2.27 kg	30	11.1	1.37	552	33.9	81
	>3.6 kg	30	1.14	0.88	579	24.7	33
	>4.5kg	30	0.41	0.63	601	14.4	12

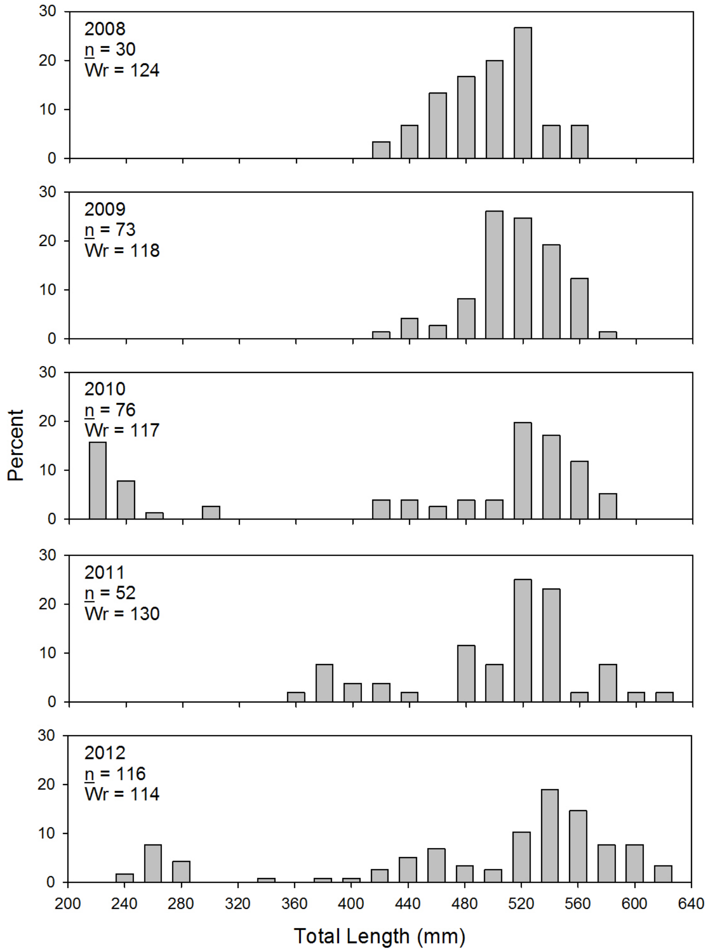

Figure 1. Length-frequency distributions (20-mm groups) of largemouth bass collected from Ocumlgee PFA using electrofishing during spring 2008–2012. Total sample size (*n*) and relative weight (Wr) are displayed for each sample year.

Institute 2011). Largemouth bass were divided into four weight categories (2.27–3.60, 3.60–4.50, 4.50–5.40, and >5.40 kg) and proportion of fish captured across these categories were examined between gears using a chi-squared test (SAS Institute 2011). Because the majority of the fish sampled contained PIT tags and were known age, sacrificing fish for sagittal otoliths was unnecessary. Thus, spring electrofishing data collected from 2008 to 2012 were pooled and von Bertlanffy (1937) growth models were fit to PIT-tagged female largemouth bass using nonlinear regression with FAMS (Slipke and Maceina 2014). The growth curve was fit with mean length-at-age data and was not extended past the maximum age obtained in the sample (Bonvechio et al. 2005). Largemouth bass condition was estimated with the relative weight (W_r) equation found in Neumann et al. (2012). A type I error rate of 0.05 was used for all comparisons.

Results

Catch rates and sample sizes of largemouth bass were low throughout the spring 2008–2012 electrofishing samples. By the beginning of sampling in 2008, the population was dominated by fish ≥457 mm TL (Figure 1). This group of fish slowly grew longer as the study progressed. The population size structure was unimodal until 2010, when smaller fish began to be collected, possibly to due natural reproduction that occurred after male largemouth bass were observed in 2009. By the final year of the study, the length-frequency distribution had broadened considerably, containing largemouth bass from 240–635 mm TL; however, in all years the majority of the fish collected were ≥457 mm TL (Figure 1).

Volunteer anglers fished 213 angler-h over 21 angling events in spring 2012 and caught 64 largemouth bass with the largest fish collected being 635 mm TL (Table 3). On average, it took anglers 3.76, 7.35, and 53.25 h to catch a largemouth bass greater than 2.27 kg, 3.6 kg, and 4.5 kg, respectively. Electrofishing in spring 2012 captured 116 largemouth bass, and the largest fish collected was 625 mm TL (Table 3). Multiple captures of individual bass were uncommon; of 180 total fish scanned, there were only 15 recaptures (12%). Furthermore, of 16 fish greater than 4.5 kg, only one was a recapture (6%). Thus, angling and electrofishing combined obtained 1 trophy bass (>3.6 kg) per 0.69 ha. Catch rates of both gears followed a similar trend of declining as fish size increases, but electrofishing CPUE was 8–50 times higher than angling CPUE in each size group of fish (Table 3). Angling appeared to catch more largemouth bass between 3.60 and 4.60 kg and less between 4.50 and 5.40 kg (Figure 2), but overall the distribution

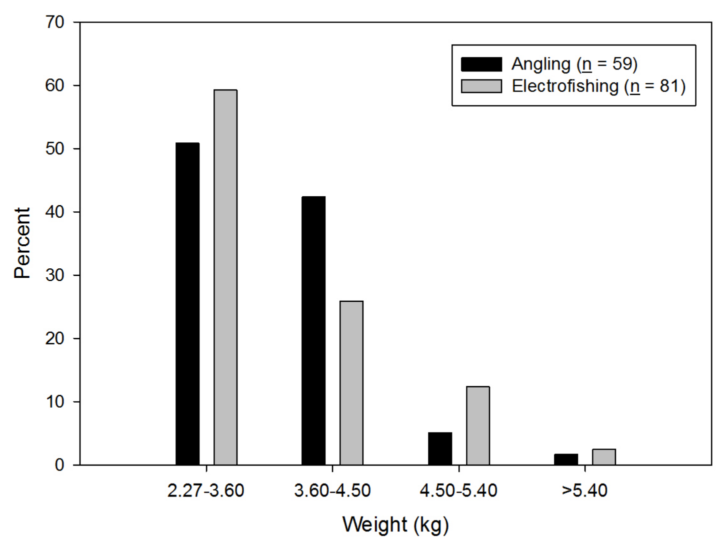

Figure 2. Percent of largemouth bass captured across four weight categories by angling and electrofishing in spring 2012. Number of fish (*n*) collected by each gear is displayed in legend.

of catch was similar between gears across the four weight classes ≥2.27 kg ($\chi^2 = 5.28$, df = 3, $P = 0.1526$).

In 2012, the length-frequency distribution of all sizes of fish obtained from angling differed from the length frequency of electrofishing (KSa = 2.183, $P = 0.0001$; Figure 3). Mean length of all females caught by angling was 545 mm TL compared to 489 mm TL for electrofishing (Table 3). However, length frequencies were similar between spring electrofishing and the sample from the fall dewatering event (KSa = 1.286, $P = 0.0731$), indicating that spring electrofishing sample closely approximated the true length distribution (Figure 3). The length frequency of the spring angling sample differed from that of the fall dewatering event (KSa = 2.802, $P < 0.0001$), as did the combined spring electrofishing and angling sample (KSa = 2.081, $P = 0.0003$). For largemouth bass >457 mm TL, the spring electrofishing length frequency was similar to the spring angling sample (KSa = 1.145, P = 0.1462) and the fall dewater event (KSa = 1.453, P = 0.0293; Figure 3). However, the spring angling sample and the fall dewatering event had differing length frequencies for fish >457 mm TL (KSa = 2.128, $P = 0.0002$). Similarly, the length frequency of the combined spring sample was also different from the fall dewatering event (KSa = 2.128, $P = 0.0002$).

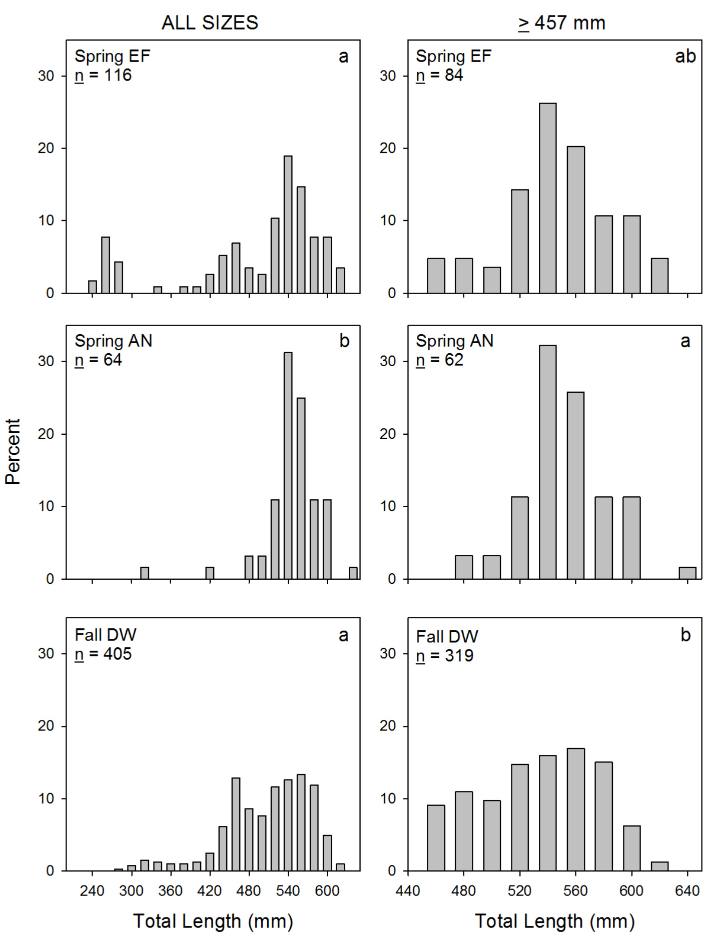

Figure 3. Length-frequency distributions (20-mm groups) of all sizes of largemouth bass and those ≥457 mm TL collected from Ocumlgee PFA using electrofishing (EF) and angling (AN) in spring 2012 and during the fall dewatering event (Fall DW). Total sample size (*n*) is displayed for each sample. Lowercase letters in upper right hand corner of each panel denote differences and similarities in distributions collected in samples within each size group (Kolmolgorov-Smirnov Test, $P < 0.0125$).

Table 4. Table depicting the associated sample size (*n*) and standard error (SE) of the mean total lengths (mm) of PIT tagged known-age female largemouth bass caught during spring electrofishing samples ($n = 394$) from 2008 to 2012. Minimum and maximum size captured is also provided.

Age	Mean TL	*n*	SE	Minimum	Maximum
1	243	37	7.56	157	390
2	422	21	8.51	363	490
3	469	46	5.31	347	546
4	511	78	3.28	420	568
5	529	56	3.34	465	585
6	537	38	5.52	445	624
7	562	79	3.49	508	635
8	541	39	2.88	505	605

Ages for largemouth bass ($n = 394$) ranged from 1 to 8 years, with missing age-2 and age-6 fish, matching years with no stocking. Growth of fish was fast, with mean length exceeding 500 mm TL by age 4 (Table 4). Mean total length (TL) at age for known-age PIT-tagged females from electrofishing in the spring from 2008–2012 was described by von Bertalanffy growth curves as $547.1(1 - e^{-0.759\,[age + 0.21]})$. This equation predicted that largemouth bass reached 457 and 508 mm TL in only 2.59 years and 3.69 years, respectively.

Electrofishing first detected males in the reservoir in 2009. Four males were found in 2009, 3 in 2010, 5 in 2011, and 4 in 2012, and all were removed from the impoundment. Untagged female bass captured in the lake during routine electrofishing from 2009–2012 ($n = 18$ across all years) were tagged at capture and became part of the known tagged female population (Table 1). Male largemouth bass may have entered the reservoir from an upstream 2.5-ha pond within the drainage but accidental stocking of male bass in the reservoir also occurred: of 16 males collected during spring 2012 electrofishing, 4 were PIT-tagged and thus had been stocked. Another PIT-tagged male largemouth bass was collected during the dewatering event. Another 49 males were collected in previous years that were deemed recruitment within the reservoir or emigration from the upstream pond. In all, males composed 14.6% (59 out of 405 fish) of the 2012 sample, or a female:male ratio of 6.9:1.

Discussion

Fisheries managers have struggled with effective ways to reduce high densities of slow growing largemouth bass in small impoundments. In the past, the principle management strategy to address this issue was to encourage harvest, but high voluntary release rates of anglers and lack of harvest by anglers have largely eliminated this option (Myers et al. 2008, Willis and Neal 2012). Also, high release rates by anglers increases the likelihood of density-dependent reductions in largemouth bass growth (Aday and Graeb 2012, Wright and Kraft 2012). Labor-intensive, manual removal of stunted fish and protective slot limits have been recommended to increase growth and the number of quality and preferred-size largemouth bass (Parks and Seidensticker 1998, Schramm and Willis 2012).

Another method to avoid density-dependent population responses is to control reproduction. Stocking fish that are sterile or otherwise unable to spawn successfully has been used to create trophy fisheries of a variety of species, but this technique has rarely been attempted in ponds or small impoundments (Wright and Kraft 2012). Our study documented the successful creation of a trophy largemouth bass fishery at Ocmulgee PFA by stocking only females to reduce or eliminate recruitment in combination with stocking several supplemental forage species and instituting a catch-and-release regulation. This stocking strategy created a low-recruitment, fast-growing largemouth bass population that complimented the habits of anglers that ascribe to a voluntary release mentality.

Trophy largemouth bass management generally requires appropriate genetics, good habitat, high productivity, low mortality (especially fishing), low abundance of competing predators, high biomass of available prey, and reduced intraspecific competition for available resources (Crawford et al. 2002, Wilson and Dicenzo 2002, Myers and Allen 2005). As largemouth bass approach trophy size, the largest individuals compete for optimum size prey (Lawrence 1957, Timmons and Pawaputanon 1980, Eberts et al. 1998). Naturally produced forage may not reach optimum size for such large predators, so stocking additional large-sized forage may be warranted to increase existing prey for trophy largemouth bass (Eberts et al. 1998). At Ocmulgee PFA, our goal was to stock maximum-sized prey that could be utilized by memorable-sized (≥510 mm TL, Neumann et al. 2012) largemouth bass. Research indicated that juvenile and adult largemouth bass typically can eat prey up to 50 percent of their total length (Lawrence 1957, Johnson and Post 1996). Thus we stocked prey species that would provide a prey supply between 60–300 mm TL for trophy largemouth bass reaching about 635 mm TL. Furthermore, previous research found that there was an abundant population of small white crappie (*Pomoxis annularis)* in this impoundment (Bonvechio et al. 2014). Therefore, supplemental forage was provided at sizes and in numbers that would provide the most noticeable benefit in terms of increasing growth and biomass of trophy largemouth bass.

These management strategies resulted in extremely fast growth in this population. Allen et al. (2002) used mean total length (TL)-at-age across 32 largemouth bass populations in Florida and described fast growing females as those that reached 457 and 508 mm TL in 4.36 and 5.45 years, respectively, lower than the rates observed in this study. Additionally, the growth rates of female largemouth bass in mixed-gender populations in other Georgia small impoundments were less than those found in this study (Bonvechio et al. 2013). Fast growth rates along with low recruitment resulted in a population dominated by largemouth bass ≥457 mm TL within four years of the initial stocking, and this skewed size structure lasted up to eight years after initial stocking.

In Georgia, it required a tournament angler an average of 305 h to catch a bass 2.27 kg or larger (Quertermus 2013). Anglers were most successful at catching fish of this size in Lake Seminole, needing only 78 h to accomplish. In comparison, our angler survey on Ocmulgee PFA showed that anglers caught a 2.27-kg largemouth bass in 3.76 h. Also, most (92%) of the largemouth bass caught by anglers in spring 2012 were at least 2.27 kg. Nearly 58% of the 405 bass that were measured and weighed during the dewatering period exceeded 2.27 kg. Thus, size structure of this population was unusually large. By utilizing both angler and electrofishing, we captured a trophy (> 3.6 kg) largemouth bass for every 0.68 ha of reservoir and for (> 4.5 kg) largemouth bass, every 2.8 ha of reservoir. In comparison, Crawford et al. (2002) documented a trophy largemouth bass for every 10 ha in Lake Pasadena, Florida, recognized as a lake with high trophy production.

Failure to accurately sex fish before stocking can limit the effectiveness of this strategy. For instance, one male largemouth bass mistakenly identified and female and stocked into an all-female bass pond at Auburn University resulted in reproduction that tripled bass population density and reduced growth of the initial stock by 20% in one year (M. Maceina, Auburn University, personal communication). However, this was not the case at Ocmulgee PFA, where male largemouth bass were mistakenly stocked into the lake as early as 2009, but bass density remained low, with no reduction in growth or condition. Because we maintained high densities of numerous forage species through the study, predation on largemouth bass eggs or fry by these species may have been limiting factors in preventing or reducing bass recruitment (Regier 1963, Chew 1972, Barwick and Holcomb 1976. It appeared that gender identification errors made during screening processes at the hatchery were higher when fish were smaller (i.e., mean TL ~ 204 mm). Thus, to reduce errors fish should be raised to the largest size possible (> 250 mm TL) before gender determination is attempted.

Obtaining useful trophy largemouth bass data can be a challenge (Wilson and Dicenzo 2002, DeJesus et al 2009, Dutterer et al. 2014). Seasonal catch and length data from volunteer angler surveys has been a useful and cost-effective way to assess trophy largemouth bass populations. These data in our study were verified with the known population in the reservoir, thus allowing us to more accurately identify biases (Prentice et al. 1993). Angler data in our study was skewed towards larger fish in our study, possibly due to the trophy reputation of the lake causing anglers to target only the largest fish. While these data were still useful for age data, they did not appear to accurately depict size structure of the population even when combined with electrofishing data. Thus, caution should be used when using these data for age- or size-structure analyses. However, in systems where natural reproduction does not occur, angler data will likely be more similar to electrofishing data as observed in our study for fish ≥457 mm. In any case, we are confident our application of angler-supplied data was a valid technique that can be utilized in the future to collect certain kinds of information on larger fish. Our objectives in this study and for Ocmulgee PFA were specifically tailored towards creating and evaluating a female-only, trophy bass lake and both angler and electrofishing data appeared to be adequate in estimating the metrics of interest.

We believe that this strategy of a lake with female-only trophy bass lake caters to a larger subgroup of specialized and motivated anglers, and as a result of high angler satisfaction, angler recruitment and fishing license sales have the potential to increase on a unique system such as Ocmulgee PFA (Fedler and Ditton 1994, Beardmore et al. 2011). Although not immune to human error (i.e., misidentification of male fish), a program designed to stock only females appears to be a viable option to control density and maximum growth of piscivorous fish in smaller systems such as Ocmulgee PFA. Agencies interested in beginning a similar program should ensure a stable forage supply exists each year and that fish are protected by either high minimum-length or catch-and-release regulations. Finally, angler expectations should be properly defined for these systems, as densities and overall catch rates of the target species are usually low.

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