Largemouth Bass
IN SOUTH CAROLINA

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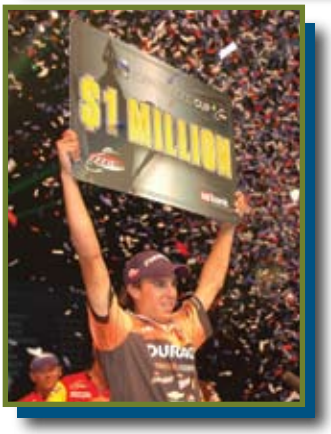
INTRODUCTION

The topwater plug sits quietly next to a stand of cypress trees. The angler gently twitches the rod and suddenly the water violently explodes, the plug disappears, and his heart rate accelerates. In an instant etched in time, the largemouth bass comes to the surface, shakes its mighty head and sends the plug back to the angler. Scenes like this are repeated every day, making largemouth bass the most popular inland sportfish in South Carolina and much of the United States. Besides their desire to catch fish, bass anglers are interested in learning about this species and finding ways to improve angling opportunities. As the steward for natural resources in South Carolina, the Department of Natural Resources (SCDNR) monitors the status and health of largemouth bass populations in South Carolina. The goal of this booklet is to deliver SCDNR's information on largemouth bass to the angling public. We hope to provide useful information that leads to improved fishing opportunities for largemouth bass.

The largemouth bass, whose scientific name is *Micropterus salmoides,* is one of the black basses, a group of sportfish that includes redeye, smallmouth, and spotted bass, all of which now occur in South Carolina - though only largemouth and redeye bass are native to South Carolina. The state record largemouth bass weighed 16 lbs. 2 oz. and was caught from Lake Marion in 1949. A fish caught from a pond in Aiken County in 1993 tied the record.

Figure 1. Largemouth bass, courtesy of Fritz Rohde, NC Division of Marine Fisheries

Because of its statewide abundance and excellent sporting qualities, largemouth bass is the most popular freshwater sportfish species in South Carolina. A 2006 survey showed that 247,968 black bass anglers spent 3.3 million days seeking bass, principally largemouth bass. In 2006, the total economic impact of black bass fishing in South Carolina was estimated at $215 million.



METHODS

SCDNR's Freshwater Fishery section started a standardized sampling protocol for largemouth bass in South Carolina reservoirs in 1997. Its purpose is to ensure consistency in data collections within and between years, so that results can be compared. This work enables staff to evaluate the condition and status of bass populations within reservoirs, track changes that may occur and recommend appropriate actions to enhance fishing prospects for anglers. The standardized sampling plan was adjusted in 2001 to make it more efficient and effective. For those interested in the details of our sampling plan, it may be found online at *http://www.dnr.sc.gov/fish/fwfi/files/2001_annual_report.doc.*

Sampling Design

The current protocol calls for sampling in the spring when the surface water temperature is between 59 and 68°F. That's when bass move into shallow near-shore areas to spawn. Sampling occurs during daytime, using boat-mounted electrofishing equipment operated by a three-person crew. The number of sites sampled depends on reservoir size and the number of fish needed to meet sampling objectives. Because all reservoirs can't be evaluated every year, the large reservoirs are sampled on an alternating basis.

Large reservoirs (more than 5000 acres) are divided into three or more zones of approximately equal area as shown in Figure 2. Small reservoirs are treated as a single zone. Shoreline sampling sites in each zone are randomly selected ahead of time. Each site is sampled for 30 minutes as the boat is driven parallel to the shoreline. To assure that the sampling is representative of the population,

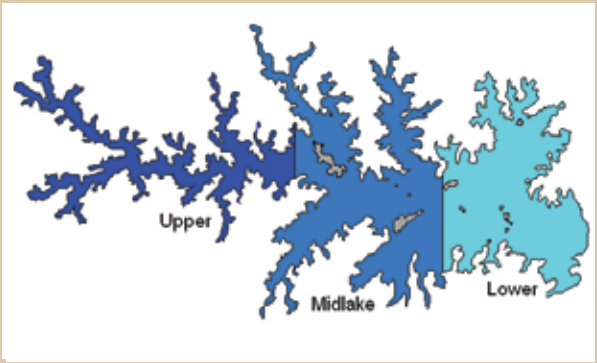


Figure 2. Lake Murray showing approximate boundaries between Upper, Midlake, and Lower zones

three primary sites and several additional secondary sites are chosen ahead of time within each zone. All largemouth bass are netted, measured and weighed but only those seven inches long or longer count toward the target numbers. When the sampling objective is to estimate the length, weight and catch rate of bass in the reservoir, target numbers are 30 fish per sample site and 90 per zone. If target numbers for a zone aren't met at the primary sites, secondary sites are added as needed. After fish are weighed, measured and examined for general condition, they are returned to the water alive.

Fourteen reservoirs, listed in Table 1, are discussed in this report. Results for lakes Marion and Moultrie are often combined and reported as Santee-Cooper because they are managed as a single unit. The location of these reservoirs is provided in the map below.

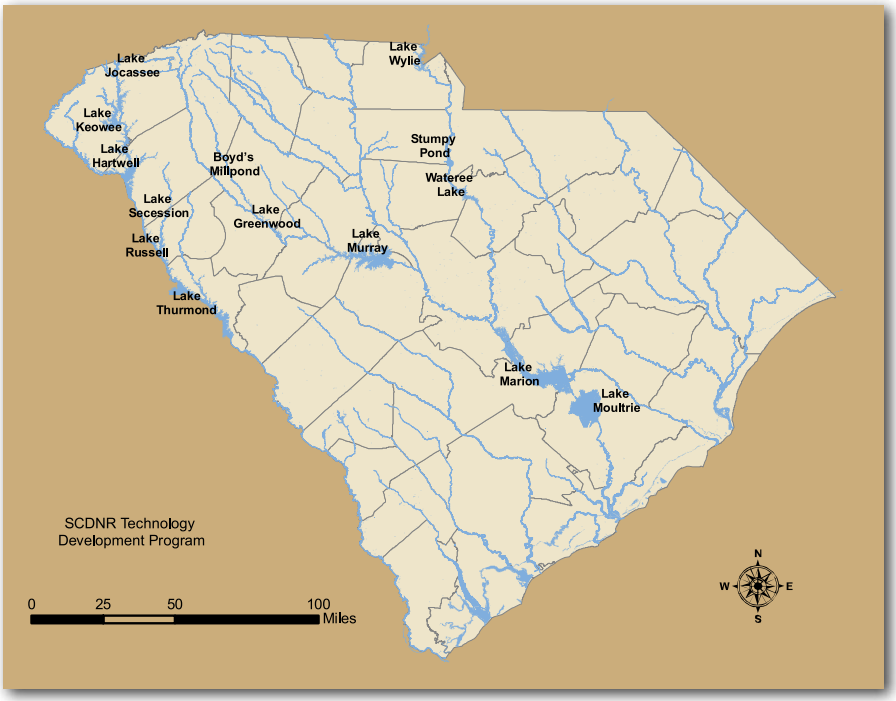


Table 1. Reservoirs sampled using Standardized Sampling Protocol for spring electrofishing. Surface acres included for size comparison. Number of samples and hours of electrofishing effort are totals for all years of sampling.

Reservoir	Years	Acres	Samples	Effort
Boyd's Mill Pond	1999-2002	183	15	7.4
Stumpy Pond	2003-2004	800	10	5.0
Lake Greenwood	1997-1998 2003-2005	11404	57	27.6
Lake Hartwell	2001-2003	56000	40	20.4
Lake Jocassee	2000-2001	7566	42	20.6
Lake Keowee	1999-2000	18372	40	23.5
Lake Marion	1997-2005	110600	96	46.9
Lake Moultrie	1997-2005	60400	94	45.2
Lake Murray	1998-2001	50800	63	30.8
Lake Russell	1998-2000	26650	27	13.5
Lake Secession	1997-1999	1425	18	8.2
Lake Thurmond	1997-1999	70000	33	16.1
Wateree Lake	1998-2001	13710	37	19.8
Lake Wylie	2002-2004	12455	34	17.1

Age Determination

Biologists need age information from individual fish to estimate growth and mortality rates, which give insight into the condition of the population. Biologists in South Carolina rely on otoliths to determine the age of largemouth bass. Otoliths are part of the inner ear of fish and play a role in balance and hearing. Estimating the fish's age from an otolith is very similar to counting the annual growth rings in a tree. In an otolith, a new layer of material is added to the outer surface each day. During periods of rapid growth (i.e. summer and fall), the individual layers are thicker and differ chemically from those formed during periods of slow growth (i.e. winter and spring). When viewed through a microscope, the accumulation of daily layers formed during rapid growth appears as a clear band. The accumulation of layers formed during slow growth appears as an opaque band. The transition from a clear band to an opaque band is called an annulus. Since an annulus forms each year, the age of a fish in years can be determined by counting the number of annuli on the otolith (Figure 3).

Figure 3. Cross section through a largemouth bass otolith showing annual growth rings.

RESULTS

Average Length at Age

The average total length of a bass at a certain age is a good index of the rate of growth. Populations with faster growth rates are generally thought of as doing "better" than populations with slower growth rates, or they may warrant different management strategies. Faster growth generally increases the management potential of the fishery by reducing the time it takes to produce a desirable fish. The average length at age can be used to compare growth within and between reservoirs. Table 2 shows average length at age of largemouth bass in 13 South Carolina reservoirs, through age-7. The reservoirs in the table are arranged in decreasing order of average length at age-3 (highlighted in yellow). During the period of this study Santee-Cooper bass grew the fastest to age three. Among the major reservoirs, Lake Russell bass were the slowest growing. At age-3 they were nearly two inches shorter than Santee-Cooper bass. On average, it takes three years to produce a 14-inch largemouth bass in South Carolina. The oldest fish aged during this period was a 15-year-old female from Lake Murray.

Table 2. Average total length at age (inches) of largemouth bass collected and aged during spring electrofishing in South Carolina reservoirs, 1997-2005. Fish <6.9 inches were assumed to be Age-1.

Reservoir	Years	Age						
		1	2	3	4	5	6	7
Santee-Cooper	1997-2005	7.5	12.6	15.4	16.9	17.8	18.7	18.9
Murray	1998-2001	7.2	11.9	14.6	16.1	17.2	17.2	17.3
Jocassee	2000-2001	6.1	10.7	14.3	15.9	17.3	16.9	19.1
Wylie	2002-2004	6.8	10.3	14.3	16.1	16.7	17.2	17.0
Wateree	1998-2001	7.4	11.2	14.2	15.7	16.9	17.8	18.2
Keowee	1999-2000	7.5	11.8	14.1	15.5	16.3	16.9	18.8
Thurmond	1997-1999	6.7	11.2	14.1	15.6	17.0	17.6	18.7
Greenwood	1997-1998 2003-2005	6.4	11.1	13.9	15.6	16.7	17.8	18.8
Hartwell	2001-2003	7.0	11.1	13.7	15.1	16.5	16.9	18.1
Russell	1998-2000	6.8	10.9	13.7	14.8	15.9	17.3	18.2
Secession	1997-1999	6.4	10.8	13.7	15.3	16.8	17.2	18.5
Stumpy Pond	2003-2004	5.9	10.6	13.5	15.8	16.5	17.7	19.1
Boyd's Mill	1999-2002	5.8	10.0	13.0	14.6	15.4	16.7	17.9
SC Average		6.7	11.1	14.0	15.6	16.7	17.4	18.4

SUMMARY: South Carolina reservoirs produce a range of growth rates. Among the reservoirs in this report, the fastest growing largemouth bass in South Carolina are found in the Santee-Cooper reservoirs. For the large reservoirs, lakes Russell and Hartwell have the slowest growing bass.

Length-Weight Relationship

There is a relationship between the length and weight of largemouth bass. Simply put, as bass grow longer they get heavier. But the relationship can differ between bodies of water. Experienced anglers know that some lakes or coves produce plumper fish than others. Relatively plump bass generally indicate a good food supply while relatively thin bass may indicate a limited food supply or some other problem that is affecting their well-being. A typical length-weight relationship is shown below.

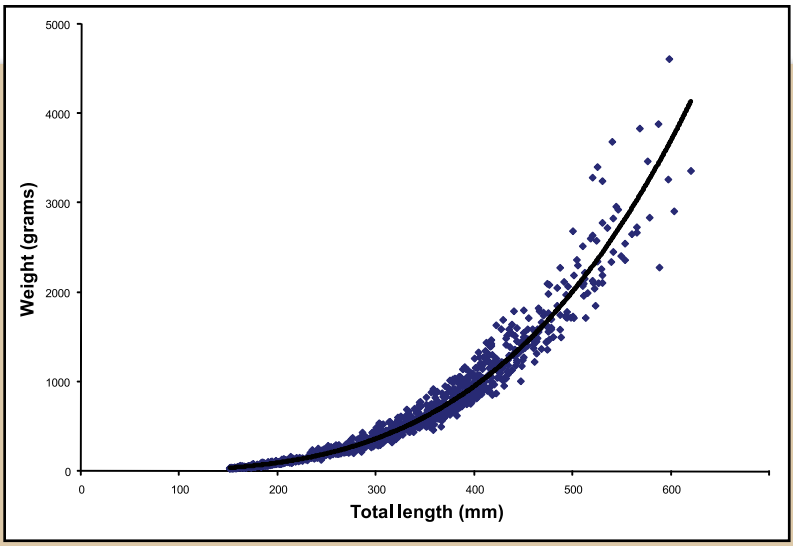


Figure 4. The relationship between length and weight for 1226 largemouth bass collected during the spring from Lake Greenwood during 1997-2005.

As some anglers would occasionally like to estimate weight based on a length measurement, we have put together a chart that compares the average weight at length for two distinct areas of the state and a table that calculates average weight at total lengths of 16 and 20 inches for 11 South Carolina reservoirs.

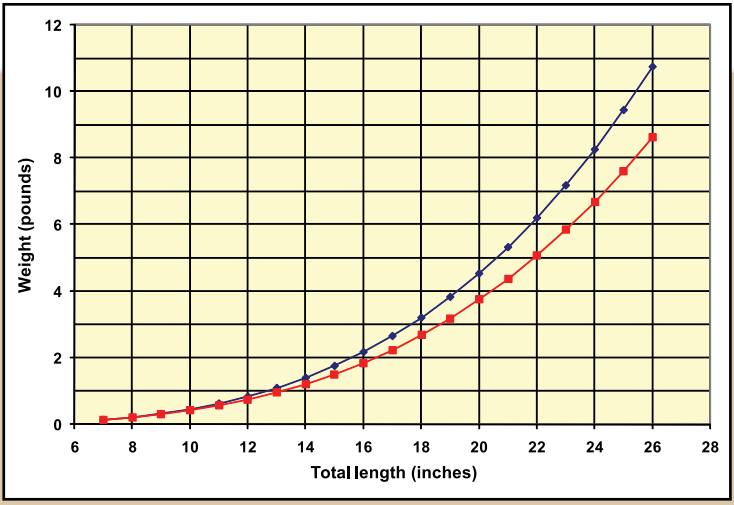


Figure 5. Average weight of spring-caught largemouth bass in four Santee piedmont lakes (Murray, Greenwood, Wateree and Wylie) in blue, and four Savannah piedmont lakes (Keowee, Hartwell, Russell and Thurmond) in red, based on data collected from 1997-2005.

This information demonstrates that, for a given length, the average weight of a largemouth bass varies within South Carolina reservoirs. For a given length, lakes Murray and Greenwood have the highest weights while lakes Thurmond and Russell have the lowest weights. In general, bass from reservoirs in the central piedmont (Murray, Greenwood, Wateree and

Table 3. Calculated weights of largemouth bass from 11 South Carolina reservoirs.

Reservoir	Number	Calculated weight (lbs.) at length	
		16 in.	20 in.
Murray	763	2.3	4.7
Greenwood	1226	2.3	4.8
Wateree	1611	2.2	4.6
Wylie	1117	2.1	4.4
Jocassee	438	2.1	4.4
Moultrie	2582	2.1	4.3
Marion	1766	2.0	4.2
Keowee	578	1.9	3.8
Hartwell	1049	1.8	3.8
Thurmond	1041	1.8	3.7
Russell	843	1.8	3.5

Wylie) are relatively plump while those from most Savannah River reservoirs (Keowee, Hartwell, Russell and Thurmond), are relatively thin. Bass from lakes Marion, Moultrie and Jocassee tend to be of average plumpness. Comparing the weight at length of an individual largemouth bass to a standard weight for that length provides a statewide index of its relative plumpness. The standard weight at length for South Carolina bass was defined in 1994 by SCDNR using the lengths and weights of 18,873 bass. A fish with a relative weight of 100 has an average weight for its length. Plump fish have relative weights above 100 while thin fish have relative weights below 100. Table 4 lists average relative weights for South Carolina's reservoirs.

Table 4. Average relative weight of spring-caught largemouth bass for 14 large South Carolina reservoirs. A relative weight of 100 indicates a fish of average weight for South Carolina.

Reservoir	Number sampled	Relative weight
Boyd Mill	324	131.6
Murray	763	114.6
Greenwood	1226	106.6
Wateree	1611	105.7
Wylie	1117	103.4
Marion	1766	101.5
Jocassee	438	100.8
Moultrie	2582	100.6
Russell	843	95.7
Monticello	169	95.5
Keowee	578	94.1
Thurmond	1041	93.6
Hartwell	1049	91.4

The comparison of relative weights among the large reservoirs shows that Murray, Greenwood and Wateree have the plumpest springtime bass in South Carolina, indicating a surplus of prey. Conversely, Hartwell, Thurmond and Keowee have the thinnest springtime bass, indicating less available forage during the spring in those reservoirs. In general, the more productive reservoirs have more food available than the less productive reservoirs. One would also expect slower growth in the less productive reservoirs.

SUMMARY: A relationship exists between the total length and weight of largemouth bass. For large reservoirs, those in the central piedmont (Murray, Greenwood, Wateree and Wylie) have relatively plump bass while most Savannah River reservoirs (Keowee, Hartwell, Russell and Thurmond) have relatively thin bass. Plump bass generally indicate a good food supply while thin bass indicate a somewhat limited food supply for the population.

Genetics Surveys

The largemouth bass was first described as a species from a specimen collected near Charleston, South Carolina, in 1802. More recently scientists have divided the species into two separate subspecies, the northern and the Florida bass. A 1983 genetic survey showed that pure Florida bass were

restricted to peninsular Florida while South Carolina was part of a large mixing zone, where populations possess some mix of characteristics from Florida and northern largemouth bass.

The Florida bass is of great interest to South Carolina anglers because of its reputation for fast growth and large individual fish. In the early 1990's, SCDNR conducted a survey to determine the extent of the genetic influence of the Florida bass in South Carolina. It was found that Florida bass characteristics dominated most populations. However, the proportion of Florida bass characteristics decreases as one moves upstream from the relatively mild coastal plain to the piedmont. For example, lakes Marion and Moultrie in the coastal plain were nearly 100 percent Florida bass. In contrast, the Lake Wateree population in the piedmont was less than 50 percent Florida bass.

Freshwater fishery biologists have compared Lake Moultrie bass with Lake Wateree bass. These two stocks were placed together in Lake Paul Wallace, a 300-acre reservoir near Bennettsville. Results showed that the Lake Wateree stock grew faster to age 1, but by age 4, the Lake Moultrie bass were larger and plumper. From the perspective of size, the more Florida-like coastal plain stock performed best in this coastal plain reservoir. This is consistent with results from other studies that have compared the two pure subspecies. Currently, the SCDNR has adopted a supplemental stocking approach that promotes the stocking of fish native to the area. Further evaluations across regions are warranted in the future to better define performance differences between local stocks of largemouth bass and appropriate stocking zones for each.

SUMMARY: Florida bass genetic characteristics are most prominent in the coastal plain and, in general, those characteristics decrease in the piedmont region of South Carolina. A performance comparison in a coastal plain reservoir showed that bass from Lake Moultrie parents grew faster and to a larger size than bass from Lake Wateree. Repeating studies in other areas of the state will tell us more about performance differences among South Carolina stocks.

Abundance

Catch rate is routinely used by fishery managers to provide an index of population density or to measure potential fishing success. Catch rate is simply the number of fish captured, divided by some unit of effort. For example, if two ponds were sampled for 30 minutes each and 30 bass were captured in pond A and 15 bass were captured in pond B, then pond A has a higher catch rate (1.0 bass per minute vs. 0.5 bass per minute) and one may infer it has a higher density of bass. We used the catch rate of age-2 largemouth bass as an indicator of reproductive success. In South Carolina, an age-2 largemouth bass averages about 11 inches so the abundance of that age class is indicative of the relative strength of new fish entering the fishery in a given year. The

abundance of age-3 and older largemouth bass was used as a measure of the density of the "fishable" population, those fish were greater than 12 inches.

Surprisingly little variation was found in the catch of age-2 fish within a reservoir among years (Figure 6). Some reservoirs were more variable (e.g., Russell) or more stable (e.g., Greenwood) than others, but overall, abundance of age-2 largemouth bass in these South Carolina reservoirs was relatively stable among years. Not all reservoirs experienced higher levels of reproductive success in the same years. For example lakes Russell, Wateree

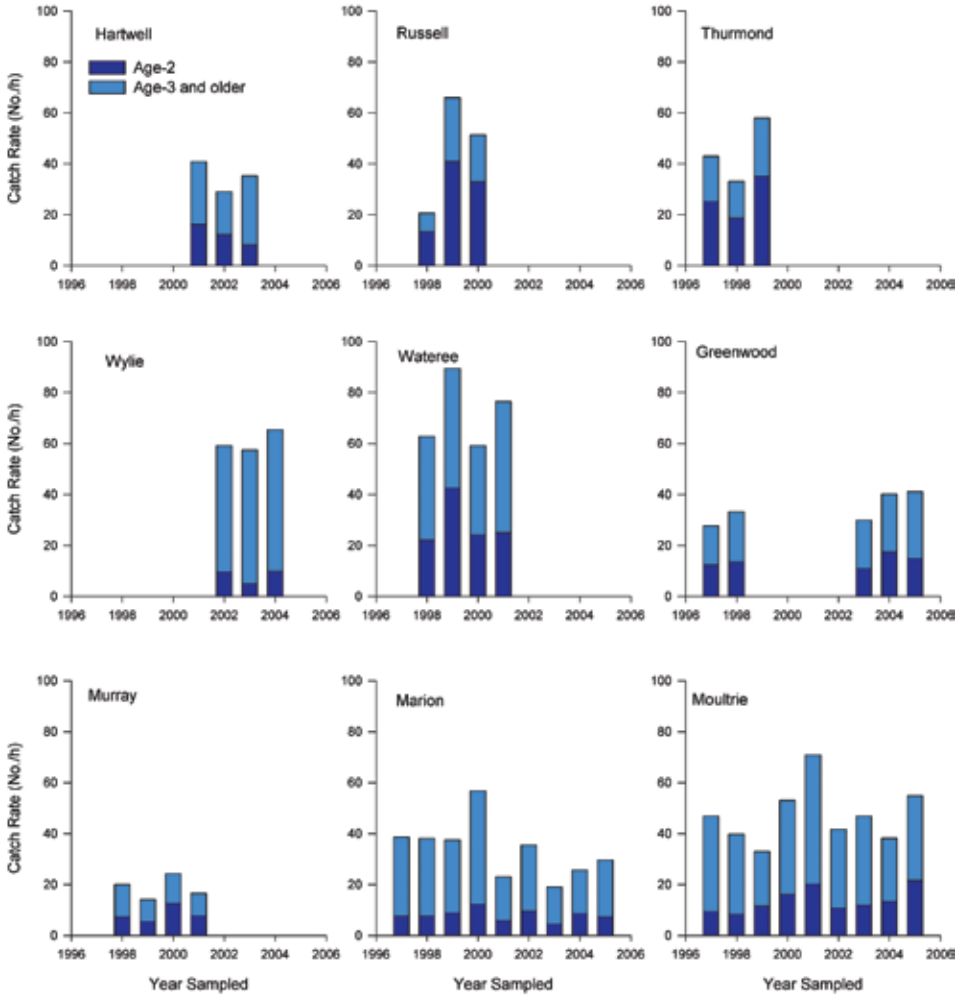


Figure 6. Annual catch rate (No./h) of age-2 largemouth bass (dark blue bars) and age-3 and older largemouth bass (light blue bars) collected from selected South Carolina Reservoirs, 1997 – 2005.

and Thurmond achieved their highest catch rates of age-2 bass during 1999, indicating that 1997 was a good year for reproduction in those reservoirs. Other reservoirs had only average (Marion and Moultrie) or below average (Murray) catch rates of age-2 bass during that year.

As for age-2 fish, there was not much variation among years in the abundance of bass that were age-3 and greater within each of the studied reservoirs. However a wide range of catch rates of age-3 and older bass was found among reservoirs, seeming to indicate a wide range in the density of fishable bass among reservoirs. For example, the catch rate data indicate that there were more than five times as many fishable bass in Lake Wylie when compared to Lake Murray. However, when comparing catch rates among reservoirs, one must assume that the probability of capture is the same within the reservoirs being compared. Thus, it is possible that differences between reservoirs are due to relatively poor sampling efficiencies in some reservoirs compared to others. SCDNR needs to evaluate this in the near future, as anglers are interested in comparing abundance of bass among the state's reservoirs.

SUMMARY: Within a reservoir, relatively minimal variation occurred in abundance of age-2 and age-3 and older bass. Comparisons among reservoirs indicated a wide range in the density of fishable bass among reservoirs. This may be due to differing sampling efficiencies among reservoirs; further evaluation is needed.

Structural Indices

Two of the most common ways to describe the size structure of bass in a reservoir are proportional stock density (PSD) and relative stock density (RSD). PSD is the percentage of fish in a sample that are 12 inches or greater in length; only bass 8 inches or longer are considered. High PSD values correspond to a population that consists mainly of larger individuals while lower PSD values indicate a population that mostly consists of smaller individuals. RSD is the percentage of fish greater or equal to any specified length. For example, RSD-15 and RSD-20 are the percentage of bass that are greater than 15 and 20 inches in length, respectively.

Desirable values for PSD and RSD indices vary with management objectives. A "balanced" population generally has PSD values of 40-70 and RSD-15 values of 10-40. Those index values reflect a population that has reasonable proportions of small and large fish. Many anglers prefer to catch fewer but larger fish and in these instances managers may attempt to move the largemouth bass population toward a management objective termed "big bass." The "big bass" management objective occurs when a greater proportion of the largemouth bass population is comprised of larger fish, with PSD and RSD-15 index values ranging from 50-80 and 30-60, respectively.

In twelve large South Carolina reservoirs mean PSD and RSD-15 values

ranged from 42 to 87 and 9 to 61, respectively. The attached table provides an idea of which populations contained the largest proportion of small and large fish. For example, Lake Russell had the smallest proportion of bass over 12-inches (PSD = 42) and the smallest proportion greater than 15-inches (RSD-15 = 9), with no fish over 20-inches, while Lake Marion had a large proportion of bass greater than 12-inches (PSD = 85) and the largest proportion of bass greater than 15-inches (RSD-15 = 61) and 20-inches (RSD-20 = 12). Based on PSD and RSD index ranges, eight of the 12 reservoirs would be considered "big bass" reservoirs (PSD = 50-80, RSD-15 = 30-60), while the other listed reservoirs more closely resemble a "balanced" population.

Table 5. Mean stock indices of selected large South Carolina reservoirs, with years sampled. Minimum stock, quality, preferred (P), and memorable (M) bass were defined as 8, 12, 15, and 20 inches, respectively. Reservoirs in dark blue indicate "big bass" populations while those in light blue indicate "balanced" populations.

Reservoir	Years Sampled	PSD	RSD-15	RSD-20
Marion	1997-2005	85	61	12
Moultrie	1997-2005	79	54	12
Monticello	1997	82	53	5
Wylie	2002-2004	87	39	12
Jocassee	2000-2001	64	36	6
Murray	1998-2001 1997-1998	63	36	4
Wateree	1998-2001	70	32	2
Greenwood	2003-2005	63	30	5
Hartwell	2000-2003	70	26	2
Keowee	1999-2000	66	22	2
Thurmond	1997-1999	51	17	1
Russell	1998-2000	42	9	0
Statewide Average		71	39	6

SUMMARY: The Santee-Cooper lakes have the highest percentage of bass greater than 12, 16, and 20 inches while lakes Russell and Thurmond have the lowest percentage. Eight of 12 reservoirs had characteristics of a "big-bass" reservoir.

Mortality

Mortality has two components: natural and fishing. Natural mortality, as the name implies, is death resulting from natural causes. Disease, predation and old age are three examples of natural mortality. Fishing mortality is death resulting from fishing activity. It may be intentional, as when an angler takes the day's catch home for dinner. Or, it may be unintentional, as when an angler releases a fish and the fish later dies due to the stress of capture. Taken together, natural mortality and fishing mortality add up to the total mortality a fish population experiences.

Biologists estimate total mortality by examining the decline in numbers of fish in a population between successive age groups. Figure 7 is an idealized catch curve based on an annual mortality rate of 30%. Each age group has 30% fewer fish than the previous one. At 30% annual mortality rate few fish survive to age 13 or 14. In the real world, the numbers are messier and the curve is not as smooth. However, Figure 8, which shows the catch curve for largemouth bass in the Santee-Cooper system, makes evident the decline in numbers with age. Because our best data were those between age 2 and age 5, we used that portion of the curve to estimate the total mortality rate. For Santee-Cooper, total annual mortality was estimated to be approximately 29%. Estimates of total annual mortality rates for selected reservoirs in South Carolina are shown in Table 6. As the table shows a rather large range of mortality rates occurs in South Carolina reservoirs. Annual mortality in Lake Russell was

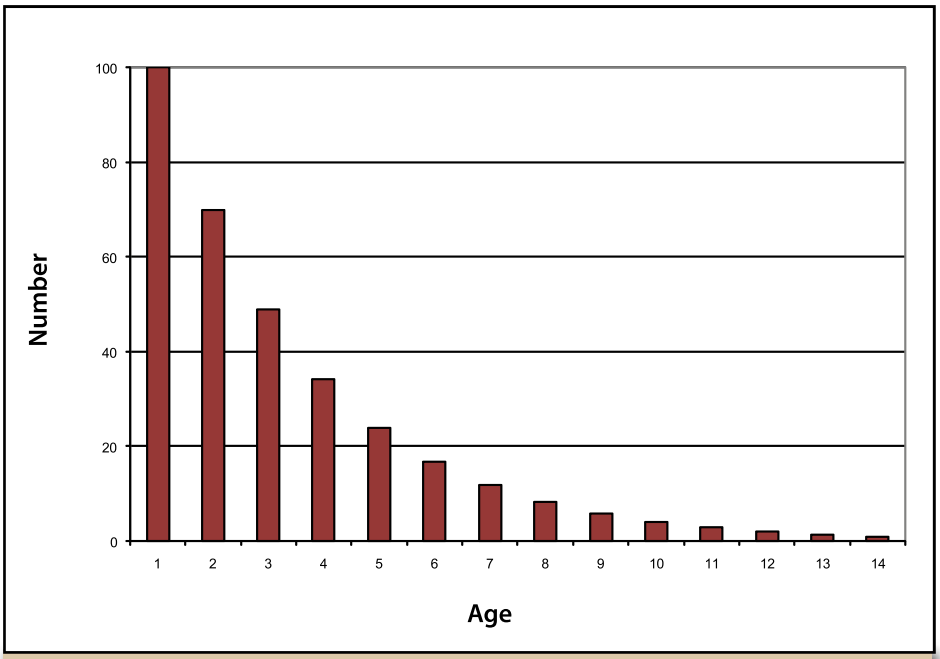


Figure 7. Hypothetical catch curve showing 30% total annual mortality.

approximately twice as high as Santee-Cooper. A relatively high rate of mortality can limit the size of bass in a population by removing them before they attain a large size.

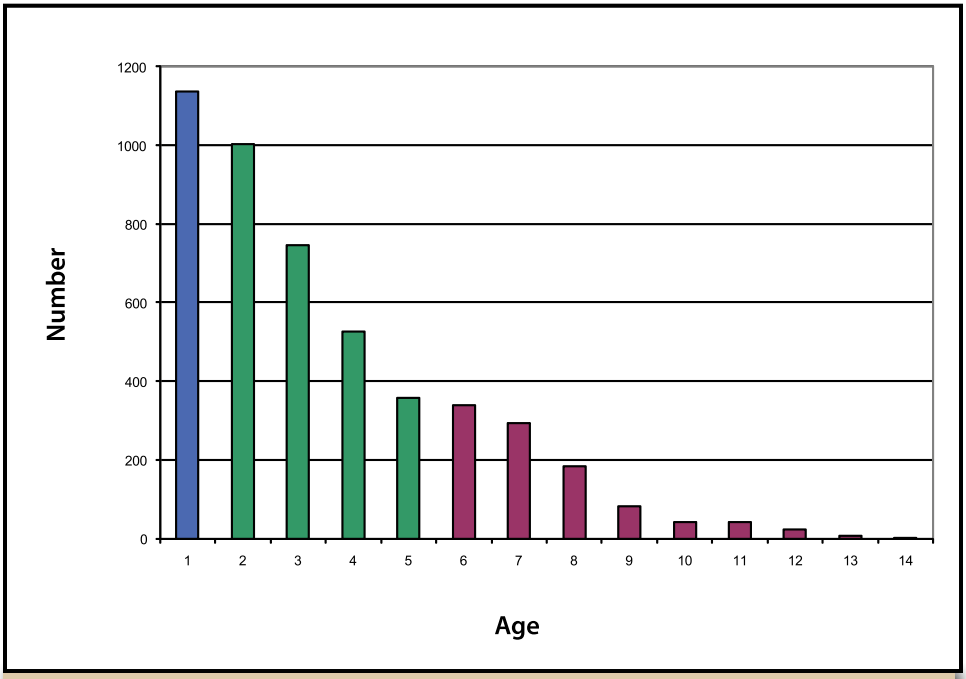


Figure 8. Catch by age for largemouth bass in the Santee-Cooper reservoirs, 1997-2005.

Table 6. Estimated total annual mortality A (%) of largemouth bass in 13 South Carolina reservoirs.

Reservoir	Age-classes	Years of data	A
Stumpy Pond	3-6	2003-2004	22.7
Santee-Cooper	2-5	1997-2005	29.1
Hartwell	2-5	2001-2003	36.7
Secession	2-5	1997-1999	37.0
Boyd's Mill	2-5	1999-2002	37.9
Greenwood	2-5	1997-1998, 2003-2005	39.7
Wylie	3-6	2002-2004	40.4
Murray	2-5	1998-2001	41.6
Wateree	2-5	1998-2001	47.2
Keowee	2-5	1999-2000	47.9
Jocassee	2-5	2000-2001	47.9
Thurmond	2-5	1997-1999	53.0
Russell	2-5	1998-2000	60.3

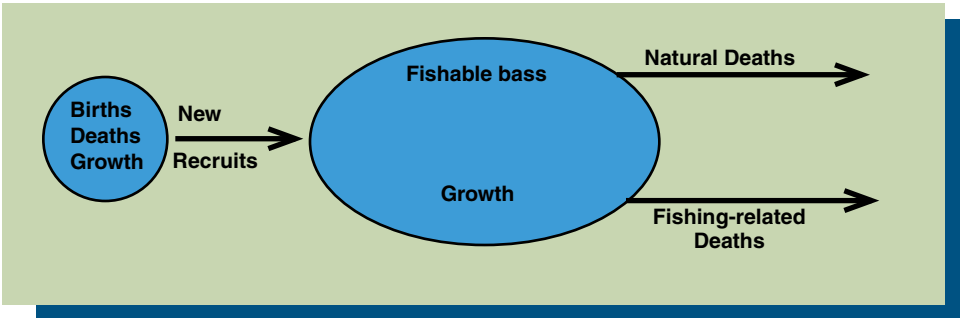
Population Dynamics

Overview

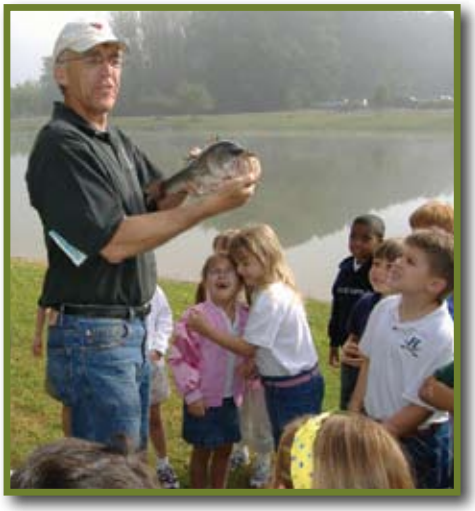
The characteristics of a bass fishery are controlled by the balance between reproduction, growth and mortality within a body of water. This relationship is depicted in the following figure and explained in the paragraphs that follow.

A recruit is a fish that has attained a size desirable to anglers. The number of bass that become recruits is dependent on the balance between birth and mortality rates. The length of time it takes for a newly born fish to become a recruit is determined by its rate of growth. The number of recruits that enter the fishery will vary from year to year.

Rate of growth determines a bass' size at any point in time. For example, it may take a bass two years to reach 12 inches in length and two more years to reach 16 inches. Thus, the length of time a bass survives within a population determines its size at death, when it is removed from the fishery by either an angler or natural causes. The number of fish that remain within a fishery at a point in time is determined by the rate of mortality.



Biologists use population models to evaluate the relationships between recruitment, mortality and growth in a bass population. With good estimates of these factors, biologists can estimate how a particular population is performing. Also, models provide an opportunity to predict how a proposed regulation change might affect a fishery.



Currently, the statewide regulation for largemouth bass allows a harvest of 10 fish a day with no minimum size limit. Exceptions to this are lakes Wylie, Marion, Moultrie and the

Georgia waters of the Savannah River and its reservoirs, which have a 12-inch minimum. Since anglers rarely keep bass less than 12 inches in length, we chose to evaluate the effects of 12-, 14-, 16- and 18-inch minimum length limits on some South Carolina bass fisheries. We assumed that the rate of mortality would not change due to the regulations. Then SCDNR Freshwater Fisheries Biologists used the model to predict fisherman harvest in numbers and weight and the average weight at harvest of an individual bass that would occur under each minimum length limit. SCDNR estimated the rate of natural mortality for largemouth bass in South Carolina to be 25% per year by assuming a maximum possible age of bass of 15.

SCDNR evaluated seven major South Carolina reservoirs – Jocassee, Hartwell, Thurmond, Greenwood, Murray, Wateree and Santee-Cooper. These reservoirs were chosen because they had the best available biological data and they represented the range of reservoir characteristics observed in South Carolina.

All reservoirs harvested maximum numbers of bass with a 12-inch minimum size limit (Figure 9). This was expected because, at higher minimum lengths, an increasing percentage of the population would be lost to natural mortality.

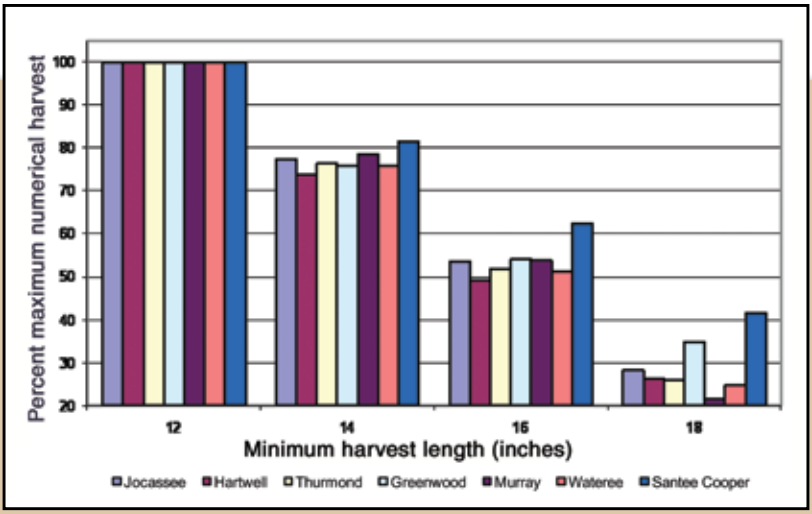


Figure 9. Percent of maximum numerical harvest for four possible minimum length limits.

The average weight of a harvested bass was maximized by an 18-inch limit (Figure 10). In fact, the average weight at harvest among the seven reservoirs was 1.9, 2.4, 2.9 and 3.6 pounds at 12-, 14-, 16- and 18-inch minimum length limits, respectively. This increase was also expected as the longer one waits to harvest a bass, the heavier it will get.

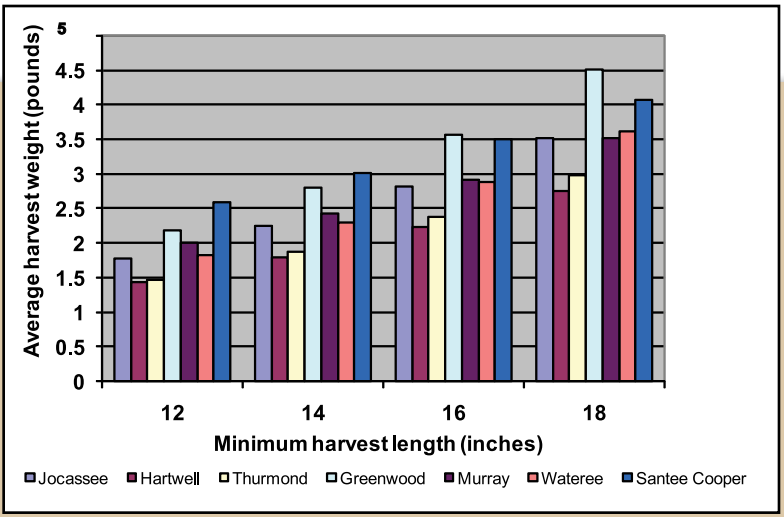


Figure 10. Average harvest weight for four possible minimum length limits.

Estimating the total harvest weight, also called the "yield," of a fishery is a method that combines the numbers harvested and the average size at harvest. Under the right conditions (i.e. relatively low natural mortality, fast growth) it is possible to have a higher yield in total weight at a minimum length limit that delays harvest.

For the seven reservoirs we considered, harvest weight was maximized with a 12-inch minimum size limit. However, approximately 96% of the maximum harvest weight was obtained with a 14-inch size limit and 82% was obtained with a 16-inch size limit (Figure 11). In other words, on a statewide average basis:

- A 12-inch minimum size limit maximized numbers and total weight harvested with an average individual bass weight of 1.9 lbs.
- Compared to a 12-inch minimum length limit, a 14-inch minimum size limit would produce 77% of the numerical harvest and 96% of the total weight harvested, with an average individual weight of 2.4 pounds.
- Compared to a 12-inch minimum length limit, a 16-inch minimum size limit would produce 54% of the numerical harvest and 82% of the total weight harvested, with an average individual weight of 2.9 pounds.
- Compared to a 12-inch minimum length limit, an 18-inch minimum size limit would produce 29% of the numerical harvest and 55% of the total weight harvested, with an average individual weight of 3.6 pounds.

These results suggest that it's reasonable to consider a statewide 12-inch minimum size limit for South Carolina's major reservoirs. They also suggest that a 14-inch minimum size limit is worthy of consideration if anglers are

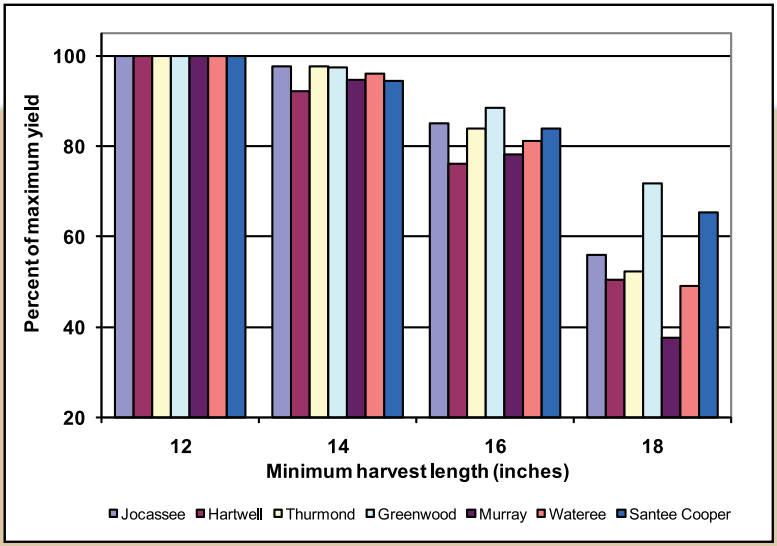


Figure 11. Percent of maximum possible harvest, in weight, of four possible minimum length limits.

willing to accept a slight decrease in total yield and numerical harvest in order to have a greater opportunity of catching a larger fish. Perhaps more importantly, they show what choices exist for reservoir-specific regulations. For example, Lake Greenwood and the Santee-Cooper lakes appear to have the greatest potential among the reservoirs for larger fish. The approach can be directed at each individual reservoir to more fully assess the pros and cons of a variety of possible regulation changes.

SUMMARY: Population models were used to evaluate 12-, 14-, 16- and 18-inch minimum size limit regulations for seven large reservoirs in South Carolina. Results suggested that a 12-inch minimum size limit is reasonable as it maximizes numbers harvested and total harvest weight. Results also suggest that a 14-inch minimum size limit could be considered for South Carolina's major reservoirs, if anglers are willing to accept a slight decrease in total harvest weight and numerical harvest and in order to have a greater opportunity to catch a larger fish. Sufficient biological information is now available to assess changing current management strategies and regulations on SC reservoirs in order to optimize the biological production and social allocation of the bass resource.

We hope this booklet has provided you with some insights into the biology and management of largemouth bass in South Carolina. Anglers should remember that fishing regulations in South Carolina are drafted by the SCDNR based on biological data and community input, but must be approved by the State Legislature. As the state's steward for natural resources, SCDNR continually updates its biological information. The angling public may obtain up- to-date information by contacting the Regional Fishery Biologist for that area of the state where a particular body of water is found; a contact list for these biologists is provided on the next page. In addition, SCDNR biologists are always interested in hearing about the experiences or concerns of local anglers, as this helps them stay better informed of the current status of the largemouth bass resource. We stress the importance of interested citizens, angler groups and conservation groups partnering with SCDNR and the legislature to consider particular situations and, where needed, develop regulations that are biologically sound and will improve largemouth bass angling in South Carolina.

Regional Fishery Biologists:

Region 1:
311 Natural Resources Drive
Clemson, SC 29631
864-654-6346 ex. 12

Region II
2007 Pisgah Road
Florence, SC 29501
843-661-4767

Region III
2726 Fish Hatchery Road
West Columbia, SC 29172
803-955-0462

Region IV
305 Black Oak Road
Bonneau, SC 29431
843-825-3387

Conclusions:

1 Largemouth bass experience a range of growth rates in South Carolina reservoirs. Among the reservoirs discussed in this report, the fastest growing largemouth bass in South Carolina are found in the Santee-Cooper reservoirs. For the large reservoirs, lakes Russell and Hartwell have the slowest growing bass.

2. For large reservoirs, those in the central piedmont (Murray, Greenwood, Wateree and Wylie) have relatively plump bass while most Savannah River reservoirs (Keowee, Hartwell, Russell and Thurmond) have relatively thin bass. Plump bass generally indicate a good food supply while thin bass indicate a somewhat limited food supply for the population.

3. Florida bass genetic characteristics are most prominent in the coastal plain and, in general, those characteristics decrease in the piedmont region of South Carolina. A performance comparison in a coastal plain reservoir showed that bass from Lake Moultrie parents grew faster and to a larger size than bass from Lake Wateree. Repeat studies in other areas of the state will tell us more about performance differences among South Carolina stocks.

4. Within a particular reservoir, relatively minimal variation in abundance of 'young' and 'fishable' bass occurs from year to year. Comparisons among reservoirs indicate a wide range in the density of fishable bass. This may be due to differing sampling efficiencies among reservoirs; further evaluation is needed.
5. The Santee-Cooper lakes have the highest percentage of bass greater than 12, 16, and 20 inches while lakes Russell and Thurmond have the lowest percentage.
6. We used population models to evaluate 12-, 14-, 16- and 18-inch minimum size limit regulations for seven large reservoirs in South Carolina. Results suggested that a 12-inch minimum size limit is reasonable as it maximizes numbers harvested and total harvest weight. Results also suggest that a 14-inch minimum size limit could be considered for South Carolina's major reservoirs, if anglers are willing to accept a slight decrease in total weight and numerical harvest and in order to have a greater opportunity to catch a larger fish.
7. Sufficient biological information is now available to assess changing current management strategies and regulations on South Carolina reservoirs in order to optimize the biological production and social allocation of the bass resource.

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