Age and Growth of Trophy Largemouth Bass in Florida

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Abstract: Otoliths from 822 trophy (≥4.5 kg) largemouth bass (*Micropterus salmoides*) caught by anglers in Florida were obtained from taxidermists during 1987–1993. The fish were harvested from 211 different water bodies. Longevity and mean growth exceeded those reported previously in Florida. Mean age of trophy largemouth bass statewide was 9.7 years and ranged from 4.0 to 16.5 years. Mean growth averaged 0.54 kg/year with a range of 0.28–1.27 kg/year. Growth rate of trophy largemouth bass increased from north to south Florida. Accelerated growth, longevity and strong year classes were important for trophy largemouth bass production in Florida. Fifty-six percent of the trophy fish were harvested by anglers during January–March. Peak months for trophy harvest were progressively later in the year from south to north Florida and coincided with the largemouth bass spawning season.

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Florida has a national reputation for producing trophy-size largemouth bass. This has been attributed to a long growing season and physiological characteristics of the Florida largemouth bass (*M. s. floridanus*) (Chew 1975).

During the 1980s anglers began to complain about trophy largemouth bass catch rates. Chapman and Fish (1983) reported an apparent decline in the weights of trophy-size largemouth bass occurring in Florida from 1975 to 1982, based on data from fishing tournaments, a trend that continued until 1992 (Watson and Johnson 1993). Florida fisheries biologists also observed reduced trophy catch rates while electrofishing during this period (Fla. Game and Fresh Water Fish Comm., unpubl. data). A continuing decline in the trophy largemouth bass fishery would have tremendous impact on Florida anglers and associated industries. Effective management plans to reverse this decline would require understanding population dynamics of these trophy fish.

Porak et al. (1986) reported that the time required for largemouth bass to reach 3.6 kg ranged from 6 to 12 years. Only 3 largemouth bass >4.5 kg were aged during their study because biologists avoided sacrificing trophy-size fish. Due to the paucity of available data for trophy-size largemouth bass, little was known of their age structure, growth rates, distribution or seasonal harvest in Florida. This information would be critical for proper management.

Therefore, objectives of this study were to determine age distribution and growth rates of trophy (≥4.5 kg) largemouth bass in Florida and to determine seasonal distribution of harvest of these fish. This information could be utilized to more effectively manage trophy largemouth bass in Florida and other southeastern states where Florida largemouth bass have been introduced.

We are grateful to all taxidermists who participated in this program, without whom this study would not have been possible. L. Connor and W. Shaeffer are especially appreciated for help with data compilation and analysis. We appreciate J. Chadwick and S. Townsend for manuscript preparation. This study was partially funded by Federal Aid in Sport Fish Restoration, Project F-24 of the Florida Game and Fresh Water Fish Commission.

Methods

A program for collecting otoliths of trophy largemouth bass (≥4.5 kg) was established with 50 taxidermists throughout Florida and 1 in south Georgia, 1987–1993. Each taxidermist was asked to obtain information from anglers on the date, water body, and county in which the trophy fish was captured. Taxidermists were also requested to personally measure total length (to the nearest 1/4 inch) and weight (to the nearest 1/4 pound) and remove otoliths from each trophy largemouth bass. All weights were converted to kilograms (kg). Otoliths were stored in coin envelopes. Scales and measuring sticks were provided to participants as necessary. Because some taxidermists did not measure length consistently, we only utilized fish weights to analyze size and growth.

Taxidermists were not asked to determine the sex of fish. Porak et al. (1986) and Schramm and Smith (1987) found differential growth between sexes of largemouth bass in Florida. Males grew slower than females and never attained trophy size.

Otoliths were sectioned and mounted as described by Porak et al. (1986). All otoliths were aged by 2 independent readers, and data for fish whose ages were not agreed on were excluded from age and growth analyses, but were used to examine seasonal harvest.

Trophy largemouth bass harvested January–June were assigned an age 1 year greater than the number of annuli on their otoliths. Newly formed annuli were observed as late as August, which is later than reported for smaller largemouth bass by

Crawford et al. (1989). Fish harvested by anglers July–December were assigned an age of an additional 0.5 year to reduce the effect of collecting samples throughout the year.

Mean growth for each trophy largemouth bass was determined by dividing its weight by its age (kg/year). These values were calculated for comparison only and do not imply linear growth.

Monthly harvest of trophy largemouth bass was determined January 1988–December 1990 only. An incomplete collection year occurred in 1987, as the study began in September 1987. We contacted taxidermists quarterly until 1991 and in 1991–1993 contacts were reduced to 1 or 2 times each year. As a result of reduced contact with taxidermists, data was not consistently collected by them throughout 1991–1993.

The state was divided into 3 regions for analysis of seasonal harvest of trophy largemouth bass (Fig. 1). The South region was below latitude 27° 39′ 13″. The Central region was between latitudes 27° 39′ 13″ and 29° 25′ 04″, south of Orange Lake but including most of the lakes in Ocala National Forest. The North region was north of latitude 39° 25′ 04″ to the state boundary.

Latitudinal effects on mean age and weight of trophy largemouth bass were tested by determining the latitude of each lake identified during this study. Age was regressed against weight and latitude, while weight was regressed against age and latitude. Significance was assumed at $P < 0.05$.

Results and Discussion

Contributing taxidermists provided otoliths from 822 trophy largemouth bass from 211 different water bodies ranging from 0.4-ha ponds to 181,299-ha Lake Okeechobee. Five or more trophy largemouth bass were collected from 28 different water bodies. A total of 807 samples were used for age and growth analyses since an age could not be determined for 15 fish.

Trophy largemouth bass averaged 9.7 years of age and ranged from 4.0 to 16.5 years (Table 1). Longevity of largemouth bass in this study was greater than reported by Porak et al. (1986) who collected female largemouth bass to age 12. Two of the oldest largemouth bass, which were 16.0 and 16.5 years old, were caught in Washing-

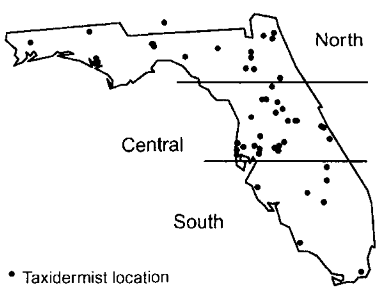

Figure 1. Regional boundaries and location of taxidermists during study of trophy largemouth bass in Florida, 1987–1993.

Table 1. Distribution, mean age (years) and range in age (years) of weight groups (kg) of trophy largemouth bass from Florida (collected from taxidermists), 1987–1993. SE in parentheses.

Weight group	*N*	%	Mean age	Range in age
4.5–4.9	445	55	9.5 (0.1)	4.0–16.5
5.0–5.4	222	28	9.9 (0.1)	4.0–14.0
5.4–5.8	91	11	10.1 (0.2)	5.0–16.0
5.9–6.3	32	4	10.0 (0.3)	7.0–14.0
6.4–6.7	10	1	9.9 (0.7)	7.0–14.0
≥6.8	7	1	11.0 (0.8)	9.0–14.0
Total	807	100	9.7 (0.1)	4.0–16.5

ton County in northwest Florida. An area including Marion, Putnam, and Clay counties in north central Florida, characterized by infertile systems (Canfield 1981), also yielded 7 fish ≥ age 14.

Longevity was obviously a critical factor in trophy largemouth bass production. However, a grand mean of age frequencies from 16 largemouth bass populations sampled by electrofishing in Florida indicated that only 0.3% of the fish were females ≥ age 9 (Coleman et al. 1984, Porak et al. 1986). These researchers also found that total annual mortality averaged 0.47 for these populations. Obviously, few largemouth bass survive long enough to attain trophy size.

On the other hand, accelerated growth was also important for producing trophy largemouth bass. Range in age of each weight group overlapped, indicating variability in growth rates of trophy largemouth bass. Growth rates of trophy largemouth bass ranged from 0.28 to 1.27 kg/year and averaged 0.54 kg/year. Sixteen fish (2.0%) exhibited growth rates >0.91 kg/year. Mean weights of trophy largemouth bass at each age sampled in this study were much greater than those of 268 females sampled from 22 Florida populations during previous studies (Coleman et al. 1984, Porak et al. 1987). Trophy fish < age 9 exhibited extremely fast growth, as upper ranges of weights of female largemouth bass sampled in previous studies did not exceed 4.5 kg until age 9 (Fig. 2). Obviously, our samples are truncated below 4.5 kg and a higher mean weight would be expected, but that does not negate that growth rates of largemouth bass harvested as trophies during this study were faster than those of most other female largemouth bass.

Mean age of trophy largemouth bass increased significantly as latitude increased (Table 2). However, variability was high and resulted in $r^2 < 0.1$. Results in the southern latitudes were heavily influenced by the number of fast-growing largemouth bass sampled from Lake Okeechobee ($N = 100$). Mean weight also increased with latitude because age increased. Simply, older fish tended to be heavier. Growth rates decreased with latitude, as would be expected, since growth, as defined, is a function of age and trophy fish tended to be younger in lower latitudes.

The trend between mean age and latitude is probably a result of changes in water

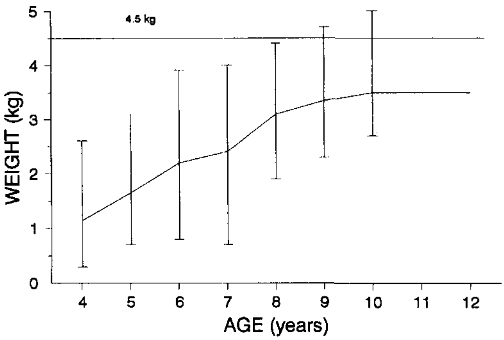

Figure 2. Mean weight at age of female largemouth bass (*N* = 268) collected by electrofishing from 22 Florida populations previously studied (Coleman et al. 1984, Porak et al. 1987). Vertical bars represent range in weight for each age group.

Table 2. Mean age (years) by weight group of trophy largemouth bass (≥4.5 kg) from 3 regions in Florida (*N* = 807). Mean growth (kg/year) for each region is included. Regions described in Figure 1.

Weight group (kg)	South *N*	South Mean age	South SE	Central *N*	Central Mean age	Central SE	North *N*	North Mean age	North SE
4.5–4.9	101	8.6	0.2	225	9.3	0.1	119	10.5	0.2
5.0–5.4	34	9.0	0.3	128	9.8	0.1	60	10.7	0.3
5.4–5.8	7	9.6	0.4	48	9.6	0.2	36	11.0	0.7
5.9–6.3	3	8.7	0.9	21	9.8	0.4	8	10.9	1.2
6.4–6.7				3	9.7	1.2	7	10.0	1.3
≥6.8	1	12.0		2	10.0	0.0	4	11.2	1.5
Total	146	8.8	0.1	427	9.5	0.1	234	10.7	0.3
Mean growth		0.56			0.53			0.48	

fertility, length of growing season, and/or genetic influences. Water fertility positively affects total fish biomass (Kautz 1980) and largemouth bass growth rates (Porak et al. 1987). Canfield (1981) reported high levels of naturally occurring phosphate deposits in many south and central Florida drainages, while soils in the panhandle region are relatively infertile. Furthermore, cultural eutrophication is more common in south and central Florida, which also increases water fertility.

The effects of water fertility were clearly demonstrated by 2 lakes in the panhandle portion of the state. Both lakes were fertilized and intensively managed. The mean growth of trophy largemouth bass from these 2 lakes was 0.61 kg/year, which was similar to growth in the southern latitudes of Florida (0.56 kg/year) but greater than mean growth for north Florida (0.48 kg/year). Likely, lake trophic state was most influential in growth rates of trophy largemouth bass.

Although this study showed a weak correlation of growth with latitude, McCauley and Kilgour (1990) reported a negative relationship between latitude and largemouth bass growth and that growth rates were proportionate to accumulated days with average temperatures >10 C. They also stated that an increase of 2.0 C in mean annual air temperature would result in a 16% increase in body weight of a 5-year-old largemouth bass in midcontinental United States. Although climatic data were not analyzed for this study, Florida temperatures range from sub-tropical in the south to temperate in the north.

Latitudinal differences in growth of trophy largemouth bass may also be influenced by genetic factors. The South and Central regions approximate the geographical area where pure Florida largemouth bass populations are found, while intergrade populations occur in the North region (Phillip et al. 1983). In a study of largemouth bass >3.6 kg in Oklahoma, Horton and Gilliland (1993) determined that Florida largemouth bass grew significantly faster than northern largemouth bass (*M. s. salmoides*), F_1 hybrids or largemouth bass with F_x phenotypes.

The impact of strong year classes on trophy largemouth bass production was demonstrated in several lakes in this study. Nineteen of 28 (68%) trophy largemouth bass sampled from Orange Lake (North region) during this study were from the 1976 and 1977 year classes. These were documented by Colle et al. (1987) to be strong year classes that experienced high survival during a period of highest areal coverage (50%–95%) of hydrilla (*Hydrilla verticillata*).

Extreme water level fluctuations also resulted in strong year classes of largemouth bass that were apparently influential on trophy largemouth bass production. Forty-seven percent of the 19 trophy fish from Lake Kissimmee (Central region) were from a strong 1978 year class. A planned 1977 drawdown of the lake produced an extremely large 1978 year class (Williams et al. 1979), which comprised 10% of the largemouth bass population in 1984 (Coleman et al. 1984). Typical contribution of age-6 largemouth bass in Florida populations is less than 3% (Porak et al. 1986). A similar trend was observed in Lake Tohopekaliga (Central region). Although few trophy largemouth bass otoliths ($N = 5$) were contributed during this study from Lake Tohopekaliga, 3 (60%) of these fish were from the 1980 year class which followed a 1979 planned lake drawdown.

Fifty-six percent of the trophy largemouth bass sampled were caught by anglers from January through March (Fig. 3). However, a breakdown of harvest by region revealed that trophy largemouth bass harvest in the South region increased in December and declined after February. The peak harvest of trophy fish in the Central region was evenly distributed from January through March. Trophy harvest in the North region peaked in March and April. These seasonal trends are probably due to the effect of water temperatures on spawning activity which causes largemouth bass to spawn later at higher latitudes. Spawning fish are typically more vulnerable to anglers (Allan and Romero 1975). Peak harvest periods for trophy largemouth bass in our study coincide with pre-spawning and spawning periods in each region (Fla. Game and Fresh Water Fish Comm., unpubl. data).

Management Implications

Mean age of trophy largemouth bass in Florida ranged from 4.0 to 16.5 years of age, which offers both opportunities and challenges to fisheries managers. Accelerated

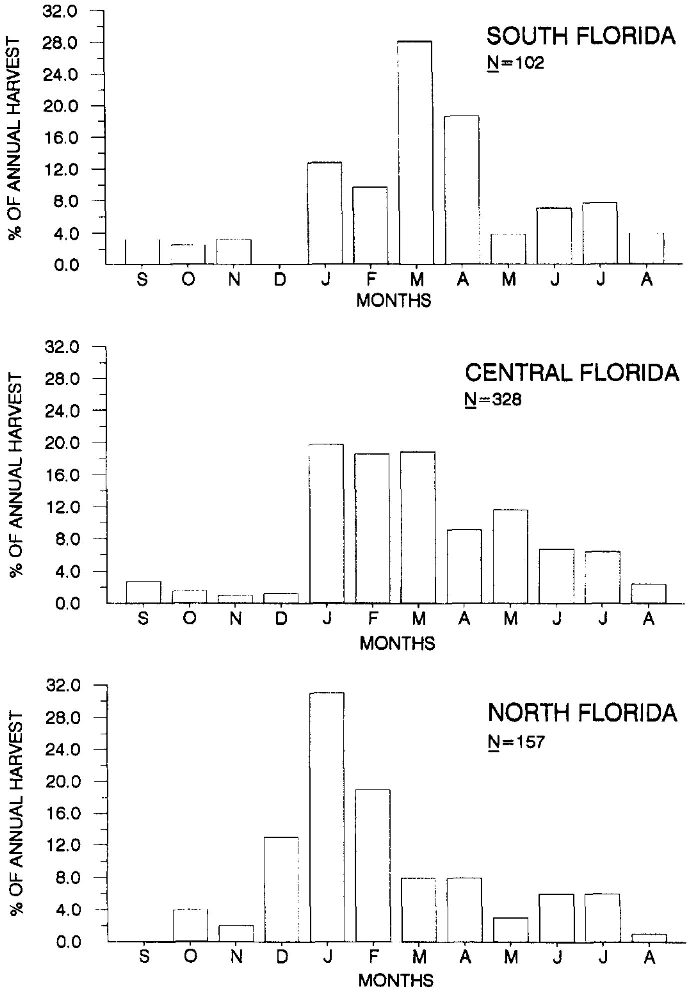

Figure 3. Monthly distribution of harvested trophy largemouth bass (≥4.5 kg) reported by taxidermists in 3 areas of Florida, 1988–1990.

growth rates (ages 4–8 in Florida) were important for trophy largemouth bass production in some water bodies. Water bodies with fast-growing trophy largemouth bass should be the best candidates for regulation management, since fish can reach trophy status in <8 years. Adverse affects from compensatory natural mortality or the potential for reduced growth rates from density dependent factors would be less likely in a system with fast growth rates.

The fact that fish as young as age 4 reached 4.5 kg may present an opportunity. Largemouth bass from water bodies known to produce fast growing trophies may outgrow their cohorts because of genetic factors. If a program could be developed to obtain fast-growing trophy fish, fishery managers could use them as brood stock to perpetuate their growth traits.

Data from this study also indicated the importance of longevity in trophy largemouth bass production in many lakes. As discussed previously, trophy largemouth bass averaged 9.7 years of age and only 0.3% of the female largemouth bass in 16 Florida water bodies sampled were ≥ age 9. Protection of largemouth bass with strict harvest restrictions should play an important role to enhance survival to trophy size. High minimum length limits (e.g., 610 mm) and slot length limits (e.g., 381–610 mm) have recently been implemented in several Florida water bodies to manage for trophy largemouth bass as well as increase numbers of quality-sized largemouth bass.

Considering the length of time required for largemouth bass to grow to trophy size, particularly where growth rates are slow, few fish live long enough to attain trophy status. In these situations, trophy largemouth bass management should consider other objectives to take advantage of all aspects of the fishery. Management strictly for trophy fish would overlook a huge portion of the fishery.

Latitudinal differences in mean age and growth suggests development of trophy fisheries could be expected to take longer further north. On the average, it took 2 additional years for largemouth bass to attain trophy size in north Florida compared to the southern part of the state. Individual differences could be as great as 12 years if a slow-growing north Florida fish is compared to a fast-growing south Florida fish. Fishery managers need to consider that this disparity in growth likely exists throughout the range where Florida largemouth bass are stocked.

Management tools, such as water level manipulation and aquatic plant management, are used throughout the southeast to enhance largemouth bass numbers. This study demonstrated the importance of strong year classes in producing greater numbers of trophies 10–14 years later. Integrating harvest restrictions with management efforts to enhance year class strengths may further increase the numbers of trophy largemouth bass produced. In light of the ever-increasing demands from multiple user groups on our water bodies, this information on the importance of strong year classes on trophy largemouth bass production may be useful to fishery managers in convincing regulatory agencies and lake or reservoir managers of the value of proposed fish management plans.

Peak harvest periods of trophy largemouth bass corresponded with the largemouth bass spawning season which varied with latitude. Closed seasons are occasionally considered by fishery managers. Our data suggests that trophy harvest could be reduced or delayed significantly if a closed season was implemented for a 2- or 3-month period. Proper use of this management tool would require knowledge of regional harvest patterns to allow managers to design appropriate closed seasons.

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