EFFECTS OF BASS STOCKING AND RATES OF FISHING ON A LARGEMOUTH BASS POPULATION

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Abstract: Supplemental stocking of fingerling and intermediate size largemouth bass (*Micropterus salmoides*) did not provide substantial control of forage fish populations; however, stocking fingerling bass may have improved year class strength in those years they were stocked. Although loss of stocked intermediate-size bass over the spillway was negligible, those fish were vulnerable to angling. A measured rate of fishing (F = 0.08) was exerted on a population of bass estimated at 22.3 harvestable bass/ha weighing 34 kg/ha.

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Since 1950 Alabama has maintained small public fishing lakes ranging in size from 12.8 to 100 ha in areas where natural fishing waters are not adequate to meet fishermen demands (Byrd and Moss 1957). These lakes are stocked, fertilized, and managed by the Alabama Game and Fish Division. (Byrd and Moss 1957, Byrd and Crance 1965).

Lee County Lake, a 52 ha state-owned and managed public fishing lake, was first stocked with bluegill (*Lepomis macrochirus*) and redear sunfish (*Lepomis microlophus*) in December 1968. Largemouth bass were introduced in May 1969. Prior to the introduction of bass, black crappie (*Pomoxis nigromaculatus*) were introduced from an unknown source which resulted in the lake becoming crowded with small crappie.

The catch of largemouth bass has been relatively low at Lee County Lake when compared with other state-owned and managed lakes. From 1 October 1971 through 30 September 1975, the average yearly fishing pressure of 283..8 trips/ha produced a catch of only 3.5 bass/ha weighing 3.9 kg/ha. This compares with an average of 337.5 fishing trips/ha yielding 70 bass/ha weighing 32.9 kg/ha during the period 1950 to 1964 from existing state-owned lakes (Byrd and Crance 1965).

Stocking 15 to 20 cm largemouth bass was suggested as a possible management tool for improving fish communities dominated by small forage fish (Snow 1968). The intensive method of raising large numbers of largemouth bass on artificial food for stocking is now well developed (Snow 1960, 1963, 1968, 1969, 1971, Snow and Maxwell 1970).

The objectives of this study were to determine if the low harvest of largemouth bass at Lee County Lake was because of low production of bass and to determine which management practices, stocking fingerling or intermediate-size bass, might best correct the problems caused by the large crappie population. Relative rates of bass recruitment, growth, fishing, and natural mortality were studied.

MATERIALS AND METHODS

Lee County Lake is fertilized at recommended rates and checked periodically for balance by state biologists using seining methods. Fishermen are requested to weigh their fish as they leave the lake, and a creel record is kept by the concessionaire (Table 1).

Additional largemouth bass were stocked in an effort to control crappie reproduction and increase the bass population. Largemouth bass fingerlings were stocked in 1970. Fingerling Florida largemouth bass (*Micropterus salmoides floridanus*) were stocked in the spring of 1972, 1973, and 1974. On 7 and 8 November 1974, 3,223 sub-adult bass from the Marion Fish Hatchery, 89 percent of which were between 16.5 cm and 21.6 cm were stocked. These bass were marked by clipping the left pectoral fin. The concessionaire recorded the numbers and weights of these marked bass separate from the native bass in the creel record.

A barrier consisting of 2.5 cm by 5 cm welded wire attached to a frame was installed below the spillway to determine the number of fin-clipped bass leaving the lake. The area between the barrier and spillway was seined periodically to enumerate emigrant fish.

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Table 1. Creel records at Lee County Lake.

Year[a]	*Bream (Lepomis sp.)* Catch (kg/ha)	Avg. Wt. (kg)	*Black Crappie* Catch (kg/ha)	Avg. Wt. (kg)	*Largemouth Bass* Catch (kg/ha)	Avg. Wt. (kg)
1971-72	114.0	0.11	180.5	0.08	8.2	0.85
1972-73	134.0	0.11	329.0	0.10	5.7	1.07
1973-74	184.0	0.12	118.0	0.12	13.4	1.16
1974-75	69.5	0.13	88.0	0.24	6.0	1.38

[a]Fiscal year of October 1-September 30.

The existing bass population was sampled primarily by gill netting and angling. Electro-fishing, seining, and hoop nets were used to a lesser extent. Two experimental gill nets were set overnight 22 times from August 1974 to May 1975.

Angling began in June 1974, and continued through September 1975. Catch per unit effort was recorded for the period 22 June 1974, through 14 July 1975. One of the authors fished a total of 296.8 hrs during that period. Other people fishing as part of the study contributed 129.3 hours of fishing pressure

Scale samples were removed from 176 bass for aging; 167 of these bass showed distinct scale annuli and were aged using a micro-projector.

During the period 14 August 1974 to 14 July 1975, 122 bass 24 cm and larger were tagged with anchor tags. The concessionaire retained tags from the creel as fish were weighed. From catch data and return rate of tagged fish in the concessionaire's creel record, the number and weight of harvestable size bass were estimated (Ricker 1975).

RESULTS AND DISCUSSION

Marion Bass

By 5 January 1975, 237 (7.4%) of the 3,223 fin-clipped bass stocked on 7 and 8 November 1974, had been weighed into the creel. During this period many more of these fish were apparently retained by fishermen but not weighed. These bass were easily caught. Although the limit was 6 bass, one person brought in over 50 to be weighed. Others apparently kept over the limit but did not wish this to be known and simply drove by the concession stand without weighing their catch. Fin-clipped bass were rarely caught or sampled after January 1975.

During the 2 periods the spillway barrier was in place (21 November 1974 through 18 March 1975, and 17 April 1975 through 10 July 1975) only 1 of the fin-clipped bass was captured below the spillway. Since it appears few of these bass left the lake over the spillway, fishing and natural mortality must have been high to account for the apparent tremendous reduction in numbers. The large standing crop of crappie, 187 kg/ha estimated at Lee County Lake by Hongpromyart (1974), were too large for these bass to eat and may have limited the usable forage for the bass to such an extent that it reduced their survival.

In this respect, intermediate-size bass may possibly prove beneficial when the forage species are small, as might be found the fall after a heavy spawn of crappie or bluegill. However, fishing mortality must be strictly controlled for stockings of these bass to be successful.

Existing Bass Population

By utilizing several sampling methods, various size ranges of bass were sampled. The gill nets selected for bass in the 27 cm to 40 cm range. Angling proved to be a very effective method of sampling bass larger than 24 cm and seining effectively sampled bass less than 21 cm.

Length and weight at capture and back-calculated lengths were both considered in evaluating the growth of bass. Since bass were collected over a rather wide time range (June 1974-July 1975), a wide range of lengths and weights at capture within year classes could be expected than if the collections were of a shorter duration. A rather wide range of weights for each age class was evident (Table 2).

The 1974 year class showed a bimodal length distribution. The smaller size range 9 cm to 22 cm was collected by seining in May 1975. The larger size range 24 cm to

Table 2. Weight range, average weight and modal length at capture for each year class of largemouth bass at Lee County Lake.

Year Class	Weight Range Low (kg)	Weight Range high (kg)	Average Weight (kg)	Modal Length (cm)
1969	2.27	3.52	2.77	56
1970	1.70	3.37	2.31	51
1971	1.02	2.44	1.62	46
1972	.57	2.22	1.14	41
1973	.34	1.44	.71	36
1974	.01	.45	.34	30[a]
	—	—	.03	15[b]

[a]Faster growing bass from 1974 year class.

[b]Slower growing bass from 1974 year class.

34 cm was collected by gill netting and angling. The larger group was first collected in November 1974 and continued to be collected into June 1975.

Lengths of fish at each annulus for each year class were back calculated from the scales using the body length-scale radius equation $y = 1.136 + 0.057 x$ ($P < 0.01$) (Table 3). From these back-calculated lengths it appears the 1969 and 1970 year class grew at a faster rate than subsequent year classes. Some of the bass in these first year classes probably reached a size large enough to feed on the numerous small crappie resulting in faster growth.

Table 3. Back calculated lengths (cm) of each year class of largemouth bass at Lee County Lake.

Year Class	Age in Years 1	2	3	4	5	6
1969	26.59	40.31	46.41	50.22	52.22	54.71
1970	27.51	38.46	43.94	46.94	48.87	
1971	23.71	37.06	42.34	44.93		
1972	22.81	34.29	40.18			
1973	22.94	35.18				
1974 Average	18.47					
1974 Slow Growing	12.90					
1974 Fast Growing	26.29					

Threadfin shad (*Dorosoma petenense*) were introduced in 1972. No increase in bass growth was evident after their introduction, although it is possible that growth could have been slower if the shad were not present during these years. Bluegill and crappie reproduction was slight during this period as indicated by routine balance checks.

The 1974 year class had an average back-calculated length of only 18.5 cm at annulus formation which is low when compared with other years. The rapidly growing fish grew at a rate of 26.3 cm. This is slightly faster than the average for previous years. Probably the slower growing fish have a higher mortality during their first 2 yrs of life because of a longer period of vulnerability to predation. This could account for the high back-calculated lengths from previous year classes of bass if this pattern of bimodal first year growth is a consistent phenomenon.

An estimate of total mortality and subsequently, an estimate of the rate of fishing, is possible by first regressing the common log of numbers of fish captured from each year

class against age (Fig. 1). Bass from the 1974 year class were considered to be incompletely recruited into the sport harvest; therefore, they were not included in the analysis. Also, the 1971 year class is not well represented and is excluded from the data set. The regression indicated the total annual motrality (a) to be 24 percent and Z, the instantaneous rate, to be 0.28. Partitioning total mortality into that caused by fishing (F = 0.08) and natural causes (M = 0.20) was possible by using a measure of the rate of exploitation (u = 0.07) and employing Ricker's (1975) equations 1.13 and 1.3 respectively. Dividing the year's catch of 93 bass 24 cm and larger by F gives an average estimated population of 1,162 harvestable size bass or 22.35 bass/ha weighing 13.52 kg.

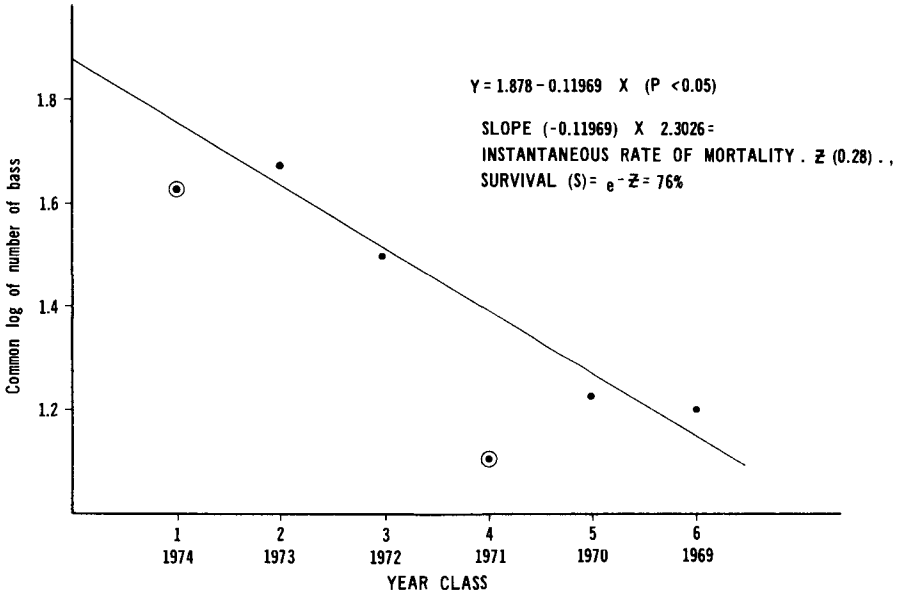

Fig. 1. Regression of age and common log of number of bass in each year class. Open circles represent data not included in the calculations.

It appeared there was lower recruitment of bass during 1971. During the years 1969 through 1974, 1971 was the only year bass fingerlings were not stocked during the spring. Although stocking bass fingerlings into a crowded crappie population did not effectively reduce crappie numbers, it does appear to have increased the year class strength of the bass population.

The population estimate is higher than the estimates of largemouth bass standing crops reported by Emig (1966), but approximates the lower limits of actual values of harvestable size bass 24 cm and larger reported by Swingle (1950) from balanced bass and bluegill populations. He found a range of 23.8 to 140.7 kg/ha of harvestable size bass in such populations. Swingle (1951) assumed a 79.5 kg/ha population of harvestable size bass when he calculated the number of bass to be stocked in a new or recently renovated farm pond. Graham (1974) reported standing crops of harvestable size bass from bass, bluegill, and channel catfish (*Ictalurus punctatus*) pond populations in Missouri to range from 63.8 to 70.1 kg/ha where annual harvest rates ranged from 0 to 40 percent. The standing crop of harvestable size bass is much lower in Lee County Lake than in similar habitats containing bass and bluegill populations without crappie. It appears that a dense crappie population will reduce the standing crop of largemouth bass. The relatively low biomass of bass could be explained by the food habits of black crappie. Hornsby (1975) found that the largest volume of food consumed by crappie at Lee County Lake was fish, primarily threadfin shad.

The large average size of bass in the creel and from sampling can be explained by the low total annual mortality (24%). Recruitment of harvestable size bass is apparently low, possibly because of predation by large fish, the relatively small percentage of forage available to small bass, and competition for this forage by crappie. Once bass are recruited into the harvestable size range, forage is adequate and the low rate of fishing mortality allows accumulation of large bass in the population.

Catch and catch per unit effort for bass were high for one of the authors despite the low total catch of bass reported by other fishermen at Lee County Lake. In the 296.8 hrs fished by one of the authors, a total of 129 bass weighing 185.5 kg were caught (0.61 kg/hr). The average weight of bass was 1.44 kg.

In approximately 1 year, one of the authors was able to catch 9.1 percent of the standing crop of harvestable size largemouth bass (based on an estimate of 34.1 kg/ha while applying a fishing pressure of only 5.63 hr/ha. This demonstrates the effect 1 fisherman can have on a moderately large body of water by fishing intensively for largemouth bass.

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