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Long-Term Stocking Success of Largemouth Bass and the Relationship to Natural Populations

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Abstract.—Despite the widespread use of supplemental stocking, survival of age-0 and age-1 stocked fish is often variable and stocking success is not commonly evaluated through adult size-classes. We evaluated the long-term contribution of stocked largemouth bass *Micropterus salmoides* from three annual stockings in 15 reservoirs in Illinois. Stocked largemouth bass were marked with fin clips and sampled for 5 years. Contribution of stocked fish to the population was highest for age-0 (21%) and age-1 largemouth bass (17%) but decreased significantly in adult fish (5%). Contribution of stocked bass was not associated with either populations of wild largemouth bass or latitude. Survival of stocked fish was similar to survival of wild fish through age 1. Age-0 abundance of wild and stocked largemouth bass were positively correlated in the fall following stocking, suggesting that similar factors may influence initial survival. Survival of stocked fish from age-1 to adult age decreased significantly compared to wild fish, resulting in low contribution of stocked bass to the adult population. Adult and age-1 catch per unit effort of stocked largemouth bass were positively correlated with the mean size of stocked bass in the first fall after stocking and the following spring, indicating that lakes with higher growth rates have increased contribution of stocked fish. We found limited contribution of stocked fish to adult largemouth bass populations due to low survival from age-1 to adult age. Assessments of fish stocking success should evaluate survival of stocked fish through adult ages or they may omit a critical period for mortality.

Introduction

Fish stocking is a common practice used to introduce a species to a new system (Dauwalter and Jackson 2005), sustain fish species in areas where there is no natural reproduction (Santucci et al. 1994), supplement wild populations where they have been reduced by angling and habitat degradation (Wingate 1986), or alter genetics of a population (Maceina et al. 1988; Buckmeier et al. 2003). Survival of stocked fish has been related to a number of variables, including stocking size (Gunn et al. 1987; Santucci et al. 1994; Szendrey and Wahl 1996; Farrell and Werner 1999; Yule et al. 2000; Brooks et al. 2002), stocking density (Fielder 1992), competition with other fish (Gunn et al. 1987), abundance and type of available prey (Stahl et al. 1996; Szendrey and Wahl 1996; Donovan et al. 1997; Sutton and Ney 2001), and density of resident predators (Santucci et al. 1994; Stahl et al. 1996; Szendrey and Wahl 1996; Yule et al. 2000; Michaelson et al. 2001). Initial survival is often assessed; however, few

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studies have evaluated long-term survival of adult stocked fish (but see Wahl and Stein 1993). Because the goal of most stocking is to increase adult abundance, understanding the survival of stocked fish through adult ages is important. Recruitment of stocked fish may or may not be set in the initial months after stocking; therefore, it is critical to assess long-term stocking success.

Stocking is a tool for managing reservoir largemouth bass *Micropterus salmoides* populations, and fish are often stocked on top of naturally reproducing populations. This practice is used when a weak year-class is expected (Boxrucker 1986), to alter population genetics (Maceina et al. 1988; Buckmeier et al. 2003) or because of public pressure to stock largemouth bass (Buynak et al. 1999). Several studies have examined supplemental stocking of largemouth bass in large lentic systems, and typically, the contribution of stocked fish to year-class strength is low (Loska 1982; Boxrucker 1986; Ryan et al. 1998; Buynak and Mitchell 1999; Buckmeier and Betsill 2002; Porak et al. 2002; Hoffman and Bettoli 2005). Most studies evaluating stocking success have been conducted in one or two lakes. A few studies have been conducted on a large number of lakes, but they have only measured success through the first year after stocking (Hoxmeier and Wahl 2002; Porak et al. 2002). Because the goal of many stocking programs is to increase the harvestable population, there is a need to examine the contribution of stocked largemouth bass to adult sizes or to catchable sizes. Estimates from creel surveys of the contribution of stocked fish to the adult population have varied by individual reservoir from no survival (Boxrucker 1986) to moderate contribution (11.6%; Buynak and Mitchell 1999). To our knowledge, no studies have examined variation in adult stocked largemouth bass survival across a number of reservoirs to assess factors that could influence success.

Because largemouth bass are stocked in reservoirs with naturally reproducing populations, wild fish could affect recruitment of stocked fish. Natural largemouth bass can compete with stocked fingerlings for prey resources and habitat (Neal et al. 2002) or stocked fish may displace native fish if a system is close to carrying capacity (Buynak and Mitchell 1999; Buckmeier and Betsill 2002). Largemouth bass are also the most abundant predator in many lakes and reservoirs and have been shown to prey heavily on other stocked fish species, contributing to low stocking success (Stein et al. 1981; Wahl and Stein 1989; Santucci and Wahl 1993; Hoxmeier and Wahl 2002; Schlechte et al. 2005).

Prey species and abundance could also influence long-term growth and survival of stocked largemouth bass and have been shown to influence growth and survival of age-0 fish (Stone and Modde 1982; Hoxmeier and Wahl 2002). Competition with other fish species for prey resources could reduce largemouth bass stocking success. Stocked largemouth bass can have difficulty switching to natural prey, which can also contribute to low growth or survival (Porak et al. 2002). Managers must also consider the ecological risks of stocking, including how stocked fish can affect the fish community (Olson et al. 1995; Pearsons and Hopley 1999; Brenden and Murphy 2004). Stocked largemouth bass have the potential to be affected by the native fish community through either competition or predation.

The objectives of this study were to (1) evaluate recruitment of stocked largemouth bass to adult age, (2) compare survival of stocked and wild fish, (3) identify how survival and contribution of stocked fish are influenced by wild bass populations and latitude, and (4) determine when recruitment of stocked fish to the adult population can be determined. We observed wild and stocked largemouth bass from initial introduction into the adult life stage in 15 Illinois reservoirs. Lakes were chosen to include a range of wild largemouth bass abundances. We examined lake-to-lake differences in contribution of stocked fish to the population to determine how stocking success can vary within a lake. We also examined variation in stocking success among lakes to determine how reservoir specific differences may influence stocking success. We use these analyses to make management recommendations regarding how long supplemental stockings should be monitored to determine success, and whether or not stocking is an appropriate tool for manipulating largemouth bass populations in a particular lake.

Methods

Largemouth bass were stocked in 15 reservoirs in Illinois (Figure 1). Each reservoir was stocked with largemouth bass fingerlings in 1999, 2000, and 2001. Largemouth

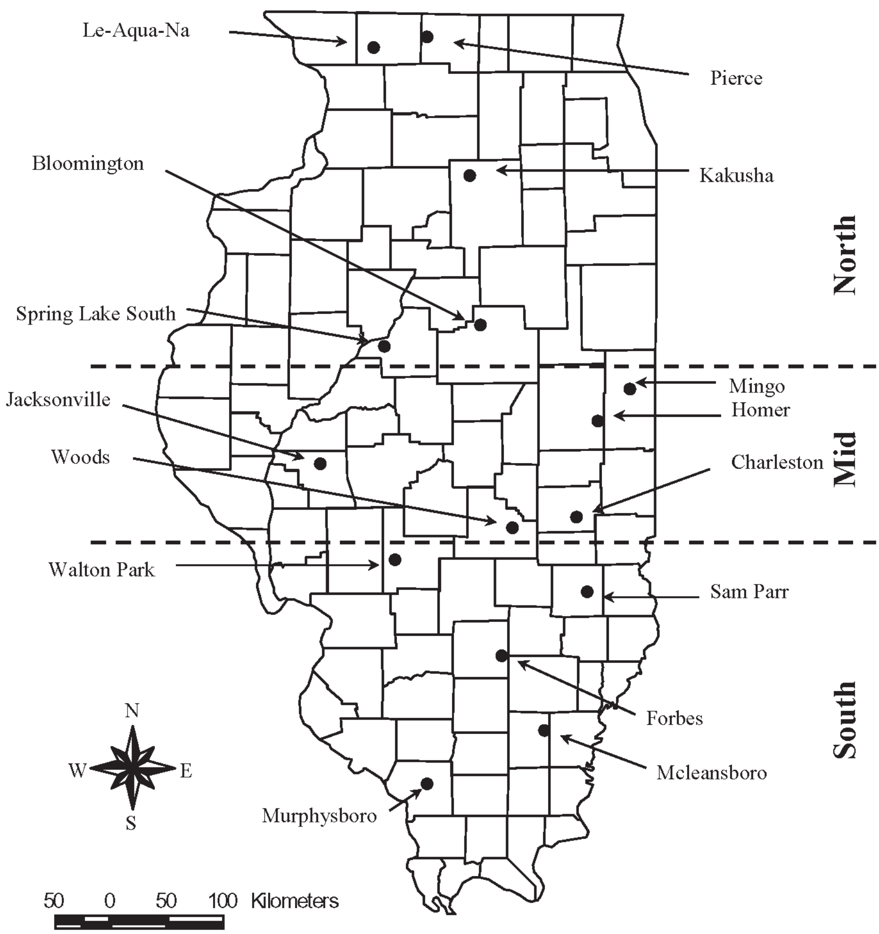

Figure 1. Location of 15 lakes in Illinois stocked with fingerling largemouth bass in 1999, 2000, and 2001 (from Hoxmeier and Wahl 2002). Dashed lines indicate the separation of lakes into regions (North, Mid, and South) based on latitude.

bass were the main predator in all of the reservoirs, and the primary forage fish were bluegill *Lepomis macrochirus* and gizzard shad *Dorosoma cepedianum*. Stockings occurred in the 15 reservoirs in an attempt to increase predator abundance as a means to control bluegill populations. Lakes were chosen in order to include a range of wild largemouth bass population abundances, growth, and recruitment. Stockings occurred in mid-July to mid-August, and the target stocking size was 100 mm with a density of 60 fish/ha (Table 1). Each fish was marked with a pelvic fin clip in order to identify stocked fish in future samples. All fins were clipped by the Illinois Natural History Survey staff, and care was taken to remove the fin as close to the origin as possible to prevent regrowth. Clips were identifiable for the duration of the study, based on concurrent work in experimental ponds with these sizes of fish (K. G. Ostrand, US Fish and Wildlife Service, Abernathy Fish Technology Center and D. H. Wahl, unpublished data). Over a 5-year period, a low proportion of fish (10.4%) had fin regeneration, and for those that did, marks were still identifiable due to distortion in the fin rays. Pelvic fin clips were left or right in alternating years to aid in determining which year each fish was stocked when it was recaptured.

Relative abundance of stocked and wild largemouth bass was assessed using three-phase AC electrofishing (standard protocol for Illinois Department of Natural Resources) for a minimum of 5 years and continued until no marked fish were observed in electrofishing samples. Each lake was elec-

Table 1. Characteristics of 15 Illinois lakes stocked annually in July and August with fingerling largemouth bass from 1999 to 2001. Information is based on the mean of stockings in each reservoir. Angler pressure is the number of angler hours per hectare estimated from creel census performed by the Illinois Natural History Survey Creel project in 1996–2000. Secchi depth is the mean annual secchi depth measured monthly at a designated station through 1999–2001.

Lake	Size (ha)	Mean depth (m)	Secchi depth (m)	Stocking density #/ha	Percent of 60-m lake buffer as urban	Angler pressure (h/ha)
Bloomington	250		0.54	60	1.1	156
Charleston	113	2.4	0.45	60	17.1	No data
Forbes	212	4.6	0.64	60	8.2	207
Homer	32	2.5	0.63	60	No data	815
Jacksonville	198	3.8	0.90	59	15.4	119
Kakusha	21	1.3	0.53	73	3.2	306
LeAquaNa	16	3.2	0.90	71	2.5	1,833
McLeansboro	30		0.89	60	4.1	148
Mingo	69	3.7	0.85	60	6.0	492
Murphysboro	58	4.2	0.89	60	0.0	282
Pierce	66	3.4	0.88	60	0.3	1,005
Sam Parr	73	3.1	0.84	60	47.3	536
Spring South	247	1.2	0.68	60	No data	371
Walton Park	12	1.6	0.55	107	2.4	264
Woods	11	2.2	0.68	60	0.0	373

trofished on two dates in the spring and two in the fall. Three fixed transects of one half hour each were electrofished on each lake on each date. Half-hour transects were chosen to ensure high probability of collecting stocked largemouth bass on a transect and to standardize sampling effort among lakes. One transect in each lake was located at the stocking site, and the remaining two were evenly spaced across the remaining shoreline. All largemouth bass collected were measured for total length, examined for clips, and assigned a year-class based on clip, length-frequency, and aging from scales (for age-0 and age-1 fish). Catch per unit effort of stocked and wild largemouth bass was calculated for age-0 in the fall, age-0 the following spring, age-1 in the second fall, and adult fish in subsequent falls. Catch per unit effort of adult largemouth bass was calculated for each stocking at combined ages of 3, 4, and 5 years. Adult ages could not be delineated into individual years, due to the lack of age data and the inaccuracy of using length-frequency analysis to determine age for these larger largemouth bass. Catch per unit effort was averaged across years for each reservoir, using reservoir as the experimental unit to evaluate differences among reservoirs and examined for relationships with reservoir characteristics using Pearson correlation analysis. Sampling fish populations through electrofishing can result in variation from lake to lake or select for larger individuals (Jackson and Noble 1995). As a result, we calculated the proportional contribution of stocked fish to the total largemouth bass population. Catch per unit effort (CPUE) of stocked largemouth bass from electrofishing samples was divided by the CPUE of all largemouth bass sampled for each date of sampling. Using a proportion rather than CPUE alone allowed us to better compare values across lakes; we assumed that the ratio of stocked to wild fish was independent of catch rates.

To further study differences in contribution of stocked fish, we examined change in survival between stocked and wild largemouth bass. Survival was estimated as the proportion of change in CPUE from electrofishing at three time steps, from the first fall following stocking to the subsequent spring (age-0 fall to age-0 spring), from the first spring following stocking to the subsequent fall (age-0 spring to age-1), and from the second fall following stocking to the adult age (age-1 to adult). Using these metrics, we could examine differences in declines in CPUE between wild and stocked fish.

We also examined differences in contribution of stocked largemouth bass with latitude. We divided the study lakes into North ($n = 5$), Mid ($n = 5$), and South ($n = 5$) regions within Illinois (Figure 1). A repeated measure analysis of variance (ANOVA) was used to determine differences in stocking contribution among these regions at different ages (age-0 fall, age-0 spring, age-1, and adult). To determine the influence of wild largemouth bass populations, we examined differences in contribution of stocked fish and survival of both stocked and wild fish between lakes with varying largemouth bass populations. Lakes were categorized as high, medium, and low largemouth bass populations using natural separations in CPUE of adult and age-0 largemouth bass in the population of each lake. Years were blocked by lake and examined for significant differences in percent contribution of stocked largemouth bass for each time step. We then examined differences in contribution and survival between these designated groups using repeated measures ANOVA.

Results

Contribution of stocked fish to the total largemouth bass population varied among lakes. Proportion of stocked largemouth bass in the first fall following stocking ranged from 3% to 50% of the total population across lakes. Stocked largemouth bass CPUE was lower than wild fish for all age-classes and declined through time (Table 2). Percent contribution of stocked fish to adult largemouth bass was the lowest of all age-classes, ranging from 0% to 18% of the total largemouth bass collected in electrofishing samples.

Similar factors appeared to influence initial abundance of stocked and wild largemouth bass. Stocked largemouth bass CPUE in the first fall following stocking was correlated with wild age-0 CPUE ($r = 0.55$; $P = 0.03$). However, adult stocked largemouth bass CPUE was not correlated with CPUE of stocked largemouth bass in the first fall after stocking ($r = 0.17$, $P = 0.55$) or the first spring ($r = 0.26$, $P = 0.34$). Age-0 wild fish abundance was correlated with the abundances of all older wild fish age-classes. Catch per unit effort for age-0 wild fish was positively correlated with age-0 in the spring ($r = 0.63$; $P = 0.01$), age-1 ($r = 0.92$; $P < 0.0001$), and adult ($r = 0.63$; $P = 0.01$) wild fish. Unlike abundance, the mean size of age-0 stocked largemouth bass in the fall was related to abundance of older stocked fish. Mean size of stocked largemouth bass in the first fall after stocking was positively correlated with CPUE of age-1 ($r = 0.74$, $P = 0.002$; Figure 2A.) and adult ($r = 0.68$; $P = 0.006$; Figure 2B.) stocked largemouth bass.

There were also no differences between years for percent of stocked largemouth bass for age-0 in the fall ($F = 0.22$; df $= 2$; $P = 0.80$), age-0 in the spring ($F = 1.19$; df $= 2$; $P = 0.32$), age-1 ($F = 0.16$; df $= 2$; $P = 0.85$), or adult ($F = 3.20$; df $= 2$; $P = 0.06$) fish. Because there were no differences in stocking contribution in lakes among years, for

Table 2. Lake size and stocking densities for 15 Illinois lakes stocked with fingerling largemouth bass. Catch per unit effort (CPUE) was determined from fall and spring AC electrofishing transects in each lake for age 0 in fall after stocking and the following spring, age 1 the following fall, and adults (> 250 mm) in subsequent years through age-5.

	Mean stocked CPUE (#/h)				Mean natural CPUE (#/h)			
Lake	Age-0 fall	Age-0 spring	Age-1 fall	Adult	Age-0 fall	Age-0 spring	Age-1 fall	Adult
Bloomington	5.1	0.7	0.2	0.0	42.9	5.1	10.0	26.7
Charleston	6.0	0.9	0.1	0.1	6.0	8.3	1.1	8.7
Forbes	4.7	5.3	0.7	0.8	19.1	9.2	6.1	15.2
Homer	0.7	0.5	0.1	0.0	22.4	10.2	5.5	17.7
Jacksonville	7.5	12.6	3.2	0.6	10.5	6.1	2.4	17.0
Kakusha	3.8	1.3	0.7	0.5	45.0	7.5	8.3	12.3
LeAquaNa	3.4	2.7	0.1	0.1	10.8	10.7	1.7	12.2
McLeansboro	3.6	4.4	0.9	0.8	11.6	6.4	2.6	7.0
Mingo	2.7	0.8	0.8	0.1	20.0	10.8	6.2	11.2
Murphysboro	3.3	3.9	1.6	0.6	18.6	7.9	2.8	12.3
Pierce	14.3	12.7	2.0	0.4	61.4	24.4	15.8	18.2
Sam Parr	4.2	4.2	3.3	2.0	20.7	14.5	5.3	13.9
Spring South	0.7	1.0	0.0	0.0	15.5	11.9	1.8	25.3
Walton Park	5.2	4.0	1.0	2.3	7.7	5.7	4.3	10.8
Woods	0.3	0.3	0.8	0.0	9.7	3.8	3.1	11.8

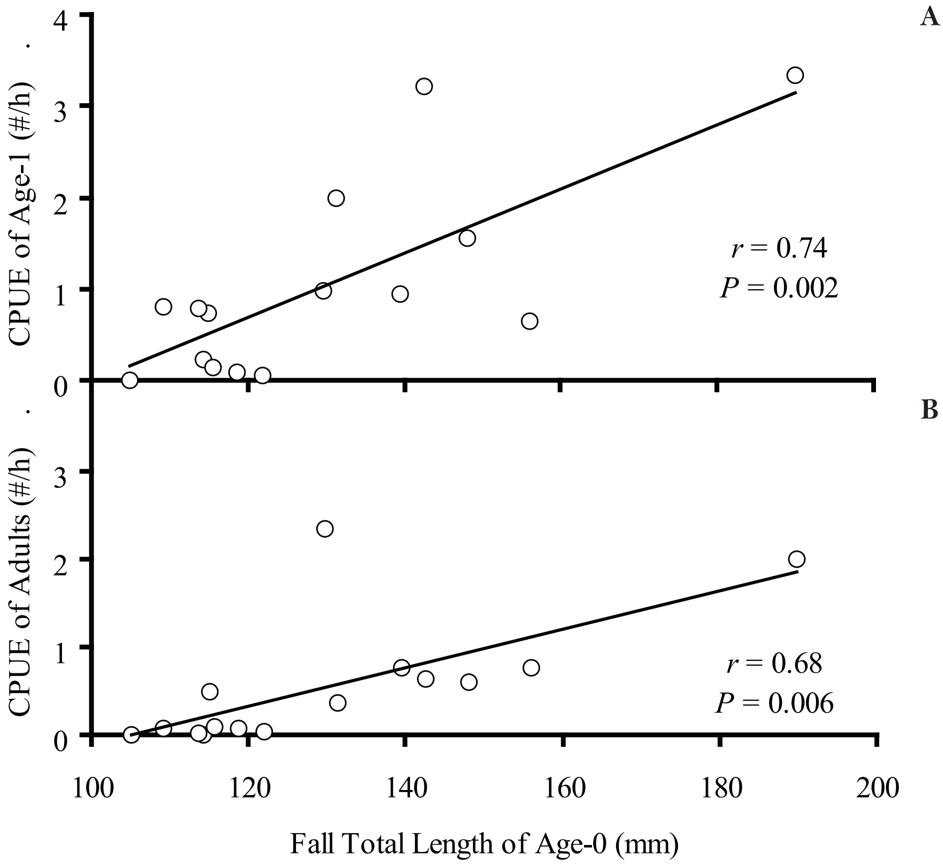

Figure 2. Relationship between and mean total length of age-0 stocked largemouth bass in electrofishing samples in the fall following stocking and CPUE of age-1 (age-1; A) and adult (age-2–5; B) stocked largemouth bass in fall electrofishing samples in 15 lakes in Illinois. Values are means from three annual stockings.

additional analysis we used the mean contribution and survival of stocked largemouth bass and focused the analysis on examining variation between lakes. There was also no difference in stocking contribution in separate regions (F = 3.28; df = 2; P = 0.07), nor was there an interaction between region and age (F = 0.56; df = 6; P = 0.76). However, contribution of stocked largemouth bass differed by age-group (F = 11.42; df = 3; P < 0.0001; Figure 3). Adult contribution of stocked largemouth bass was lower than age-0 in the fall (t = –4.68; P < 0.001), age-0 in the spring (t = –5.38; P < 0.001), and age-1 fish (t = –3.42; P = 0.008). The proportion of stocked largemouth bass in the population decreased between the age-1 and the adult stage.

Abundance of wild fish large enough to prey on stocked fish was not correlated to stocked largemouth bass abundance. The CPUE of wild largemouth bass predators (>250 mm) was not correlated with the CPUE of age-0 stocked fish in the first fall following stocking (r = 0.13; P = 0.65) or the following spring (r = 0.10; P = 0.73). Catch per unit effort of wild adult bass was also not related to stocked adult bass numbers (r =

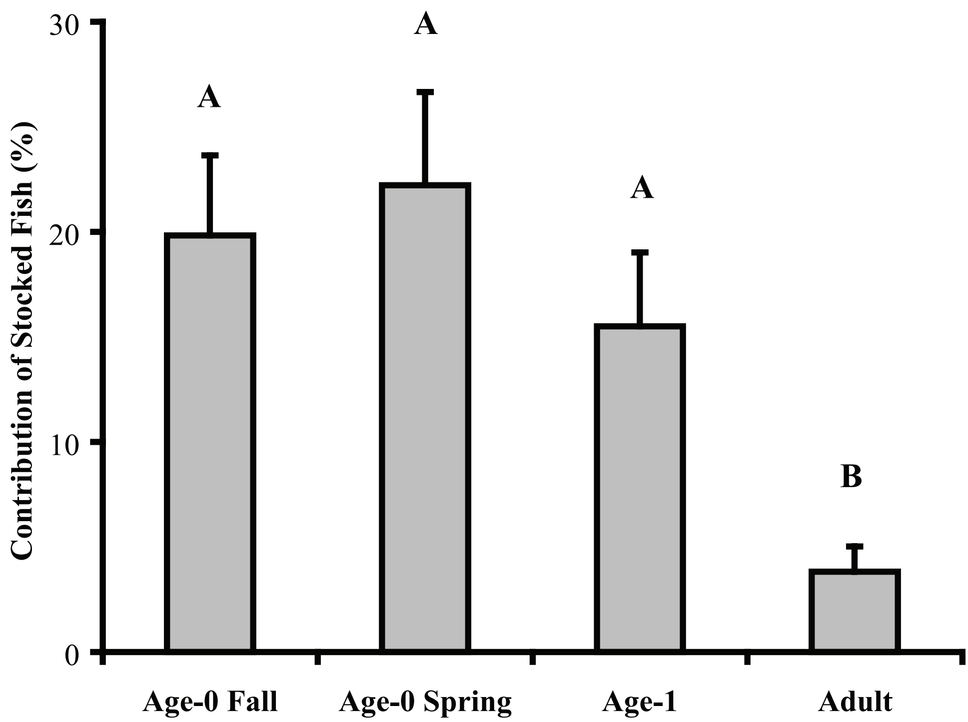

Figure 3. Contribution of stocked largemouth bass to the total population through time. Age-0 fall is the first fall after stocking. Age-0 spring is the following spring. Age-1 refers to the second fall following stocking and adult is the mean of fall contribution from the third, forth, and fifth fall following stocking. Different letters represent bars that are significantly different ($P < 0.05$) and error bars represent the standard error.

–0.35; $P = 0.20$). Similar trends existed when examining the influence of wild bass populations (high, medium, or low) and contribution and survival of stocked and wild fish. No differences in stocking contribution existed between high, medium, and low bass populations ($F = 1.10$; df = 2; $P = 0.36$), nor was there an interaction with age ($F = 1.36$; df = 6; $P = 0.26$). Contribution differed among age-groups ($F = 12.82$; df = 3; $P < 0.0001$), with contribution of stocked adult fish lower than age-0 fall ($t = -4.96$; $P < 0.0001$), age-0 spring ($t = -5.70$; $P < 0.0001$) and age-1 ($t = -3.62$; $P = 0.005$) fish. Survival of stocked fish did not differ among lakes with high, medium, and low wild largemouth bass populations ($F = 1.15$; df = 2; $P = 0.35$); however, stocked fish had lower survival than wild fish ($F = 29.77$ df = 1; $P < 0.001$). The interaction between stocked and wild survival with age was also significant ($F = 6.4$; df = 2; $P = 0.0062$) due to survival of adult wild largemouth bass being greater than survival of stocked adult fish ($t = 5.88$; $P < 0.0001$; Figure 4). In general, there was low survival of stocked fish from age-1 to the adult age, resulting in a decrease in contribution of stocked fish to the adult age-class.

Discussion

Initial survival of stocked and wild young-of-year largemouth bass followed similar patterns in our study lakes. Both CPUE and

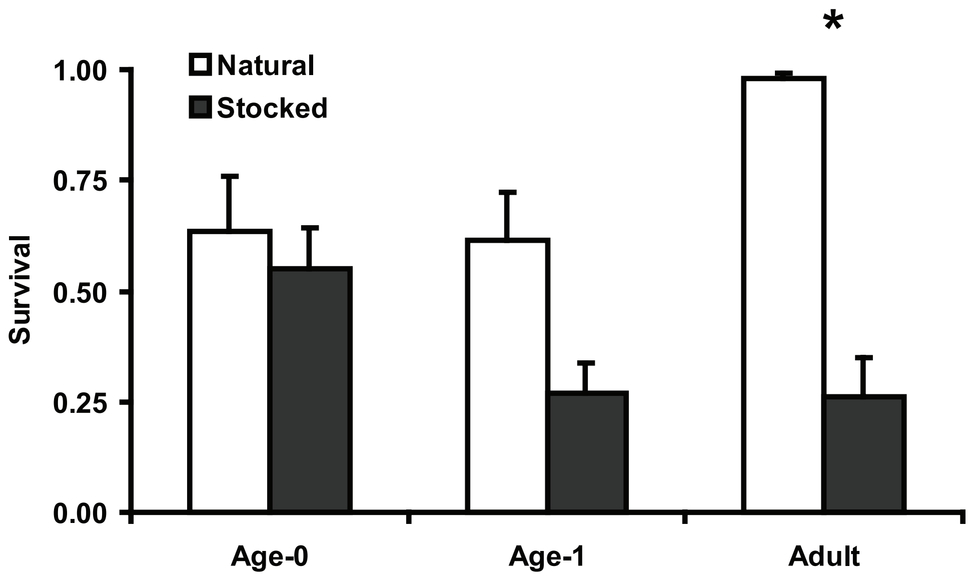

Figure 4. Mean proportion of fish surviving to a specific age-class based on decreases in catch per unit effort from electrofishing. Age-0 represents survival from the first fall following spawn/stocking to the first spring. Age-1 represents survival from the first spring through the second fall following spawn/stocking. Adult represents the survival from the second fall to adult age. The asterisk represents a significant difference ($P < 0.05$) between stocked and wild fish. Error bars represent the standard error.

mean total length of age-0 stocked and wild largemouth bass were correlated the first fall after stocking and the following spring. Similar factors may influence first-year survival and growth of stocked and wild largemouth bass. Also, factors that cause low recruitment of wild fish may also be limiting stocked largemouth bass survival. Other studies have also shown no differences in mortality of stocked and wild largemouth bass in the first year following stocking (Buckmeier and Betsill 2002; Hoxmeier and Wahl 2002; Jackson et al. 2002; Hoffman and Bettoli 2005). Stocked largemouth bass survived better in lakes that had favorable conditions for wild young-of year largemouth bass survival and growth. Unfortunately, lakes with good wild largemouth bass survival and growth are not usually the target of supplemental stocking efforts.

Overwinter survival was high for both stocked and wild fish. We observed high survival of both stocked and wild largemouth bass over the first winter following spawning/stocking, and there was no change in contribution of stocked bass over this time period. Estimates of overwinter mortality for wild largemouth bass have varied from extensive (Miranda and Hubbard 1994; Garvey et al. 1998; Post et al. 1998) to minimal (Kohler et al. 1993; Garvey et al. 1998; Jackson and Noble 2000a; Fuhr et al. 2002; Ostrand et al. 2005). Similar variation has been shown for stocked largemouth bass with overwinter mortality ranging from low (Boxrucker 1986; Hoxmeier et al. 2002) to high (Gilliand 1992). Overwinter mortality was not a major factor influencing survival of stocked fish in this study, and survival did not differ between stocked and wild fish.

Recruitment of stocked and wild largemouth bass to the adult population was determined at different times during their life spans. The relative abundance of age-0 fish was related to that of all older age-classes of wild fish, and no significant mortality occurred in older fish; thus, recruitment of wild fish was determined by the first fall. Recruitment of wild largemouth bass is commonly established by the first fall for wild largemouth bass (Jackson and Noble 2000a, 2000b; Sammons and Bettoli 2000). However, no relationship existed in Illinois reservoirs between relative abundance of age-0 stocked fish (both fall and spring) and relative abundance of stocked fish as adults. Survival of stocked bass decreased from age-1 to adult age, but survival was similar between age-1 and adult wild fish. This decrease in survival was also evident by a significantly lower contribution of adult stocked fish to the adult largemouth bass population. There appears to be substantial continued mortality in stocked fish during the second year that affects recruitment to adulthood. Similar high mortality has been reported in individual lakes for stocked largemouth bass after the first year following stocking (Boxrucker 1986; Neal et al. 2002). Our results provide evidence that the abundance of adult stocked fish differs from wild fish and is not determined until the fish reach adulthood. Stocked fish may be more vulnerable to predation or susceptible to starvation than wild fish. If resources for larger fish are limited, wild fish may outcompete stocked largemouth bass. We believe that it is important to evaluate stocked fish past the first year in order to fully determine stocking success.

This study provides evidence that size of stocked fish in the first fall may be important to long-term survival. Relative abundance of both age-1 and adult stocked largemouth bass was related to the mean size of age-0 stocked fish during the first fall following stocking. There may be size-selective survival of larger fish, or lakes with higher growth rates may also yield higher abundance and contribution of stocked largemouth bass. Overwinter mortality is often size-selective for largemouth bass, resulting in larger fish surviving at higher rates than smaller fish (Miranda and Hubbard 1994; Garvey et al. 1998; Post et al. 1998). Larger fish are less vulnerable to predation (Miller et al. 1988; Miranda and Hubbard 1994) and have greater energy reserves (Miranda and Hubbard 1994; Ludsin and DeVries 1997; Post et al. 1998). Growth of stocked fish immediately following stocking may influence the long-term survival of stocked largemouth bass.

Latitude, within lake variation, and pre-existing largemouth bass populations did not influence stocking contribution or survival in this study. We did observe a greater contribution of stocked fish in lakes that were further south, but differences were not significant. We need to further examine the role of latitude on survival of stocked fish, but it does not appear to greatly influence stocking success in this study. Contribution of stocked fish showed greater variation from lake to lake than within lakes. Lakes with a high contribution of stocked fish in one season tended to have high contribution throughout the study. This suggests that certain lakes may have characteristics that are conducive to stocking, such as prey or habitat availability. Identifying these factors will allow managers to increase stocking success in a lake. Pre-existing largemouth bass populations did not appear to influence stocking success through either competition or predation. We observed no differences in survival or contribution of stocked bass in lakes with high, medium, or low wild largemouth bass populations. Similarly, predators did not affect survival of age-0 stocked largemouth bass in a previous study in Illinois

(Hoxmeier and Wahl 2002). The influence of predators on stocked fish appears to vary by species. Low survival of stocked fish has been related to predator abundance for stocked esocids (Carline et al. 1986; Wahl and Stein 1989; Szendrey and Wahl 1996) and walleye *Sander vitreus* (Santucci and Wahl 1993; Hoxmeier et al. 2006). Conversely, predation was minimal or had no influence on survival and stocking success of saugeye (sauger *S. canadensis* × walleye) (Stahl et al. 1996), channel catfish *Ictalurus punctatus* (Santucci et al. 1994), and stripped bass *Morone saxatilis* (Michaelson et al. 2001). We found that predator abundance did not have a strong influence on survival of stocked largemouth bass in Illinois reservoirs.

Our results suggest the need to evaluate long-term survival of stocked largemouth bass when evaluating stocking success. Although stocked fish may exhibit similar survival to wild fish in a system initially following stocking, significant mortality can occur through the adult age. Stocking success could be evaluated incorrectly if long-term survival is not considered. We have demonstrated that recruitment of largemouth bass is not determined in the first year after stocking in Illinois reservoirs. Many previous evaluations of stocking success have not examined stocking success beyond the first spring. These studies may omit a critical period for determining survival of stocked fish. For largemouth bass, success of stocked fish in the first year is often not reflected in creel data providing further evidence for variable survival following the first year after stocking (Boxrucker 1986; Neal et al. 2002). Managers should consider the survival of age-1 and adult fish when managing a lake or reservoir. Considering the availability of appropriate prey and habitat for larger stocked fish may reduce the mortality and increase recruitment to the fishery. We did observe a large range in stocking success with some lakes exhibiting no survival of stocked fish, whereas others had stocked fish collected in substantial numbers (as high as 21% of the adult population) up to 5 years following stocking. Because of the high variation in stocking survival among lakes, there is a need for additional studies examining factors influencing stocking success. We focused on differences in survival of wild and stocked largemouth bass and the role of and predator populations in determining stocking success. Other factors such as prey abundance and availability, available habitat, thermal regimes, and fishing pressure may also be important. Future studies should examine variation among lakes in order to further explore what factors may play a role in determining growth and survival of stocked fish.

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