Evaluation of Reduced Striped Bass Bag Limit, Lake Texoma, Texas and Oklahoma

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Abstract: We evaluated the effects of changing harvest regulations from 15 fish/day (no more than 5 fish ≥508 mm) to 15 fish/day (no more than 1 fish ≥508 mm) for striped bass (*Morone saxatilis*) in Lake Texoma, Texas and Oklahoma. A stratified random creel survey was conducted for 2 years before and 4 years after the regulation change to determine striped bass harvest and directed angling pressure. Experimental gill nets were set at 15 stations each February for 3 years before and 4 years after the regulation change to estimate changes in the striped bass abundance and size structure. Overall striped bass harvest did not change ($P > 0.05$) after the regulation change, but, as expected, the harvest of striped bass ≥508 mm did decrease ($P < 0.05$), while directed angling pressure did not change ($P > 0.05$). There were no significant changes ($P > 0.05$) in the striped bass abundance and numbers ≥508 mm after the regulation was implemented. Factors preventing the regulation change from increasing the numbers of striped bass ≥508 mm could have been angler induced mortality, growth overfishing, weak year classes, inbreeding, or a combination of these factors. The solution may be new regulations, stocking, or both.

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In recent years striped bass (*Morone saxatilis*) were the most popular sport fish in Lake Texoma, Texas and Oklahoma. From 1987 through 1990, an estimated 371,000 to 648,000 anglers visited the reservoir annually (Mauck, 1991). Annual harvest of striped bass was highest of any species and ranged from 630,000 to 970,000 fish. Also striped bass anglers accounted for 61%–72% of the angling pressure.

Striped bass were stocked into Lake Texoma by the Oklahoma Department of Wildlife Conservation (ODWC) from 1965 to 1974 (Harper and Namminga 1986). Natural reproduction has occurred annually since 1973 (Mauck 1991).

Growth of striped bass in Lake Texoma (Hysmith 1993) is typically slower than in other Texas waters (Prentice 1987). Mean total length of striped bass >2 years old in Lake Texoma is 65 mm less than mean total length of striped bass of the same age in other Texas waters.

Striped bass harvest regulations were enacted when changes in abundance and size structure of the striped bass population occurred in Lake Texoma. A 1-fish/day bag limit began on 1 September 1967, but the regulation changed to 3 fish/day, 1 September 1977, followed by a change in 5 fish/day on 1 January 1980. On 1 September 1982 it increased to 15 fish/day (no more than 5 fish ≥508 mm). The current harvest regulation was implemented 1 September 1989 and allows 15 fish/day (no more than 1 fish ≥508 mm).

The intent of the current harvest regulation was to decrease harvest of striped bass ≥508 mm and therefore increase their abundance by affording them more protection. Examination of creel data indicated reduction of the bag of fish ≥508 mm from 5 to 1 should reduce the harvest of those large fish by 27%. Also fish ≥508 mm made up only 18%–26% of the striped bass population. If striped bass ≥508 mm could be increased, more trophy (≥762 mm) striped bass could be provided for anglers. The objective of this study was to evaluate the ability of the current regulation to effect the desired changes in harvest and population abundance of striped bass ≥508 mm.

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Methods

The study was conducted at Lake Texoma, a 36,018-ha impoundment of the Red River, located 120 km north of the Dallas-Fort Worth metroplex, on the Texas-Oklahoma border. The reservoir was constructed by the U.S. Army Corps of Engineers in 1944 for flood control, hydroelectric power, and as a water source for municipal and industrial purposes. The reservoir is moderately clear, alkaline, and has a fluctuating-pool regime, with a maximum depth of 30.5 m and an average depth of 9.5 m.

A stratified random creel survey was conducted by personnel from TPWD and ODWC from 1 September 1987 through 31 August 1993 to determine striped bass harvest and directed angling pressure. Roving surveys were conducted on 12 randomly selected days, every 3 months, including 6 weekend days and 6 weekdays. Fishing pressure was determined from boat/angler counts taken by a roving clerk during a randomly selected 6-hour period in 3 randomly selected areas of the reservoir (Fig. 1). Angler interviews obtained the number of

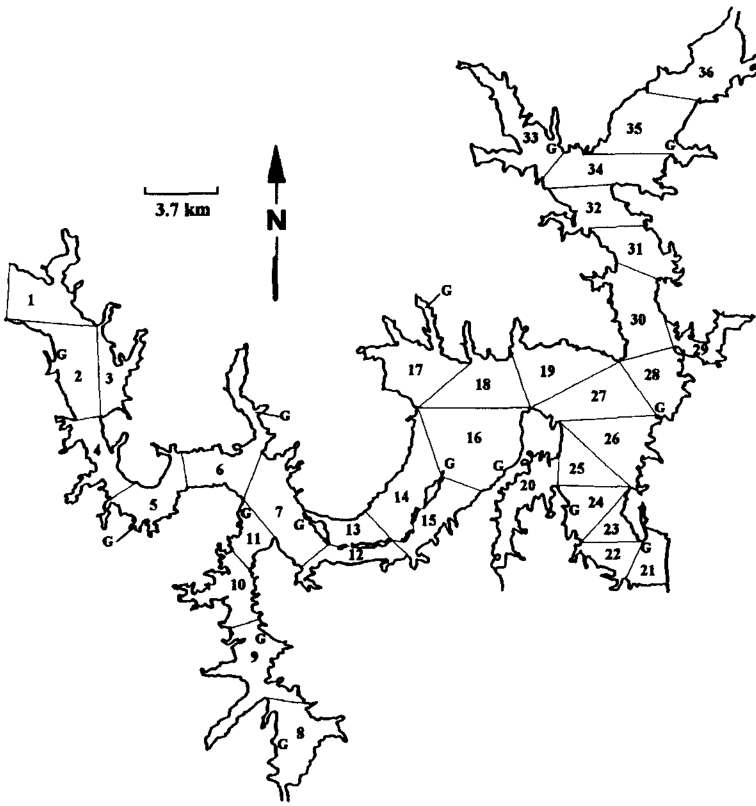

Figure 1. Location of gill net stations (G) and creel boat/angler count areas, Lake Texoma, Texas-Oklahoma, 1987–1993.

anglers in each party, hours fished, species sought, and numbers of each species harvested by 2.54-cm size group. Striped bass harvest (*N*/year and *N* ≥508 mm/year), and directed angling pressure towards striped bass (angler-hours/ha/year) were determined from angler interviews and boat/angler counts according to methods described by Malvestuto (1983) and Lambou (1961), respectively. Average daily bag of fish ≥508 mm and non-compliance rates for harvest regulations were also determined from angler interviews. Harvest and directed angling pressure were minimum estimates, since angler interviews were taken before a fishing trip was completed.

Gill nets were used to estimate changes in striped bass population abundance and size structure. From 1987 to 1993 gill nets were set during February at 15 stations (Fig. 1). Experimental monofilament gill nets were 38 m long and 2 m deep with 7.6-m mesh-size panels increasing from 26 mm to 77 mm in 13-mm increments. Nets were set in the afternoon and retrieved the following morning. Numbers and sizes (mm total length) of striped bass in each net were recorded to determine catch per unit effort (fish per net) of all striped bass and those ≥508 mm.

A 1-way analysis of variance (ANOVA) model was used to test differences before and after the regulation change in 6 variables: number of striped bass harvested/year, number of striped bass ≥508 mm harvested/year, angler-hours/ha/year seeking striped bass, number of striped bass/gill net, number of striped bass ≥508 mm/gill net, and percent of striped bass ≥508 mm collected by gill nets. A log (n+1) transformation was performed to normalize striped bass gill net data. Percent of striped bass ≥508 mm collected by gill nets was transformed with the arcsine of its square root to approximate univariate normality. Harvest and angler-hours/ha/year values were weighted by the inverse of their variances to effect variance homogeneity. Analyses were performed using the Statistical Analysis System (SAS) General Linear Models procedure (SAS Inst. 1988). Statistical comparisons were significant at $P \leq 0.05$.

Results

Harvest of striped bass (*N*/year) did not change significantly after the regulation change ($P = 0.6095$, Fig. 2). As expected, however, harvest of fish ≥508 mm decreased significantly ($P = 0.0307$) after the regulation change (Fig. 2). The annual harvest of striped bass ≥508 mm was reduced by an average of 55% after the change. This was also evident in average daily bag of striped bass ≥508 mm. Before the regulation change it was 1.4, while after the change the average daily bag of fish ≥508 mm dropped to 0.7. Non-compliance rate for legal harvest of striped bass ≥508 mm was negligible before and after the change, 0.8% and 6.6%, respectively. Thus non-compliance should not have prevented the regulation from producing the desired effects. Directed angling pressure towards striped bass (angler-hours/ha/year; Fig. 3) remained statistically the same before and after the regulation change ($P = 0.3449$).

The management strategy to increase abundance of striped bass ≥508 mm in Lake Texoma by implementing the current regulation was not realized. Gill net catch rate of all striped bass and those ≥508 mm (Fig. 4) did not change significantly after the regulation was implemented ($P = 0.2757$ and $P = 0.6411$, respectively). Percent of striped bass ≥508 mm collected in gill nets fluctuated around 26% and was not significantly different after the regulation change ($P = 0.7893$).

Discussion

Apparently the current harvest regulation has not influenced the striped bass population in Lake Texoma, which has remained stable over the past 7 years in terms of abundance and size structure. In 1982 the regulation was liberalized to allow angler harvest of the expanding striped bass population, especially fish <508 mm. When it appeared anglers were over-harvesting large (≥508 mm) striped bass, the regulation was modified in 1989 to reduce the harvest of large fish. Despite these efforts there has been no significant increase in abundance of striped bass ≥508 mm. Perhaps factors besides over-harvest

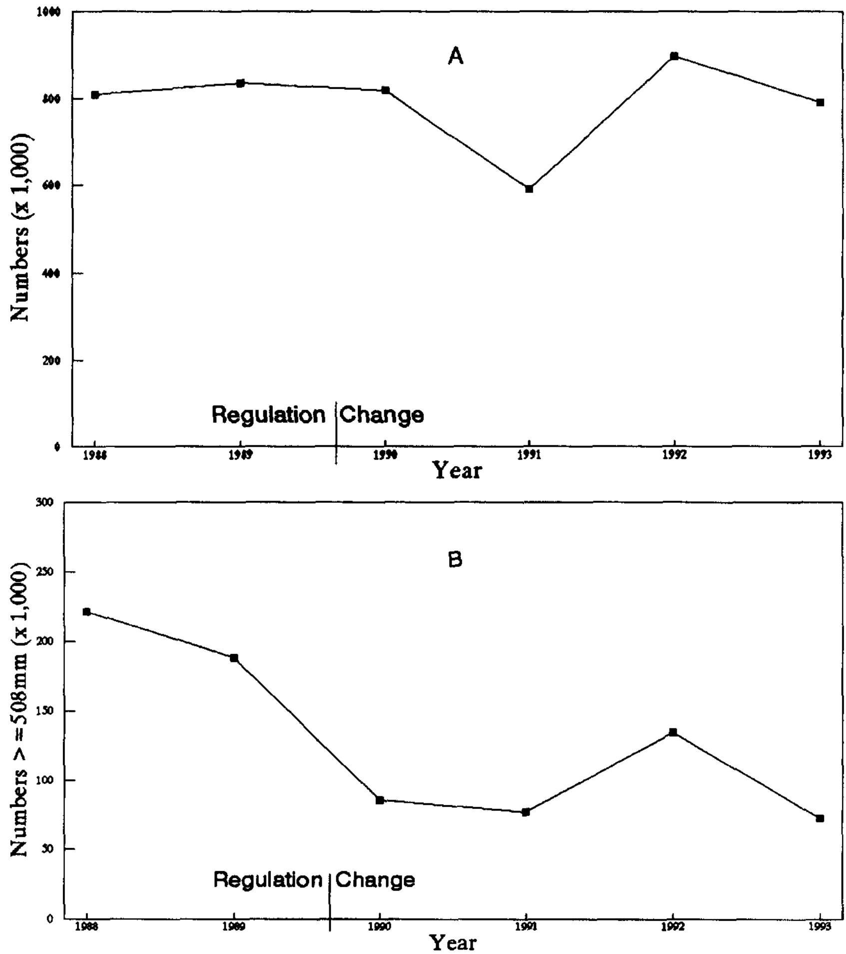

Figure 2. Angler harvest for striped bass (A) and striped bass ≥508 mm (B) at Lake Texoma, Texas-Oklahoma, 1988–1993. Time span for each creel year runs from 1 September to 31 August, e.g., 1988 = 1 September 1987 to 31 August 1988.

prevented the regulation from affecting the striped bass population. Other factors may include angler induced mortality (AIM), growth overfishing, weak year-class formation, inbreeding, or a combination of these factors.

Hysmith et. al. (1992) estimated hooking mortality of striped bass ≥508 mm was 56%, which strongly suggests AIM may have negated the intended benefits of the current regulation. According to Gigliotti and Taylor (1990) most of the benefits of catch-and-release regulations, in terms of increased numbers and sizes of fish, are lost when 20% of large-sized fish (in this case striped bass ≥508 mm) are harvested illegally. Clearly the 20% level was exceeded due to AIM, which may have been the single most causal factor preventing the regulation from increasing abundance of large striped bass. To reduce AIM, Hysmith

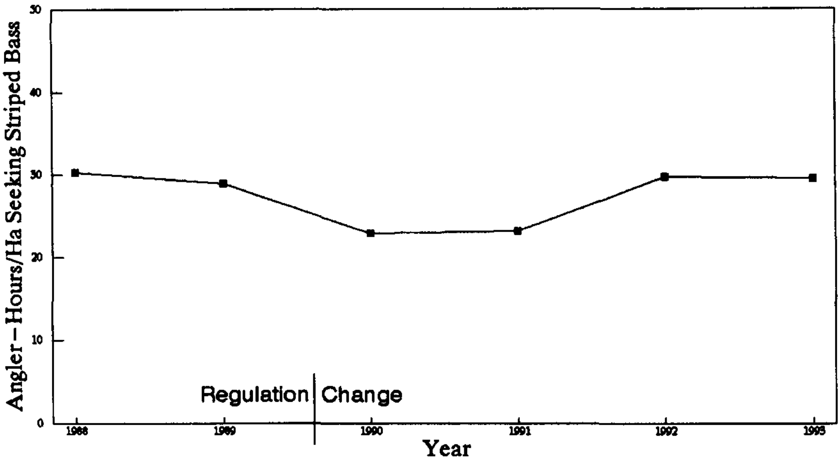

Figure 3. Directed angling pressure towards striped bass (angler-hours/ha/year) at Lake Texoma, Texas-Oklahoma, 1988–1993. Time span for each creel year runs from 1 September to 31 August, e.g., 1988 = 1 September 1987 to 31 August 1988.

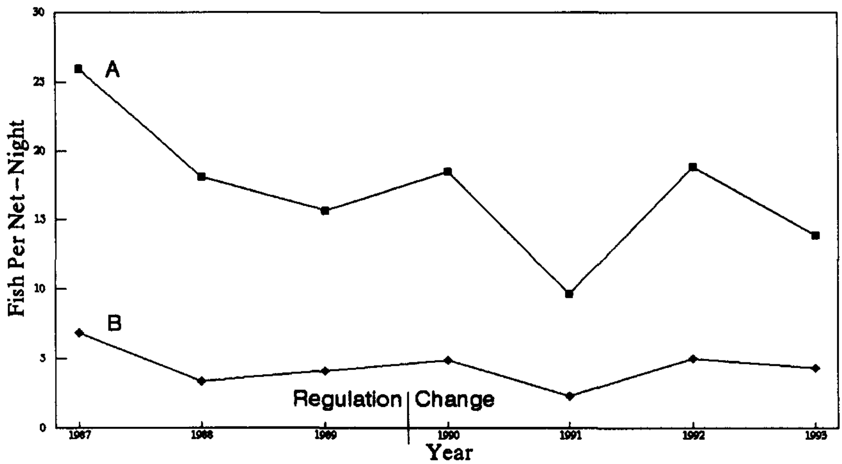

Figure 4. Mean unit catches of striped bass (A) and striped bass ≥508 mm (B) in gill nets in Lake Texoma, Texas-Oklahoma, February, 1987–1993.

et. al. (1992) suggested prohibiting the use of live (or natural) bait during the spring and summer as a method of taking striped bass. This bait type and period accounted for the highest hooking mortality.

The current regulation on Lake Texoma encourages a disproportionate harvest of small striped bass. Since overall harvest of striped bass did not significantly decrease following the regulation change and harvest of fish ≥508 mm did, the harvest of fish <508 mm increased. This may have induced growth overfishing, which occurs when anglers take smaller fish to maintain their traditional or expected creel, thereby reducing recruitment of fish to large sizes (Webb and Ott 1991). Reduced recruitment of these smaller fish beyond 508 mm because of growth overfishing would explain why there was not an increase in abundance of striped bass ≥508 mm following the regulation change. Further, growth overfishing results in populations that are stable but consist mainly of small fish. The striped bass population of Lake Texoma was stable and consisted mainly of fish <508 mm. Growth overfishing can be alleviated by minimum-length limits (Webb and Ott 1991). However, the hooking mortality of caught-and-released striped bass <508 mm at Lake Texoma was 33.3% (Hysmith et. al. 1992), which could minimize any benefits associated with a minimum length limit and ultimately result in waste of the resource.

The possibility of weak year-class formation also may have had some influence on the abundance of striped bass ≥508 mm. Although not statistically significant, striped bass gill net catch rates from 1987 to 1988 suggests an apparent decline (Fig. 4) in striped bass abundance. Therefore, no increase in abundance of striped bass ≥508 mm in later years would be expected.

Inbreeding or the mating among related individuals results in an increase in homozygosity (Gall 1987). Further, inbreeding reduces the size of the gene pool since a limited number of broodstock produce a population with reduced genetic variability. While the concept is much more complex than stated, it could be a factor in suppressing the abundance of large fish in Lake Texoma. Although ODWC stocked approximately 1 million fingerlings, these fingerlings could have come from a limited number of broodfish. The detrimental effects of inbreeding can be corrected by increasing genetic variability with striped bass from a different gene pool than the original broodstock. However, research studies on the incidence of inbreeding of striped bass in Lake Texoma and the amount of inbreeding need to be conducted.

Management of the striped bass fishery in Lake Texoma has become a complex biological and social problem. New regulations to increase the abundance of striped bass ≥508 mm (restrictive length limits or drastically reduced bag limits) will cause a reduction in the harvest of smaller fish to which anglers have been accustomed. Striped bass harvest should remain at present levels with the current regulation, but an increase of trophy fish in the creel will probably not happen. The current lake record of 15.93 kg was set in 1984, and no fish close to that size has been reported in years. The solution may be a combination of regulations and actions discussed above.

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