Development and Management of an Urban Fishery with Hybrid Striped Bass

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Abstract: Striped bass (*Morone saxatilis*) x white bass (*M. chrysops*) hybrids were introduced into Lake Osborne, Florida, annually from 1975 to 1983 as a shad control agent and sport fish for an urban fishery. Stocking rates ranged from 21 to 337 fish per hectare. Peak season creel surveys have documented a substantial hybrid fishery in terms of harvest and effort. Creel censuses indicated 21%, 8%, 2%, and 6% stocking rate returns, respectively, during 4 creel periods from 1980 to 1984 on young-of-year fish. The majority of the hybrids were harvested by bank fishermen using bait shrimp in constricted lake areas with increased water current. Clupeid fishes were the principal food item found in stomachs of hybrids. There was no apparent impact on shad populations from intensive hybrid stockings. Fingerlings averaging 40 mm total length stocked in April demonstrated better survival and growth than those stocked <40 mm. Fishermen harvest generally began in October when fish averaged 200 to 270 mm total length. The mean size of the hybrids at 1 year was 320 mm total length and weight 467 g.

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Large numbers of potential urban fishermen are deprived of quality fishing opportunities (Duttweiler 1975, Scott 1973). There is a definite need for fisheries managers to provide these urban societies with fishing opportunities. In many states, urban fishing programs include stocking waters with various predator species, panfish, catfish, bullheads, carp, and other fishes. Urban programs frequently provide access by construction of boat ramps, fishing piers, and even fee fishing lakes, but do little to enhance fish habitat. Urban fishing programs in Florida include installation of fish attractors, fish habitat manipulation by transplanting desirable aquatic plants, and the stocking of centrarchids and hybrid striped bass. The purpose of this paper is to demonstrate the use of hybrid striped bass as a fish management tool for urban lakes. The author

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Methods

Lake Osborne is located in the densely populated county of Palm Beach near the city of Lake Worth, Florida. It is a multiple use recreational lake consisting of 144 ha. Much of the lake is within a county park, and approximately 50% of the shoreline is residentially developed. Water flows through the lake via urban and agricultural canals.

Population growth and accelerated municipal development has created a need for urban fishing areas. Like many urban lakes in Florida, Lake Osborne's habitat has been degraded due to shoreline dredging and filling and impact from storm water effluent. Urban runoff and associated pollution has caused a gradual degredation of water quality and is expressed by a fish population dominated by shad species.

Hybrids were introduced to utilize an abundant standing crop of gizzard (*Dorosoma cepedianum*) and threadfin (*D. petenese*) shad and to supplement an urban sport fishery through put, grow, and take. Hybrid fingerlings were initially stocked in 1975 and in each subsequent year to 1983 at various rates for a total of 171,400 fish. All hybrids were reciprocals (striped bass male x white bass female) except for partial introductions of originals (striped bass female x white bass male) in 1981 and 1982. Average size of hybrids stocked was 40 mm except for the 1982 fish which were smaller. Stocking rates were 49, 49, 49, 83, 21, 97, 166, 338 and 338 fish/ha respectively during 1975 through 1983. Rates were computed based on actual lake area excluding the miles of interconnecting canals.

Fish population data was collected annually from 1972 through 1974, and from 1977 through 1983 with rotenone from 0.4-ha sites enclosed by blocknets (Table 1). Most hybrids used for growth data were collected by hook and line. Recovered hybrids were measured in millimeters for total and standard length and weighed to the nearest gram.

A roving creel survey utilizing non-uniform probabilities was implemented on Lake Osborne (excluding canals) during the peak hybrid season (fall to early spring from 1980 through 1984) to monitor angler harvest, effort, and success of sport fishing with emphasis placed on hybrids. This program was coordinated through North Carolina State University, Institute of Statistics.

Results and Discussion

The hybrid fishery which has developed in Lake Osborne is generally considered to be excellent. The peak harvest season begins in the fall (October–November) when the Age-0 fish (April–May introductions) reach harvestable size (TL 200–270 mm) and become susceptible to angling (Figs. 1

Table 1. Mean number and weight for major fish species collected by blocknets in Lake Osborne, 1972–1983. N = number of 0.4-ha samples; n = mean number of fish per 0.4-ha; x = mean weight (kg) per 0.4-ha.

		All species		Percent sport fish	Largemouth bass		Bluegill		Redear sunfish		Shad species	
Year	N	n	x	by weight	n	x	n	x	n	x	n	x
1972	2	2,392	80	16	18	2	328	6	29	2	913	51
1973	1	904	117	30	52	13	289	9	84	10	301	59
1974	3	7,878	128	47	291	12	3,143	29	179	9	685	51
1977	2	893	53	31	13	3	381	6	24	3	300	34
1978	3	2,096	96	29	25	4	921	17	131	7	964	67
1979	2	7,671	215	11	21	4	333	9	204	11	7,052	190
1980	2	9,859	493	9	69	18	1,680	15	183	16	7,555	446
1981	2	4,984	143	41	37	7	2,691	25	374	25	1,511	82
1982	4	4,843	96	52	17	4	2,587	26	313	18	1,498	44
1983	2	9,132	213	38	71	5	3,084	42	570	28	5,046	129

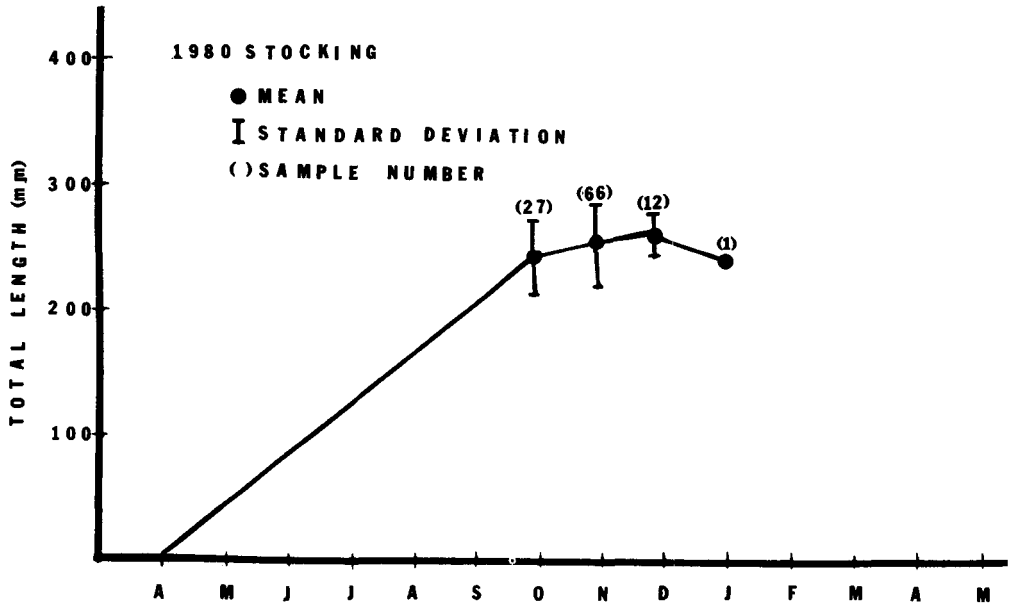

Figure 1. Hybrid striped bass growth rate derived from fishermen catches, Lake Osborne, Florida, 1980–1981.

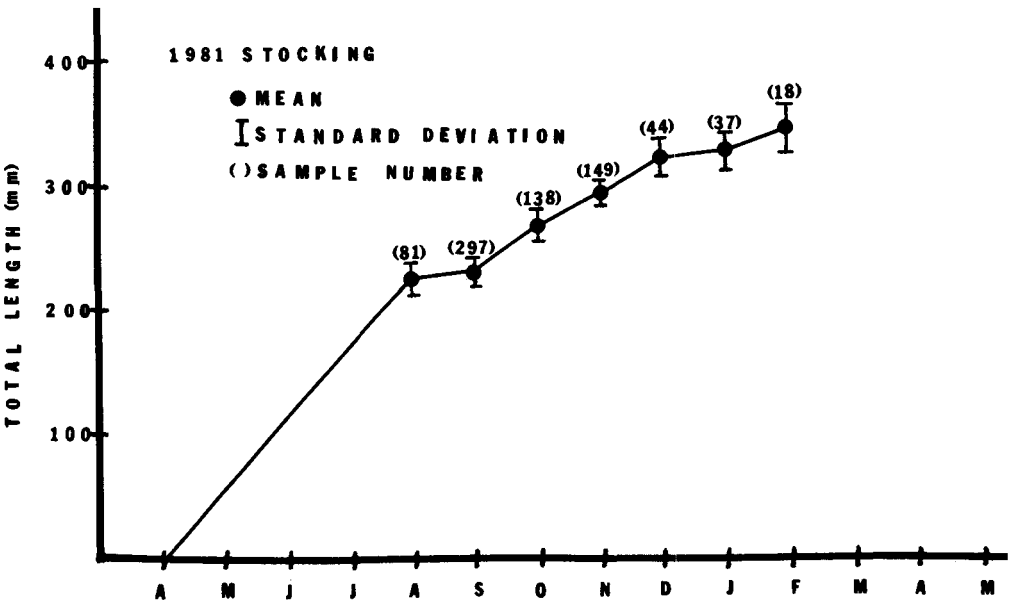

Figure 2. Hybrid striped bass growth rate derived from fishermen catches, Lake Osborne, Florida, 1981–1982.

through 4). During October–February, fishing pressure is greatest and multiple catches are common. This information is based on 2-week period creel data which is not presented. In 1982, the daily creel limit of 6 fish was raised to 10. During the cooler months (December–February), fish from older age groups (0.9–2.0 kg) are caught more frequently. Fishing success declines with increasing water temperature in the spring. The seasonal fishery at Lake Osborne compares with the seasonal hybrid fishery (originals) reported in Texas by Crandall (1978), and in Florida (original and reciprocal) by Ware (1975).

A strong young-of-the-year population providing multiple catches per trip was required to interest urban fishermen. Edwards and Okamoto (1980) reported that in a put and take urban fishery, angling pressure is influenced by stocking and harvest. High catch-rates result in high fishing pressure while negligible catches quickly result in reduced angler use. Based on personal observation and creel data, it appears that hybrid activity and harvest are stimulated by cooler water temperatures and water movement.

During periods of rainfall, coastal runoff is conveyed through the lake for discharge into the Intra-coastal Waterway. These increased water currents occur along several constricted shoreline areas attracting hybrid concentrations that are available to bank fishermen.

Most hybrids in this fishery are caught by bank fishermen using bottom rigs with both fresh or frozen shrimp. Some fish, however, are taken on other types of cut or live bait and artificial lures. Early morning, late evening, and nighttime hours are the most productive. Simplicity of the fishing method and seasonal high harvest rates stimulate hybrid fishing activity. Due to easy access areas, family participation is common.

Shupp (1976) suggested that following program initiation, the urban fishing water should be monitored to evaluate the effectiveness of its program. Creel results (Table 2) from Lake Osborne (1980–81) estimated the 124-day peak season total catch at 2,985 hybrids, a yield of 20 reciprocals/ha. Fishing pressure for reciprocals amounted to 3,073 man-hours (12%), ranking fourth in popularity behind largemouth bass (42%), panfish (21%), and black crappie (17%). The catch rate was 0.83 reciprocals/man-hour for hybrid fishermen. All recorded catches were from the 14,000 fingerlings stocked the previous spring (1980). This represents a 21% return. Total return would be greater since estimates do not include fish caught at night or fish harvested prior to and after the creel survey. While older year classes were caught, none were recorded during creel days. Harvest began in October of fish ranging from 194 to 280 mm total length (Fig. 1). Average size increased during November and December.

To determine optimum stocking density based on percent angler return, the stocking rate was increased in 1981 to 24,000 hybrids (reciprocals and originals). Creel results from 1981–82 estimated the 126-day total catch at 2,269 hybrids, a yield of 15 fish/ha. Fishing pressure amounted to 7,214 man-hours (26%), ranking second in popularity only to largemouth bass (37%).

Table 2. Expanded harvest, effort, and success estimate comparisons from 4 roving creels on Lake Osborne, Florida.

Species	Harvest				Effort (man-hours)				Success rate fish per hour			
	1980–81	1981–82	1982–83	1983–84	1980–81	1981–82	1982–83	1983–84	1980–81	1981–82	1982–83	1983–84
Largemouth bass	1,918	2,097	2,384	3,349	10,616	10,156	8,503	16,291	0.2	0.2	0.3	0.2
Black crappie	5,930	4,363	3,416	2,096	4,221	2,545	2,415	1,314	1.9	1.7	1.4	1.6
Bream	9,340	14,819	9,500	8,343	5,380	7,163	4,722	4,253	1.9	1.8	1.8	2.6
Hybrid bass total	2,985	2,269	1,486	3,204	3,073	7,214	2,663	3,580	0.8	0.2	0.2	0.8
Miscellaneous	441	117	332	1,703	1,567	41	0	3,967				0.4
Total	20,614	23,665	20,663	18,695	24,857	27,119	18,303	29,405				

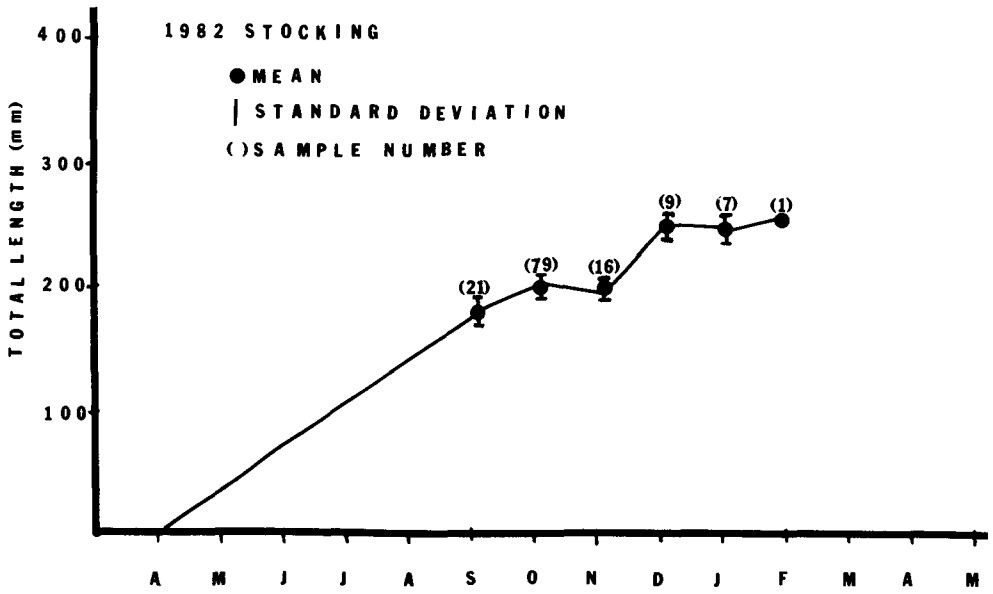

Figure 3. Hybrid striped bass growth rate derived from fishermen catches, Lake Osborne, Florida, 1982–1983.

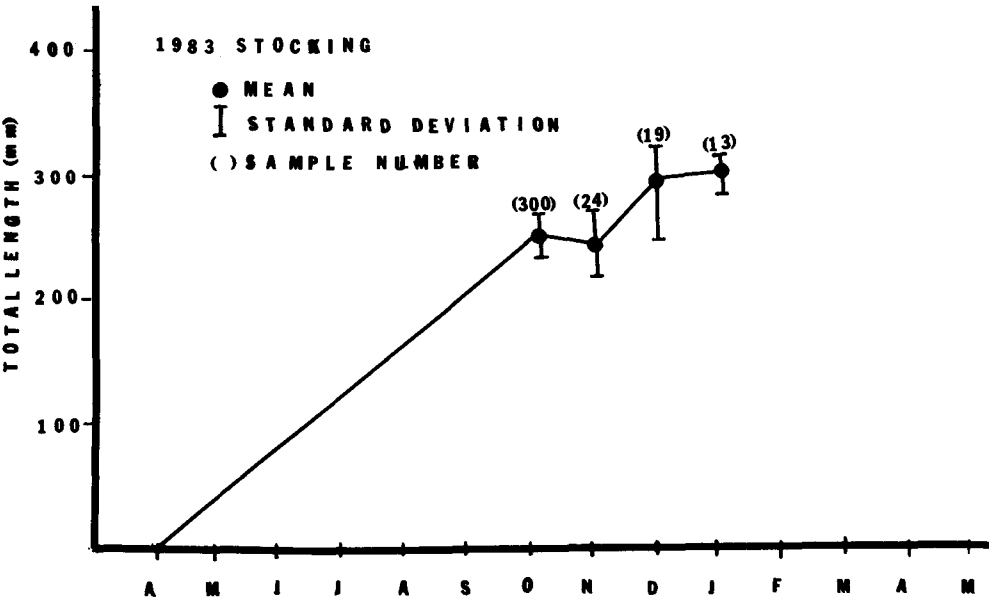

Figure 4. Hybrid striped bass growth rate derived from fishermen catches, Lake Osborne, Florida, 1983–1984.

The catch rate was 0.25 hybrids/man-hour for hybrid fishermen. Eighty-one percent of the recorded hybrids were Age-0 fish while 19% were older fish weighing up to 2.2 kg. This represents an 8% young-of-the-year stocking rate return during the creel period. Due to exceptional growth, an early harvest began in August with most fish greater than 200 mm. total length (Fig. 2).

The increased stocking rate did not increase the total number of hybrids harvested during the creel period, although the fishing pressure accelerated by 134% consequently lowering the success rate over the previous survey. However, a greater post-survey harvest was observed.

The stocking rate was further increased in 1982 to 48,700 hybrids, using a combination of reciprocals and originals. The purpose of the increased rate was to determine if the open system could be overstocked. Creel results from 1982–83 estimated the 126-day total catch at 1,486 hybrids, a yield of 10 fish/ha. Fishing pressure amounted to 2,663 man-hours. The catch rate was 0.26 hybrids/man-hour for hybrid fishermen. Fifty-six percent of the hybrids examined ($N = 25$) during creel days were from the 1982 year-class (Age-0), while 44% were older year classes. These figures represent a 2% stocking rate return during the creel period. Although the hybrid stocking rate was doubled over the previous year, harvest, growth rates, and fishermen interest decreased. Two reasons for these actions were theorized: overstocking and/or stocking of poor quality fish. The 1982 fingerlings were smaller, exhibited slower growth rates, and most probable lower survival rates than previous stockings. Harvest began in September; however, fish <200 mm total length dominated the catch until December (Fig. 3).

To determine if the below average growth rate for the 1982 year class

Table 3. Length distribution and mean number of shad species for block net samples conducted in Lake Osborne, Florida.

Inch group[a]	1977 ($N = 2$)	1978 ($N = 3$)	1979 ($N = 2$)	1980 ($N = 2$)	1981 ($N = 2$)	1982 ($N = 4$)	1983 ($N = 2$)
1	1		239			1	
2	14		3,468	187	14	308	
3	122		1,969	2,108	156	699	1,071
4	32	429	680	1,459	540	102	3,062
5	1	43		377	370	92	148
6	1	1		1,168	29	105	291
7	1	116		524	50	2	51
8	2	121	15	84	22	1	6
9	48	105	256	509	19	6	10
10	46	87	347	624	114	20	124
11	23	39	66	397	100	81	223
12	11	8	11	30	60	44	45
13	3	14	1	79	22	21	12
14				6	12	4	1
15					1	1	
Total	305	858	7,052	7,552	1,509	1,487	5,044

[a] Fish <4 inches are mostly threadfin shad.

was caused by the higher stocking rate or by the stocking of smaller, less desirable fingerlings (<40 mm), the previous stocking rate was duplicated in 1983 with larger fish. Forty eight thousand and seven hundred reciprocal hybrids 40 mm total length were stocked. Creel results from 1983–84 estimated the 125-day total catch at 3,204 hybrids, a yield of 22 fish/ha. Fishing pressure amounted to 3,580 man-hours. The catch rate was 0.77 hybrids/man-hour for hybrid fishermen. Ninety percent of the hybrids examined ($N = 68$) during creel days were from the 1983 year class stocked the previous spring, while 10% were older year classes. By expanding these percentages, a 6% stocking rate return was calculated for young-of-year fish. In addition, harvest of another 1,000 fish was documented prior to the creel period, which would increase the return rate. Growth and harvest data for the 1983 fish were satisfactory, indicating that the below normal results in 1982 were probably due to stocking fish <40 mm total length, and not from overstocking. Nearly all fish harvested by October were >200 mm total length (Fig. 4).

Clupeid fishes were the most common forage for the reciprocal hybrids in Lake Osborne; however, hybrids did not discernably alter shad population during the period from 1975 to 1983 (Table 3). Similar findings on food habits are reported on original hybrids from Lake Bastrop, Texas (Crandall 1978), and from Hartwell Reservoir, South Carolina (Williams 1970). Ware (1974) identified clupeid fishes as the principal forage for original and reciprocal hybrids in Florida lakes.

Fish stocked in the spring when mean total length was 40 mm averaged 263 mm (TL) and 257 g by fall and early winter (September–November). By late winter and early spring (February–April) the fish obtained a mean length of 320 mm and mean weight of 467 g. Ware (1975) reported first year growth, calculated as mean total length, at 307 mm and 355 mm for 2 populations of Florida reciprocal hybrids.

Age-growth data are not presented on older year classes due to difficulty in age determination of fish >370 mm.

Conclusions

With an appropriate forage base, a hybrid put, grow, and take fishery can be established to enhance urban sport fishing. Hybrid introductions serve as a management tool in urban waters where intense fishing pressure and degraded water quality make it difficult to manage native sport fish. Shupp (1972) reported that the primary objective of an urban fishing program is recreation, and that fishing pressure is the measure by which success of the program can be judged. Hybrid introductions contributed substantially to the Lake Osborne fishery in terms of seasonal harvest and fishing pressure.

Three important factors were recognized as contributing to the success of Lake Osborne's hybrid fishery. First, lake areas with constricted shoreline provided increased water current and subsequent hybrid concentrations avail-

able to bank fishermen. Second, increased water movement due to conveyance of coastal run-off during periods of heavy rainfall concentrated hybrids at mouths of in-flowing canals in addition to the constricted zones. Third, stocking of hybrids with mean total lengths of ≥40 mm exhibited better growth and harvest when compared to those stocked with mean total lengths <40 mm.

The higher stocking rate of 337 fish/ha did not significantly increase the harvest when compared to stocking rates of 97/ha or 166/ha. Based on limited data, in the author's opinion, the optimum stocking rate for Lake Osborne was determined to be approximately 138 fish/ha.

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