

Evaluation of White Bass X Striped Bass Hybrids in a Hypereutrophic Florida Lake

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Abstract: Fingerling *Morone* hybrids were stocked into Lake Apopka, Florida, in an attempt to create a sportfishery in the hypereutrophic lake. The lake was stocked with 635,000 original hybrids (8 fish/ha) in May, 1980 and 315,000 original hybrids (4 fish/ha) in May, 1981. Growth during their first year (age 0) was not rapid for either year class, however, by 23 months the mean total length of the 1980 year class was comparable to that of other hybrids in Florida and the southeast. Analysis of stomach contents indicated extensive use of shad (*Dorosoma* spp.), although grass shrimp (Palaemonidae) comprised a large part of the stomach contents of hybrids 292 mm total length and smaller. Enthusiastically accepted by anglers, a successful but localized put-grow-and-take sportfishery was created.

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Hybrids of the white bass (*Morone chrysops*) male and striped bass (*M. saxatilis*) female have been introduced into lakes and reservoirs throughout the southeast to create new sportfisheries. Fast growing and pelagic, the hybrid not only utilizes shad species but has resulted in harvestable populations within a year (Bishop 1967, Williams 1970, Crandall 1978). A hybrid bass program was initiated in Florida in 1972 (Ware, 1974) and the fish have since been stocked statewide in lakes of divergent water quality. Criteria for stocking hybrids in Florida waters typically include abundant forage, an ailing sportfishery, and an opportunity to increase angler success. Hypereutrophic lakes, which exhibit these characteristics most strongly, are of particular interest. Survival and satisfactory growth of hybrids in such lakes would supplement existing fisheries or create a fishery where one no longer exists. The objectives of this study were to evaluate growth of the hybrid and

to create a sportfishery in a hypereutrophic Florida lake in which other management options were not feasible.

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Methods

Lake Apopka has a surface area of 13,200 ha and drains an area of 213 km². Located in both Lake and Orange counties, it is the headwaters of the Oklawaha River which flows northward, ultimately emptying into the St. Johns River. Gourdneck Springs, located in the southwest end of the lake, supplies a constant flow of ground water averaging 0.82 m³/sec.

Supporting only remnants of its once famous sportfishery, this hypereutrophic lake was historically characterized by extremely productive largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), redear sunfish (*L. microlophus*), and black crappie (*Pomoxis nigromaculatis*) populations. At present, the lake has virtually no largemouth bass population, and marginal bluegill, redear sunfish, and black crappie populations. A stunted catfish (*Ictalurus* spp.) population supports an active commercial fishery. Gizzard shad (*Dorosoma cepedianum*) and threadfin shad (*D. petenense*) are the most abundant species in Lake Apopka.

Perennial phytoplankton blooms have ultimately resulted in massive summer fish kills consisting primarily of shad. Thick, shifting, organic sediment covers much of the lake bottom. Sources of nutrient enrichment have included agricultural operations and municipal sewage effluent. Steps to abate nutrient input have been taken; agricultural practices have been modified and point source influents have been stopped or altered. Proposed habitat restoration plans involving extreme drawdowns have been rejected due to cost and potential impact on the local citrus industry. Recognizing that without drastic restorative steps the lake will never support a productive native sportfishery, the Florida Game and Fresh Water Fish Commission implemented an alternative program in an attempt to create a new sportfishery. Six hundred and thirty five thousand original *Morone* hybrid fingerlings (*M. chrysops* male × *M. saxatilis* female) were stocked in May, 1980 (8 fish/per ha). An additional 315,000 original hybrid fingerlings (4 fish per/ha) were introduced in May, 1981.

Gill nets, 45 m in length, 2.4 m deep and ranging from 2.5- to 15.2-cm stretch mesh, were set to collect a minimum of 25 individuals during each sampling period. Standard and total length of each hybrid collected was measured to the nearest millimeter and weights were recorded to the nearest 0.10 g. Sex was determined and stomach contents were removed and identified when possible. Condition factors were calculated using the formula

$K_{s1} = W(g) \times 100,000 / SL(mm)^3$. Hybrids were considered age I at 12 months and age II at 24 months of age. Samples were collected at least quarterly from September, 1980 to February, 1982.

Results and Discussion

Growth

First year growth of *Morone* hybrids stocked in 1980 was not as rapid as reported for hybrids stocked in other Florida lakes, however, by 23 months of age, total lengths were nearly equal. Ware (1974) observed a mean total length of 363 mm for age I Florida hybrids. In contrast, the hybrids in Lake Apopka averaged 292 mm at 13 months; by 23 months they had attained a mean total length of 429.2 mm. Growth in length was essentially linear over the final 6 months of the investigation, averaging approximately 19 mm per month (Table 1, Fig. 1). Hybrids should have attained a mean total length of 448 mm by age II if this growth rate continued, or nearly equal to the 447 mm total length reported for age II hybrids by Ware (1974).

Crandall (1978) reported mean total lengths at annulus formation, back calculated from scale annuli, for original hybrids. Fish from the primary stocking averaged 351 mm and 429 mm at the first and second annulus respectively. While hybrids from Lake Apopka exhibited slower growth in their first year, the mean total length of the 23-month old fish equaled that of age II hybrids from the heated Texas reservoir. Bishop (1967) reported Tennessee hybrids weighed up to 2179.0 g, measuring from 427 to 490 mm total length, at 23 months of age. Generally, Lake Apopka hybrids fell short of this range of lengths (Table 1), however, an individual measuring 490 mm and weighing 1952 g was documented in December, 1981.

The rate of weight gain increased notably between July, 1981, and February, 1982, for the 1980 hybrids (Fig. 1). Although hybrids increased in mean weight by approximately 30 g per month from May, 1980 (stocking) to July, 1981, weight gain accelerated to an average of 132 g per month during the subsequent 7 month period. This rapid increase in production occurred in spite of chronic fish kills throughout July and August, 1981. The hybrids appear to have reached a size during this period that enabled them to more effectively utilize the existing forage base. Average condition factors reflected this growth, increasing from 2.44 in September, 1980, to 3.15 in February, 1982 (Table 1).

Growth of the 1981-year class of hybrids paralleled that of fish stocked in 1980 from September through December (Fig. 1). However, at 11 months the 1981 hybrids exhibited lower total lengths and weights than the 1980-year class (Table 1). Subsequent statistical analysis (Students t) revealed that the apparent difference between mean total length for the 2 year classes

Table 1. Length, Weight and Condition Factors of Hybrid Bass (*Morone chrysops* × *Morone saxatilis*) Collected from September, 1980 to February, 1981

Sampling Date	Age (months)	Number Fish	Total Length Range (mm)	Mean Total Length (mm)	Weight Range (g)	Mean Weight (g)	Mean K-Factor
1980-YEAR CLASS							
Sept. 1980	6	84	130-215	173	32.8- 120.7	61.6	2.44
Dec. 1980	9	112	183-280	229	68.0- 299.1	133.0	2.38
Feb. 1981	11	180	186-341	262	65.9- 602.3	223.6	2.56
Apr. 1981	13	107	228-373	292	120.5- 659.0	311.8	2.53
July 1981	16	47	243-398	304	154.8- 767.2	357.4	2.44
Sept. 1981	18	12	268-420	347	188.9-1,107.0	568.3	2.63
Dec. 1981	21	83	364-490	416	688.9-1,952.2	1,027.5	3.07
Feb. 1982	23	10	373-482	429	648.1-1,909.8	1,281.3	3.15
1981-YEAR CLASS							
Sept. 1981	6	26	137-225	177	31.0- 139.2	65.5	2.49
Dec. 1981	9	6	221-241	231	112.6- 150.1	129.4	2.29
Feb. 1982	11	16	217-275	252	98.3- 221.8	162.9	2.20

was not significant, while the mean weights did differ significantly ($P < 0.05$). This difference is reflected in average k-factors for the 2 year classes (Table 1). Crandall (1978) also noted slower growth rates for hybrids introduced following an initial stocking. While competition from the 1980-year class may be one explanation for the reduced growth rate of the 1981 hybrids, loss of properly sized forage due to the summer fish kills may have also been a contributing factor.

Food Habits

Fifty percent (306) of the 617 stomachs analyzed contained food organisms (Table 2). Shad and grass shrimp were the major items identified. Shad were removed from 60% of the stomachs containing food, while grass shrimp were found in 22%.

Utilization of grass shrimp was related to hybrid size. Shrimp were not found in the stomachs of fish larger than 292 mm total length, however, 27% of those fish 292 mm or smaller, whose stomachs contained food, had fed on this food item. Although grass shrimp comprised the greatest percentage of total food items found in the stomachs of smaller hybrids, they still ranked

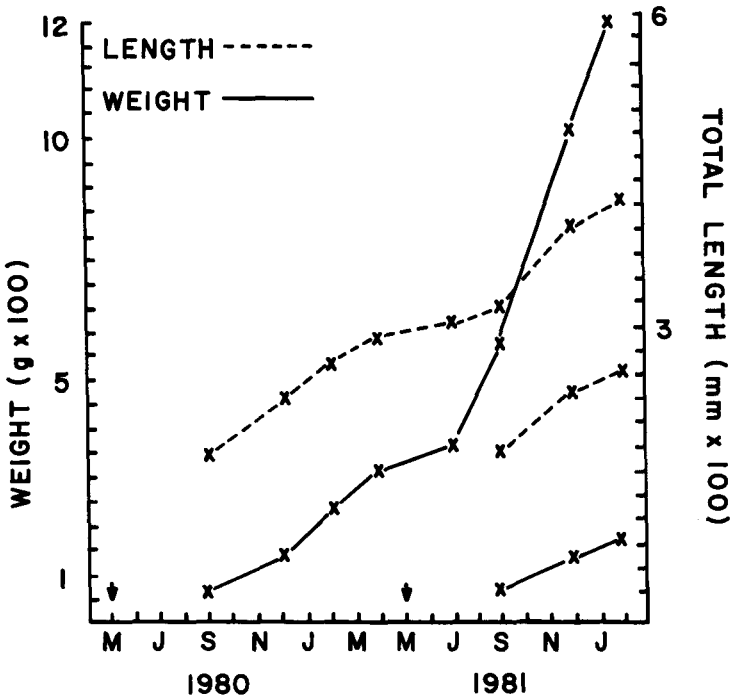


Figure 1. Growth rates of striped bass x white bass hybrids in Lake Apopka.

Table 2. Frequency and Number of Food Items Found in Stomach Contents of *Morone* Hybrids (*Morone chrysops* × *M. saxatilis*) 292 mm TL and Smaller and Greater Than 292 mm TL Collected From Lake Apopka, Florida, from September, 1980 to February, 1982

Food Item	Frequency of Occurrence		Percent Frequency of Occurrence		Total Number of Organisms Ingested		Percent of Total Food Items Ingested	
	≤ 292 mm	> 292 mm	≤ 292 mm	> 292 mm	≤ 292 mm	> 292 mm	≤ 292 mm	> 292 mm
Shad species	135	50	55.6	79.4	191	72	28.9	83.7
Other fish	36	2	14.8	3.2	78	2	11.9	2.3
Unidentified fish remains	26	11	10.7	17.5	29	11	4.4	12.8
Grass shrimp (Palaemonidae)	66		27.2		356		53.9	
Other invertebrates	5	1	2.0	1.6	6	1	1.1	1.2
# fish examined	451	166						
# stomachs containing food	243	63						
Percent stomachs containing food	53.9	38.0						

second to shad in frequency of occurrence (Table 2). This selectivity may have been due to the difference in size of the forage organisms as well as their availability.

Shad occurred in 79% of the stomachs of hybrids greater than 292 mm that contained food items and represented 84% of all food items ingested (Table 2). This preference for shad species is consistent with observations of Bishop (1967), Williams (1970) and Ware (1974).

The mean total length of the 1980 hybrids was 347.4 mm in September, 1981; shad were found in 83% of the stomachs containing food while grass shrimp were absent (Table 3). It appears that the majority of the hybrids had converted to a shad based diet. Apparently the hybrids had attained a size that enabled them to utilize larger shad. The nearly exclusive utilization of shad by the 1980-year class coincided with the period of rapid weight gain (Fig. 1). Hybrids from the 1981-year class demonstrated low utilization of shad and a greater dependence on grass shrimp in this same sampling period (Table 3).

Bayless (1972, according to Ware 1974) stated that the survival of *Morone* hybrids may be dependent on shad availability. Extensive fish kills that occurred in July and August may have had a detrimental effect on the 1981-year class (age 0) by creating a shortage of desirable sized shad. This factor combined with any competition exerted by the 1980-year class of hybrids, may have forced the 1981-year class to depend more heavily on grass shrimp. While a causative relationship between the poor growth of 1981 hybrids and their dependence upon grass shrimp might have existed, no conclusion could be drawn without information on the relative nutritional value of the 2 food items.

Angler Response

Hybrids were routinely collected throughout the lake while sampling, however, anglers utilized the spring boil at Gourdneck Springs almost exclusively when fishing for hybrids. Initially "discovered" by crappie fishermen, the hybrids have been enthusiastically accepted. Although no formal creel survey was conducted on Lake Apopka, interviews with anglers revealed that success tended to be greatest during winter months, peaking between December and February. Data acquired from these informal surveys revealed a catch per unit effort in excess of 2 fish per angler hour at times during peak winter months. On December 4, 1981, 3 anglers caught 14 hybrids in 3 hours. A single angler caught his limit of 6 fish in 1.5 hours on the same afternoon. Nine individuals boated 54 fish in 3 hours on December 8, 1981. While angler success is not always high, individuals have been observed to catch their limit in less than 45 minutes. With heavy pressure exerted only in the spring area, exploitation of the fishery is localized.

Table 3. Major Food Items from 319 Hybrid Stomachs by Major Sampling Period

Sampling Date	SHAD				GRASS SHRIMP				Percent of Total Stomachs that Contained Food, 1981	
	1980-Year Class		1981-Year Class		1980-Year Class		1981-Year Class		1980	1981
	Occurrence	Number	Occurrence	Number	Occurrence	Number	Occurrence	Number	Year Class	Year Class
Sept. 1980	33.3	30.3			20.5	26.8			84.6	
Dec. 1980	76.2	48.8			16.0	40.1			72.3	
Feb. 1981	18.4	12.1			47.4	62.1			22.8	
Apr. 1981	68.1	53.3			18.7	8.5			43.1	
July 1981	75.7	23.7			27.0	75.6			80.9	
Sept. 1981	83.3	92.3	20.0	13.6			80.0	81.8	50.0	62.5
Dec. 1981	72.7	76.9	60.0	17.9			40.0	67.9	37.9	83.3
Feb. 1982	50.0	25.0							20.0	0.0

Williams (1970) reported that *Morone* hybrids move into spawning areas with white bass and striped bass during winter months. This may explain the concentration of hybrids in the only area of flowing water (Gourdneck Springs) during the winter months. Gravid females and ripe male hybrids from the 1980-year class were collected in the spring area in December, 1981, and February, 1982. The constant temperature and flowing water provided by the springs may by itself attract the hybrids to the spring boil.

Conclusions

The introduction of *Morone* hybrids was successful in establishing a localized sport fishery in hypereutrophic Lake Apopka. Despite suboptimal growth during the first year, hybrids approached lengths and weights comparable to those throughout Florida and the southeast by the end of the second year of growth. The authors are concerned that the success of the hybrid in Lake Apopka and other eutrophic lakes may generate complacency among the angling public, detracting from the urgency to address nutrient abatement and lake restoration as management strategies for maintaining or improving native sport fisheries. However, the hybrid has proven very useful as an alternative tool, aiding management biologists in meeting their responsibilities to the public by providing a worthwhile angling experience where habitat restoration is not immediately possible.

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