

COMMERCIAL AND RECREATIONAL POTENTIAL OF THE STRIPED BASS X WHITE BASS HYBRID

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ABSTRACT

The striped bass, *Morone saxatilis*, x white bass, *Morone chrysops*, hybrid was first created in 1965 as an effort to develop a fish with the desirable qualities of a striped bass, but with the added ability to reproduce and sustain its populations in inland lakes and reservoirs. While not successful in the latter respect, the hybrid striped bass has surpassed its other expectations, exhibiting several improvements over its parental species. Anglers are enthusiastic about its recreational value while fishery managers have stocked it to provide controlled management of forage species such as threadfin shad. Recently the hybrid has been examined as a candidate for commercial aquaculture, and studies have shown excellent survival, growth, and production capabilities in several different culture environments.

INTRODUCTION

The striped bass, *Morone saxatilis*, has long been one of this country's prized marine gamefish whose ever-increasing popularity has resulted in its introduction to a wide range of new habitats. Since its very successful introduction to San Francisco Bay in 1879, the striped bass has become established in many other coastal areas outside of its native East Coast range. As a result of its highly regarded gamefish reputation with coastal anglers, its voracious appetite for baitfish, and its ability to live in either fresh or salt water environments, interest developed to use the striped bass in freshwater fisheries to control undesirable or overpopulated fish species while simultaneously offering a new freshwater sport fish.

In the early 1960's, fishery managers in several states attempted to develop self-sustaining inland striped bass fisheries, but found that striped bass were unable to reproduce in most reservoirs due to a lack of suitable spawning tributaries. Since the techniques for culturing striped bass fingerlings were still relatively new and unproven, decisions for continuing "put-grow-take" striped bass fisheries based on cost-to-benefit analyses were very difficult. With the idea of creating a fish that could reproduce in freshwater reser-

voirs, and be as well suited as the striped bass for controlling shad populations and providing a trophy recreational fishery, Stevens (1965) crossed the striped bass with several related *Morone* species in 1965. In subsequent experiments on survival and growth in ponds (Bishop 1967), it was decided that the cross between a striped bass female and a white bass (*M. chrysops*) male had produced an excellent candidate for this purpose. Although similar in appearance to its maternal parent, the hybrid was deeper bodied, grew much faster, and appeared to show the hardy nature so often characterized as "hybrid vigor" in many hybrid plants and animals. Unfortunately, or so it was thought at the time, further investigations revealed that the hybrid did not reproduce in the wild, even though it was physiologically capable of doing so, and would not be able to provide self-sustaining populations as originally hoped. However, the hybrid striped bass continued to draw interest as it demonstrated its ability to provide a better return to fishermen than striped bass in "put-grow-take" fisheries (Ware 1974). Today the striped bass hybrid is being stocked in numerous lakes and reservoirs throughout the United States.

BIOLOGY OF THE HYBRID STRIPED BASS

The hybrid striped bass is intermediate in appearance to both parental species. In comparison to the striped bass, its body is deeper, head and jaw smaller, and its back is arched posterior to the head. It can be distinguished from the white bass by the number of tooth patches present; one for the white bass and two for the hybrid. Although the adult hybrid can usually be differentiated from the striped bass based on gross external differences (Bayless 1967), a single meristic or morphometric measurement cannot definitively distinguish the two. Kerby (1979, and 1980) and Williams (1975) have offered a series of combined measurements for definite identification. However, the two fish usually can be distinguished by the number of scales above the lateral line; 7-9 for striped bass and 10-12 (usually) for hybrids (Bayless, 1967).

The major food item of adult hybrid striped bass appears to be threadfin or gizzard shad, but feeding studies indicate that it will eat any live fish including fathead minnows, carp, bluegill, mosquito fish, and golden shiners if they are abundant and of the proper size; usually 3 inches or less (Bishop 1967). Some studies indicate that a successful introduction may depend upon sufficient clupeid forage populations.

The striped bass x white bass hybrid is not physiologically sterile and both sexes produce viable gametes. F2 progeny have been successfully produced and cultured at the Dennis Wildlife Center of the South Carolina Wildlife and Marine Resources Department (Bayless 1972). However, after 16 years of their existence in freshwater rivers and reservoirs, and after early expectations that they would spawn naturally (Kerby, et al., 1971), there "has been no scientific evidence to date that hybrid striped bass have spawned successfully in the wild or crossed back to wild striped bass" (Stevens 1981). Since numerous fry stocking efforts have demonstrated the hybrid's excellent survival potential, it is not likely that this is a coincidence of nature. Although not understood, there may be some mechanism, behavioral or otherwise, that has precluded the reproductive success of striped bass hybrids in the wild. Since the potential does exist for reproduction, caution is advised for introductions where such an occurrence would be detrimental.

RECREATION AND FISHERY MANAGEMENT VALUE

The hybrid striped bass has quickly established a reputation among freshwater anglers as an excellent fighting sportfish with a quality of taste superior to either striped bass or white bass (Bishop 1967). It also provides a peak fishery from January to March when other gamefish catches are often very low (Crandall 1978).

It is the hybrid's lack of reproductive success combined with its other qualities for inland stocking programs that has seen the hybrid gain favor with many fishery managers in recent years. Better control of top predators is now often a goal of fishery management plans and "put-grow-take" reservoir fisheries of hybrids and striped bass offer this option. With the improved methods for rearing both of these fish, the costs for their production have decreased. However, the costs of establishing and maintaining a program have been consistently lower with hybrids than striped bass. Fry introductions, the least cost option, have only been successful with hybrids in establishing a viable fishery, and fry

survival studies in ponds have been greater with hybrid striped bass (Crandall 1978, Ware 1974). In Cherokee Reservoir, Tennessee, release of 35,000 hybrid fry and 3.5 million striped bass fry produced more adult hybrids than striped bass (10:1) and provided a return to the fisherman that favor the hybrid by a ratio of 80:1 (Bishop 1967). Crandall (1978) determined the cumulative cost-to-benefit ratio of stocking hybrids into Lake Bastrop, Texas, in terms of harvest and recreational value at 1:12 and 1:13, respectively. He suggested that these favorable benefits resulted from the "relatively low cost of introducing hybrids and to their harvestability."

During 1982, Aquatic Systems Incorporated successfully produced the first cross of striped bass and white bass in the western United States in cooperation with the Oregon Department of Fish and Wildlife. After several months of pond culture, 3000 hybrid fingerlings were recently released into North Ten Mile Lake, Oregon, as part of a carefully planned lake management program. Previous illegal introduction of bluegills into this system has severely impacted the native coho salmon populations of this coastal tributary lake. A prior attempt to chemically eradicate the bluegill was unsuccessful and is no longer an economically viable alternative. It is hoped that the introduction of the hybrid striped bass will reduce the competing bluegill populations, and, with simultaneous coho enhancement efforts, enable the salmon to survive. Considering the prior dismal prognosis for this salmon population, their future remains uncertain. In this instance, it was decided that the hybrid's introduction would at least provide a new sportfishery where none would otherwise exist, aside from their possible ability to bolster salmon survival.

AGRICULTURE VALUE AND PRODUCTION METHODS

The striped bass x white bass hybrid has characteristics which make it an important candidate for commercial aquaculture. Like the striped bass, hybrids can be grown in extensive pond environments or under crowded tank or cage culture conditions. But, in almost every aspect of culture, the hybrid exhibits superior qualities compared to the striped bass. It grows faster, accepts artificial foods more readily, survives the critical fry to fingerling stage in greater numbers, and is more resistant to stress and disease.

The hybrid also has several advantages over striped bass related to its marketing potential. Its increased body depth results in greater returns of edible flesh per fish. And, because it can be distinguished from striped bass, it can be readily identified as a domestically-raised aquaculture product that would not contribute to illegal sales of poached wild striped bass.

Hybrid fry culture techniques are essentially the same as those developed for striped bass, except that egg fertilization must occur by manual stripping of the two parental species; natural tank spawning methods have not been possible. Sometimes it is difficult to obtain both white bass and striped bass in peak spawning condition as the former usually spawns several weeks prior to striped bass, but use of hormones can revitalize male white bass sperm production. While intensive larval production methods have improved greatly over the last few years, most fingerlings are still produced by stocking ponds with 2-10 day old fry at 100,000 to 150,000 fry per acre. Mean survival rates after 4 to 8 weeks have ranged from about 15% to 78%, with 30% or greater harvests common. Striped bass fry survival rates are significantly lower.

Limited work has been conducted on growth of hybrids beyond the fingerling stage because most governmental hatcheries stock their hybrids at this size. After harvesting the ponds, the resulting 2-4 inch fingerlings can be easily trained to accept artificial trout or salmon diets within several days. In South Carolina, 3 g fingerlings have been grown to 523 g in one year of brackish water cage culture. Harvest densities were 18 kg/m³ (Williams, et al., in press). At the TVA Gallatin Waste Heat Aquaculture Laboratory in Tennessee, 0.3 g hybrids were reared to 113 g in 117 days using 22-32 C heated effluent. Specific growth rates were 3.1% per day with a food conversion rate of 1.94:1 (Collins, et al., 1981). Unlike striped bass, the hybrids fed well and indicated no stress at 32 C (Schweinforth, pers. comm.). In North Carolina, hybrids cultured in ponds, cages, and tanks have produced results indicating that they can be grown at densities comparable to other species such as trout and catfish (Kerby, et al., in prep.).

Aquatic Systems Incorporated has been rearing hybrid striped bass in tank systems for about two years. They have reared hybrids to 680 g in eighteen months under ambient San Diego temperatures (15° to 26°C range), and predict that hybrids can be grown to one pound in 9 months under optimal conditions. Semi-closed culture densities are routinely maintained at 32 kg/m³. At 24°C, small fingerlings, 5-14 g and 12-38 g, exhibited specific growth rates of 5.3%/day and 2.7%/day with food conversion rates of 1.0:1 and 1.5:1, respectively. In a replicated growth experiment comparing floating and sinking commercial trout rations (38% protein), hybrids grew from 45 g to 90 g in 58 days at an average temperature of 16°C. No difference was found between diets for growth, 1.2% per day, or food conversion, 1.6:1. Mortality has been less than 2% per year with no indication of cannibalism beyond the fry stage. Although much less sensitive to stressful conditions than striped bass, excessive handling of hybrids has resulted in outbreaks of disease.

The hybrid striped bass is a relatively "new" fish whose short existence has not allowed extensive ecological study to date. Past experience alone would indicate that care should be taken with the introduction of any exotic species. Yet, the hybrid striped bass may offer the best, safest, or least cost alternative for certain inland fishery management plans. Outside of its use or non-use in our natural environment, the hybrid's potential value to the aquaculture industry is unquestionably favorable.

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