North Central Regional Aquaculture Center

In cooperation with USDA

Pond Culture of Hybrid Striped Bass in the North Central Region

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Background

Striped bass (*Morone saxatilis*) have been commercially harvested for many years, however wild stocks have declined due to environmental degradation, habitat loss and over-fishing. The U.S. wild fishery of striped bass was 6.8 million kg (15 million lbs.) in 1973, but declined to less than 0.2 million kg (0.5 million lbs.) in 1990.

In the past few years striped bass populations have started to rebound due to restrictions on their harvest, but are unlikely to approach the 1973 levels. In response to decreased commercial catches, the striped bass and its hybrids have been commercially produced in ponds, raceways, and tanks to fulfill the established commercial markets. The 1995 aquaculture production was 4 million kg (9 million lbs.).

Robert Stevens produced the first hybrid striped bass in South Carolina in 1965. The original cross, or palmetto bass, was obtained by crossing female striped bass with male white bass (*M. chrysops*). The reciprocal cross, female white bass x male striped bass, also called sunshine bass, has been increasingly cultured in recent years due to the limited availability of female striped bass. Both crosses grow faster and have better survival than either parent. The hybrids are also more disease resistant and have greater tolerance for variable water quality conditions. In the North Central Region (NCR), agency personnel and anglers sometimes refer to hybrid striped bass as 'wipers'.

This fact sheet describes pond culture of the hybrid striped bass from fry to food size fish and is intended for those already familiar with basic fish culture. While most past studies have focused on the original hybrid striped bass, the reciprocal cross has been the principal cross used in the NCR due to the availability of white bass females.

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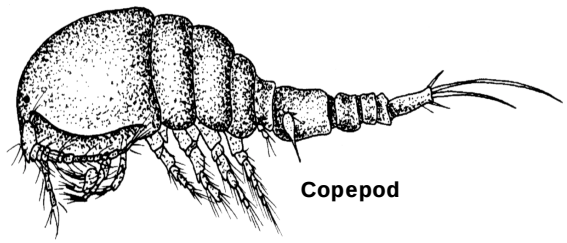
Water Quality Requirements

Hybrid striped bass are better suited for pond culture in the NCR than channel catfish (*Ictalurus punctatus*) because their preferred water temperature is 25-27°C (77-80°F), compared to the preferred water temperature of 29°C (85°F) for channel catfish. Water temperatures in the NCR seldom reach these high temperatures or if they do, only for short periods of time. Dissolved oxygen should be maintained above 5 ppm and pH between 7.5 and 8.5. Un-ionized ammonia is toxic to hybrid striped bass when in excess of 0.10 ppm. Also, hard water is recommended for hybrid striped bass culture (> 60 mg/L - $CaCO_3$) .

Hatchery Operations

Beginning fish culturists are advised not to start their culture of hybrid striped bass with the appropriation of brood stock. It is difficult and expensive to capture, handle and spawn brood fish. Striped bass brood stocks are often collected from the coastal rivers or reservoirs

of those states that permit such activities. However, with the decreased populations of this species, it is expected that further collection of striped bass will become more limited in the near future. Private domesticated striped bass brood stock supply is also limited, but is increasing. Because the white bass is native to the NCR, they may be obtained from various waters in the region.


Copepod

You must check state and local regulations about obtaining 'public' fish for aquaculture. In addition, hormones are often used to stimulate and synchronize spawning (which involves more regulations or permits), and expert observations of eggs are required for proper timing of stripping eggs.

Fish culturists can obtain 1-2 day-old sac fry from a hatchery in May or June. Fish are called sac fry at this stage because they survive the first few days of life on a yolk sac and have limited ability to swim about. The fry, 1 to 2 days after hatching, are usually transported from the producer in plastic bags filled with oxygen and a small amount of water. About 50,000 to 100,000 larvae can be placed in each 7.6 L (2 gal) of water and survive in the bags for 48 hours. It is recommended that the larvae be transported at night to avoid direct sunlight and when water temperatures are between 15 and 18°C (59 and 64°F). When the bags of fish arrive, they need to be floated in the pond or tanks for at least 30 minutes to equalize the temperature. For the next 10 to 30 minutes, the bags should be opened and small amounts of pond or tank water added periodically to adjust the larvae to differences in water quality.

These fry may be held in aquaria or tanks at 264 fry/L (1,000 fry/gal). It is possible to hold these fry for 8-10 days to produce actively swimming fry that readily consume food; however, reciprocal cross hybrids are often stocked directly into fertilized ponds. The mouthparts do not become fully developed until fry are 4-6 days old. Depending on water temperature, the yolk sac is absorbed in 8-10 days. A slightly brackish water source (7 ppt salinity) is best for fry survival and disease prevention in the tanks. Increasing salinity of fresh water is achieved by adding un-iodized table salt (sodium chloride) to the water. Fifty percent of the water volume in the aquaria should be replaced by 'fresh' water every 1-2 days, depending on water quality values (i.e., ammonia levels, nitrite levels, pH, and carbon dioxide). Because these fry have limited swimming ability, it is important to use a biofilter (eg., sponge filter) that has limited pumping action. A sponge filter works well as a biological filter, as the fry are not harmed by its suction.

For original cross hybrids, brine shrimp nauplii (*Artemia* spp) should be offered to the fry (130-530/L; 500-2,000/gal) beginning with the fourth day after hatching. The number of nauplii per weight of cysts and culture instructions are listed on the can. Within the first 12 hours after hatching, brine shrimp are the most nutritious; thus, newly hatched shrimp nauplii should be added to the aquaria every 12 hours. If the reciprocal cross is being cultured, rotifers, such as *Brachionus* spp., should be used for the initial feed. The mouth gape of reciprocal fry is half as wide as that of the original cross.

Hybrid striped bass fry can be purchased already feed-trained. This eliminates the above steps, but the price of the fish can be up to 25 times higher.

Phase-I Production

In addition to adequate water quality, hybrid striped bass survival depends on both the quantity and quality of zooplankton communities that serve as their food supply. Prior to stocking fry into culture ponds, ponds should be fertilized with a mixture of organic fertilizer (cottonseed meal; alfalfa hay, meal, or pellets; or animal manure) and flooded at least 2-3 weeks prior to stocking original cross hybrids to allow for peak cladoceran and copepod population growth. If well water is used, zooplankton inoculations consisting of mature cladocerans and copepods should be added. 'Wild' water from streams should be filtered (using saran cloth) to remove fish eggs and fry and insects, which may eat the small fry. When reciprocal hybrids are being cultured, ponds should only be flooded for 2-7 days before stocking the fry to take advantage of the initial abundance of rotifers.


Water Flea

Organic fertilizers may be applied at 90-225 kg fertilizer/surface hectare (200-500 lbs fertilizer/surface acre), depending on individual pond characteristics (i.e., the current

fertility of the pond). Following fry stocking, apply organic fertilizers at 28 kg/hectare (25 lbs/acre) weekly. The actual rate is determined by pond fertility as well as suitable water quality. Organic fertilizers should provide adequate amounts of nitrogen and phosphorus (limiting nutrients in aquatic systems) in usable forms. The organic fertilizer should be small enough to allow for rapid colonization by bacteria, algae and protozoans (food for zooplankton).

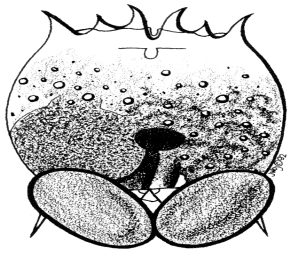
Inorganic fertilizers such as ammonium nitrate (52%-N) and phosphoric acid (32%-P_2O_5) may also be used. These fertilizers are available in both granular and liquid forms; liquid forms are preferred because they are easier to apply and produce faster results. Application rates depend on individual pond fertility (see Plankton Management for Fish Culture Ponds, North Central Regional Aquaculture Center (NCRAC), Technical Bulletin Series #114). Fertilization can increase the total productivity of the culture ponds, but higher levels of fertilization require more sophisticated management skills. The culturist needs to monitor water quality daily, particularly morning dissolved oxygen and afternoon pH and ammonia levels, and make adjustments to the fertilization scheme as needed.

Hybrid striped bass fry are best stocked into ponds during late afternoon or early evening hours to avoid harmful direct sunlight. The stocking rate for this phase of production is 250,000-500,000 fry/hectare (100,000-200,000 fry/acre). The higher rates are usually used when reciprocal cross hybrids are stocked because their initial survival is often lower. Daily feeding should begin immediately at 13 kg/hectare (12 lbs/acre) for the original cross hybrid. Recent NCRAC studies indicate that reciprocal cross hybrids take 21-28 days to switch from zooplankton to formulated feed; original cross hybrids only take 7 days to switch to formulated feed. It is important to spread feed along the entire pond edge. The young fish need time to get accustomed to feeding in the pond and initially will not actively seek out the feed. The first feed should be #0 trout or salmon crumble (38-50 percent protein). The secrets to high fingerling survival are maintenance of good water quality and several daily feedings rather than one or two feedings per day. Towards the end of this culture period, the fry should be eating #1 crumble easily. The transition between various sizes of crumble should be gradual with a mixture of both sizes being fed for several days. A guide for fish feed sizes to be used is listed in Table 1. Once the fish have switched from zooplankton to formulated feed, no fertilizers should be added.

Table 1. Suggested feeding guide for hybrid striped bass. Source: Atstupenas, E. A. and L. D. Wright. 1987. Interim Rearing Guidelines for Phase II Striped Bass. U.S. F.W.S.

Fish Size (Total Length) cm (in)	Fish Size (Weight) [#/kg (#/lb)]	Feed Size	Rate to Feed (% Body Weight)	Phase of Production and Length of Phase
3.8 (1½)	1650 (750)	#1 crumble	15	Phase I 30-45 days
4.4 (1¾)	1100 (500)	#2 crumble	10	
5.1 (2)	660 (300)	#3 crumble	6	Phase II 12 Months
6.4 (2½)	330 (150)	#4 crumble	6	
7.6 (3)	198 (90)	2.4 mm (3/32 in)	6	
12.7 (5)	44 (20)	3.2 mm (1/8 in)	4	
19.0 (7½)	13 (6)	4.0 mm (5/32 in)	3	
24.1 (9½)	7 (3)	4.8 mm (3/16 in)	3	
Food Size Fish	2 (1)	6.4 mm (1/4 in)	3	Phase III 6 Months

It is important to sample fish at least once per week to determine survival and growth of fry. These fry will most often be found along the hypolimnion (depth where water temperature turns cooler). Culture of fry in this phase will last 30-45 days and end with their harvest. Good survival is considered to be 40-50% and size of fingerlings should be 25-50 mm (1-2 in) in length and weigh about 1 g (0.04 oz) each. For the reciprocal cross, good survival is considered to be from 15 to 20% due to the difficulty of maintaining large rotifer populations.



Rotifer

Phase-II Production

Fingerlings are stocked into ponds at 20,000-30,000 fish/hectare (8,000-12,000 fish/acre). Initial feeding rate of #1 or #2 crumble is 10-15% of body weight fed daily, fed in three equal feedings. After several weeks, the same percent of body weight is fed, but in two equal feedings. Towards the end of this period, fish will consume #4 crumble or 2.4 mm (3/32 in) pellets. Again, feed size and feeding rate are adjusted as the fish grow, but the feed transition should be gradual. Monthly or bi-monthly sampling of the fish should be done to determine average fish size. During this phase, survival should be near 85-95%. Towards fall, fish are expected to weigh about 113 g (4 oz) and may be harvested when water

temperature falls below 15°C (60°F). Fish may be removed and stocked into ponds for phase-III production or left in the ponds for over-wintering and later harvested in the following spring. Hybrid striped bass have a good tolerance for low water temperature.

Phase-III Production (second year)

After Phase II fish are harvested, they should be graded to uniform sizes. Ponds for Phase III production should be stocked at 7,000-10,000 fish/hectare (3,000 - 4,000 fish/acre) if aeration is available; otherwise, with emergency aeration available, stock 2,500-5,000 (1,000-2,000 fish/acre). Fish should be fed a 36-38% protein floating feed (4.8-6.4 mm; 3/16 - 1/4 in) starting in early spring. Commercial feeds specifically formulated for hybrid striped bass are now available. Fish should be fed 3% of their body weight/day; feeding rates can be adjusted higher or lower depending on feed consumption by fish. Without continuous aeration, total feed added to the ponds should be limited to 56 kg/hectare (50 lbs/acre). Fish can be harvested at the end of the growing season and should weigh between 680 and 790 kg (1-1/2 and 1-3/4 lbs.). Harvested fish are often stunned in super-chilled water and then packed on ice for delivery to the buyer. NCRAC-funded investigations have indicated that fillet dress-out of 35-38% can be expected; eviscerated dress-out of 86-90% can be expected.

Production Limitations

The principal limitations to further production of this fish are 1) limited amount of striped bass brood stock; 2) limited information regarding nutritional requirements of these fish; 3) state regulations prohibiting the production of these fish in some NCR states; and 4) NCR consumer product recognition. As research proceeds in the NCR and elsewhere, additional information should become more available. Markets for these fish also need to be further developed and enhanced in order for increased supplies of these fish to be sold.

Recent NCR Developments

Some of the recent developments achieved through NCRAC research include 1) demonstration that hybrid striped bass grow as well or better in earthen ponds in the southern portion of the NCR as anywhere else in the United States; 2) development of white bass out-of-season spawning protocols; and 3) establishment of striped bass sperm storage and transport protocols.

Suggested Readings

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Additional Notes

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