

**Southern
Regional
Aquaculture
Center**



July, 1989

Hybrid Striped Bass

Hatchery Phase

Ronald G. Hodson and Maureen Hayes*

Hybridization within the genus *Morone* was made possible by the development of methods to use hormones to induce final maturation and ovulation of striped bass (*Morone saxatilis*). This research was being done in the early 1960s, and by 1965 the "original" cross of striped bass female x white bass male (*M. chrysops*) was made in South Carolina. Since that time all *Morone* species have been hybridized with striped bass, but none has gained the acceptance of the striped bass x white bass cross. More recently it was found that a white bass female x striped bass male exhibited the same characteristics as the "original" cross. Striped bass x white bass fingerlings made by using either striped bass females or white bass females are now available to growers. General information about techniques now used in hatcheries to produce hybrid striped bass follows.

Broodstock collection

Broodstock to produce fingerling striped bass and hybrid striped bass must be collected from the wild during their spring spawning run because the species has not been

domesticated. Spawning runs for striped bass species occur from late March to late May depending on location. Spawning grounds for striped bass are usually found near deep, swift and turbulent sections of a river, well upstream from lakes, reservoirs and sounds. Males begin their spawning run 1 to 3 weeks before the females when water temperature is less than 15° C. Female striped bass begin their spawning migration when water temperature is around 15° C. For any given population of striped bass several periods of spawning may occur during a 4- to 5-week period when water temperatures are 16 to 20° C. Periods of spawning activity during this time frequently follow sudden temperature increases of 1 or 2° C.

White bass, although restricted to freshwater, also make spawning migrations from lakes and reservoirs to inflowing streams. They generally spawn in rocky areas where water flow is turbulent. Their peak spawning season usually occurs from late March to late May depending on location. As with striped bass, male white bass usually arrive at the spawning grounds before the females. Peak spawning activity occurs when water temperatures are 18

or 19° C. There is usually more than one period of activity for a specific population.

Collection methods

Methods of collecting broodstock vary with the species, type of habitat and local laws and regulations. The most commonly used methods for collecting striped bass and white bass are hook and line, gill nets, pound nets and electrofishing.

Hook and line collections work well for white bass males and females because these relatively small fish are easy to catch in spring as schools of fish migrate toward the spawning grounds. This method is also effective for collecting striped bass males because relatively few fish are needed and the stress of capture is less likely to affect their ability to produce viable gametes than in the case of striped bass females. However, this method is less desirable to collect striped bass females because of the high mortality rate associated with the stress of capture. These large fish must be played to near exhaustion during the capture process. Females that do survive are often difficult to ovulate, probably because the blood supply to the ovaries was shut down during capture. However,

*North Carolina State University and University of North Carolina Sea Grant Program

hook and line collections are frequently the only means for private culturists to collect striped bass broodstock because other methods are restricted by law.

Gill nets are an effective way to collect striped bass and can be used in some areas, but the nets must be checked frequently to reduce stress and prevent mortality, especially in the case of females. Pound nets are efficient for taking striped bass because they fish a large area and broodstock can be removed with a minimum of stress to the fish. However, suitable sites for setting pound nets are limited and sites are frequently so far downstream from spawning grounds that broodfish are not far enough along in the maturation process to be spawned successfully.

Electrofishing is the most efficient and least stressful method for collecting white bass and striped bass broodstock. However, this method is seldom used by private culturists because it is generally impossible for private culturists to obtain electrofishing permits.

Broodstock, especially females, should be handled carefully and stress should be kept to a minimum. Frequent handling of broodstock or unnecessary roughness increases mortality due to stress and may inhibit ovulation. Fish are transported in saline water (0.3 to 1.0 percent NaCl or reconstituted sea water) with Furacin (100 ppm). Typically, quinaldine (2.0 mg/l) or MS-222 (21 mg/l) is used to sedate the fish. Ice may be added to reduce the temperature.

Hormone injections

Human chorionic gonadotropin (HCG) hormone is used to induce final maturation and ovulation of eggs and to enhance sperm production of striped bass and white bass. The hormone is injected intramuscularly below the dorsal fin. Striped bass females are usually injected as soon as possible after capture to improve the chances of successfully spawning the fish. They receive an in-

jection of 275 to 330 International Units (IU) per kilogram (125 to 150 IU per lb) of body weight to induce ovulation. An injection of 110 to 165 IU per kilogram (50 to 75 IU/lbs) of body weight is given to males to enhance sperm production.

An egg sample is taken 20 to 28 hours after injection with a 3 mm (outside diameter) glass or plastic catheter. The tube is inserted through the urogenital opening and into the ovary to take a small sample of eggs. Eggs are examined under a microscope to determine how long before ovulation will occur. Ovulation usually occurs in 25 to 50 hours depending on water temperature and stage of gonadal maturation.

White bass females are injected with 1,100 IU per kilogram (500 IU per lb) of body weight to induce ovulation. This quantity of hormone is probably well over the threshold level for induction of ovulation. Because studies have not been performed to determine the appropriate levels for white bass females, culturists tend to inject excess hormone. Sexually mature female white bass will usually ovulate within 25 to 50 hours after injection depending on water temperature. Eggs samples are generally not taken from white bass because the fish are small, relatively easy to handle and ovulation is less likely to be affected by handling stress. Egg samples can be taken from white bass using a 1.5 mm outside diameter catheter and staged under a microscope in the same manner as striped bass.

Ovulation in striped bass and white bass females is verified by applying slight pressure to the abdomen of the fish. Freely flowing eggs indicate that at least partial ovulation has occurred. There is an "art" to determining when complete ovulation has occurred, particularly in striped bass. And, accurate prediction of ovulation is critical to obtaining viable eggs. Eggs detach from the ovarian tissue (the source of oxygen) during ovulation and the effects of anoxia begin within a short time. Ideally, eggs should be stripped im-

mediately after ovulation, but in practice it is difficult to determine whether the female is fully or only partially ovulated. Optimum time for stripping eggs is 15 to 30 minutes after the first indication of ovulation. If eggs are not stripped within an hour after ovulation anoxia occurs and the eggs become overripe.

Females and males should be anesthetized with MS-222 or quinaldine to reduce stress whenever they are handled. However, during the spawning process care must be taken to prevent water containing these drugs from coming into contact with the eggs or sperm. Generally the fish are wiped dry with a towel before they are held over the spawning container.

Spawning

Striped bass females can be spawned by using one of two methods. The tank spawning method can only be used to produce pure line striped bass because female striped bass will not ovulate in the presence of white bass males. When this method is used the fish spawn "naturally" in tanks. The fish are injected with HCG and placed in tanks 12 to 15 hours before the female is expected to spawn. Usually two females and four males are placed in a circular tank and left undisturbed. The tanks may be 1.2 to 2.4 m in diameter and about 1.2 m deep. Water is supplied at a rate sufficient to create a circular velocity of 10 to 15 cm per second at the perimeter. The center standpipe must be screened and a bubble curtain used to prevent loss and impingement of eggs. When males have participated in spawning, the water will appear milky. The broodfish are removed after spawning and the eggs are incubated in the tank. Some culturists install a device to collect the eggs after they are water-hardened and the eggs are collected and incubated in McDonald jars.

The production of hybrid striped bass must be accomplished by manually stripping the eggs and sperm from the ripe fish into a container. Sperm from two or more

white bass or striped bass males is used to ensure fertilization of the eggs.

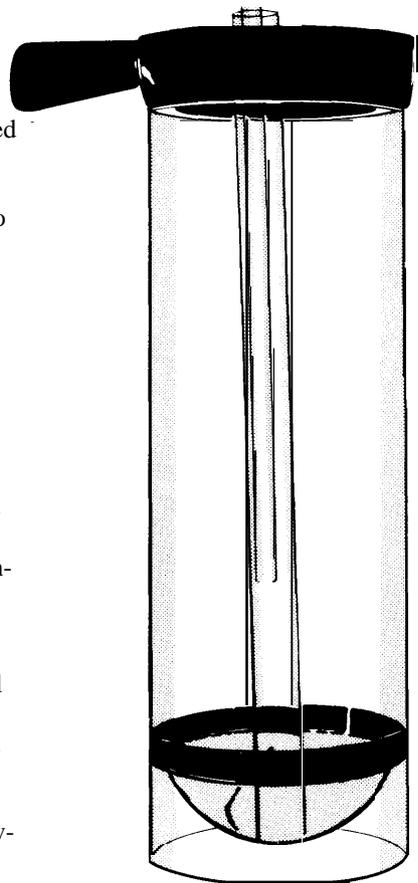
Fertilization of striped bass eggs is accomplished by using either a wet or a dry method. There appears to be little difference in the percent fertilization between the two methods. Wet fertilization is accomplished by stripping the eggs from the female into a small amount of water. Sperm are added periodically as the eggs are being stripped because sperm are motile for only 1 to 2 minutes, and the eggs begin to water-harden as soon as they come in contact with water. Water-hardening may prevent the sperm from entering the egg. This technique is best accomplished with 2 or 3 workers to efficiently remove eggs and mix in sperm at the same time. The main advantage of this method is that urine and drugs may be diluted before contact with eggs, minimizing any deleterious effects.

The dry method of spawning striped bass females is accomplished by manually stripping the eggs into a dry, clean container. Care is taken to keep water from the container until after sperm has been added. Sperm from several males is mixed in thoroughly. Water is then added to mobilize sperm and fertilization is completed within 2 minutes.

The dry method is used when stripping eggs from white bass females. However, after sperm and water are added and fertilization is complete, the fertilized eggs are added to a tannic acid solution (150 mg/l) and aerated vigorously for 7 to 12 minutes. White bass eggs are adhesive and unless treated, successful incubation is difficult. The actual amount of time eggs must be kept in tannic acid depends upon the alkalinity and hardness of the water. Other methods are known for removing the adhesive layer on white bass eggs.

Incubation of eggs and larvae

The most common method of incubating striped bass and white bass eggs is in a modified McDonald hatching jar. The jar is a tube-within-a-tube designed to allow circulating water to keep the eggs in motion and air bubbles to escape without lifting the eggs out of the jar. One jar holds 100,000 to 200,000 eggs. Optimum flow rate is 0.1 to 0.3 gallons per minute but will vary according to fluctuations in egg buoyancy during the incubation period. Egg buoyancy increases with water hardening during the first 2 hours of incubation. Water flow must be monitored closely to avoid flushing eggs from the jar. Newly hatched fry are carried by the water out of the jars and into aquaria.



The most common method of incubating striped bass and white bass eggs is in a modified McDonald hatching jar.

Eggs may also be incubated in 18- to 24-inch diameter cones with a center standpipe covered with a fine mesh screen. This method is used primarily with eggs taken from Chesapeake Bay striped bass because they have very buoyant eggs that will not stay in a McDonald jar. Using cones enables the motion of the water to circulate the eggs while being retained by the screens. After the eggs hatch the fry are retained in the cones.

Water temperature for egg incubation should be similar to the broodstock holding tanks, ranging from 16 to 20° C. Aerated well water is preferred because temperature variation is minimal. The incubation period varies inversely with water temperature. At 16 to 18° C the incubation period is between 40 and 48 hours. Two hours after fertilization, percent fertilization should be determined by counting the number of eggs with dividing cells. At 4 hours, an estimate of total number of eggs should be determined volumetrically by letting the eggs settle to the bottom of the jar. The number of eggs per milliliter may be determined by counting the number of eggs in a known volume.

A hatch rate of 50 percent is acceptable and 60 to 80 percent is considered good. The fry are held in aquaria (30- to 75-gallon capacity) or cones before pond stocking. Water exchange in these containers should be continuous. Newly-hatched hybrids have no mouth opening, an enlarged yolk sac, and a large oil globule projecting beyond the head. At 4 to 8 days post-hatch, the yolk sac and oil globule are assimilated, the mouthparts developed and fry begin to feed. Fry are stocked into fertilized ponds at 2 to 10 days post-hatch, depending on the culturists preference and experience. Fry held more than 5 days must be provided with live food such as brine shrimp nauplii or wild-caught copepod nauplii and cladocerans. Fry should be fed frequently (at least every 3 hours) during the early rearing period.

Fry may be transported when they are 1 to 2 days of age. Mortality at the age of 1 to 2 days is less than if the fry are transported at 4 to 5 days of age. Larvae are concentrated in the aquarium and then dipped from the aquarium into plastic bags. Bags are placed in styrofoam containers with approximately 2 gallons of water. All air is expelled from the bag and oxygen is added to fill the

bag. Larvae can survive well in these containers for 48 hours. Direct sunlight on the container should be avoided and water temperature maintained at 16 to 18° C. Ice may be added to the container to help maintain acceptable temperatures.

Fry may be stocked into fertilized ponds during the time period of dusk to dawn because exposure to

ultraviolet light may kill them. Bags of fry should be floated in the pond for about 30 minutes to allow the temperature to equilibrate. After the bags have been opened small amounts of pond water should be added periodically for the next 10 to 20 minutes to allow the fry a chance to adjust to any differences in water quality.