PRODUCTION OF STRIPED BASS FINGERLINGS, Morone saxatilis (Walbaum), ON OKLAHOMA STATE FISH HATCHERIES

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ABSTRACT

Experimental culture of striped bass in Oklahoma State Fish Hatcheries was initiated in 1965. This work has resulted in several procedural guidelines which will enable the successful production of striped bass. The application of these guidelines to production on Oklahoma's antiquated State Fish Hatchery System is discussed.

Factors which have influenced the application of desired methods on three State fish hatcheries are: Availability of sufficient water; fertility of ponds; aquatic vegetation; availability of equipment and supplies; quality of hatchery personnel; climate; amount and suitability of harvest equipment. These factors are discussed in relation to the 1969 rearing season.

INTRODUCTION

The desire to utilize and control shad in warm water reservoirs by biological means has produced a great deal of interest in the striped bass, *Morone saxatilis* (Walbaum). Prior to 1950, it was commonly believed this fish must spend a portion of its annual activities in salt water to successfully reproduce. But in 1941 this species was isolated in the Santee-Cooper reservoirs of South Carolina and by 1950 had produced an excellent sport fishery for striped bass. In addition, fishing success for other fish species was noticeably greater than in other reservoirs of the same age. The success achieved in these lakes prompted attempts in other areas of the United States to establish striped bass in a fresh water environment.

Most of the earlier attempts were made by transplanting adult and/or yearling fish. However, problems in obtaining healthy stock and failures in hauling the fish were encountered (Surber, 1957; Gray, 1957). Successful production of fry by several states on the Atlantic Coast made available large numbers of striped bass which were easily transported and handled. Due to poor fry survival, only one population of this species is known to have been produced by this method; and only after repeated introductions of large numbers of fry (Sandoz and Johnstone, 1965).

In recent years, many agencies have initiated rearing programs for the production of stripped bass fingerlings. Success has increased with improvement in methods each year. The Oklahoma Department of Wildlife Conservation began a program of striped bass culture in 1965 and it is felt the knowledge gained during this period would be helpful to other states contemplating a program of this type.

DESCRIPTION OF HATCHERY SYSTEM

The Oklahoma Department of Wildlife Conservation operates four fish hatcheries which produce fish for the management of the State's public waters and the stocking of private farm ponds. One hatchery is operated on a seasonal basis primarily for culture of walleye and northern pike. It was not used for striped bass production.

The Medicine Park Fish Hatchery was constructed in 1912 in an area surrounded by granite mountains directly below the State's first reservoir. Soil is sparse, rocks are numerous, and pond seepage is such that water must be continually introduced into the culture ponds. Chemical vegetation control was initiated in 1960 with moderate success. The water is moderately hard and basic. Retention of pond fertility is difficult due to the constant flow of water through the ponds. Pond bottoms

are extremely high in organic matter resulting from the introduction in past years of 10-20 tons/ acre of cattle manure annually in an effort to produce plankton blooms.

The Durant Fish Hatchery was constructed during a period of time from 1916 to 1940 in clay soil in the alluvial flood plain of the Blue River. The water supply is a low water dam in the mainstem of Blue River and water quality varies somewhat with the current land practices in the watershed. Water is pumped from this dam to a 20-acre water supply reservoir and distributed to culture ponds by a system of canals. In most cases, these canals are also used to drain the ponds preventing circulation of water during periods of high biological oxygen demand. For this reason, relatively low levels of fertility are maintained in the ponds during the production season.

The Holdenville Fish Hatchery is located immediately adjacent to the dam on Holdenville Lake in an area of sandy loam soil. This small hatchery (40 acres of culture ponds) was constructed in 1938. Water quality is poor due to the high amounts of colloidal clay in the watershed of the lake. This is the only State fish hatchery in Oklahoma with an acceptable system of water supply and drainage canals. However, the presence of highly turbid water prevents culture of large numbers of sight feeding fishes and the hatchery is now used primarily for catfish production.

STRIPED BASS CULTURE IN OKLAHOMA

The culture of striped bass fingerlings in Oklahoma was first attempted in 1965 when 125,000 striped bass fry were obtained from Weldon, North Carolina. Methods used were identical to those used for rearing largemouth bass. Approximately 18,000 fish were reared to harvestable size but all fish were lost during harvest due to inexperience in handling and poor pond design (Sandoz and Johnston, 1965).

In 1966, three million nine hundred and thirty thousand fry were shipped from North Carolina and South Carolina and stocked in culture ponds at both Durant and Medicine Park Hatcheries. No attempts were made to improve on specific culture methods from the previous year and consequently only 10,874 fingerlings were produced. Harvest methods were improved to the point that most of these fish reached the reservoir in a healthy state.

The lack of success in culturing striped bass in previous years prompted the decision to formulate a research program with the objective of determining suitable culture techniques. In 1967, a Federal Aid to Fish Restoration project was instigated to accomplish this purpose. Instructions were given that the striped bass program would be supplied sufficient funds and manpower even if other fishery programs suffered delays. A culture biologist was hired to conduct the program from an investigative point of view.

The states of South Carolina and Virginia supplied three million fry to Oklahoma for this project. Representative samples of fish and food organizms were taken throughout the program. Most were examined immediately to aid in guidance of rearing methods. Water chemistry was followed closely to maintain an accurate record of changes in pond chemistry. This practice enabled the culturist to predict oxygen depletions in advance and prevent them from occurring.

For the first time in the history of the Durant Hatchery, chemical vegetation controls were applied with varying results. An effort was made to reduce the number of predacious insects in culture ponds prior to introduction of fry and a fertilization program followed to maintain a food source for young fish.

The decision was made to harvest the fingerlings during June and July in an effort to stock them when suitable-sized forage was avail-

able in the reservoir. The first attempts to harvest fish were disastrous due to handling mortality. Methods were devised using minimum handling to prevent this mortality with good success. A total of 187,255 striped bass fingerlings were reared using methods devised as needed with little preplanning.

The rearing seasons in 1968 and 1969 enabled the evolution of rearing methods to the point it is now felt a reliable number of fingerlings can be reared to provide fish for reservoir management. In 1968, fewer oxygen problems occurred due to the removal of a layer of organic matter from pond bottoms. All personnel were more familiar with the care needed for striped bass culture and manpower and equipment needs could be predicted more closely. Production increased to 356,415 fingerlings during 1968.

In 1969, the Fishery Division dropped the emergency status of the striped bass production to allow the rearing of striped bass in the fish hatchery program. The experimental project was continued but approximately two-thirds of the fry received were stocked in ponds managed by fish hatchery personnel. These ponds were managed using methods which preliminary project information indicated would be most successful. The experimental culture biologist was available for advice in culture methods but the actual pond management was accomplished by hatchery personnel.

A total of ten million six hundred thousand fry were received from South Carolina during 1969. Production ponds were stocked with five million eight hundred thousand fry and three million six hundred thousand were stocked in experimental ponds. A total of one million two hundred thirty-six thousand two hundred ninety-four fingerlings from 1½-3" in length were harvested from June 2 to July 14, 1969. Of these, nine hundred fifty-five thousand six hundred five were reared in production ponds managed by standard hatchery personnel. This type of success in future years would provide substantive proof of the feasibility of producing hatchery reared fingerlings for use in the management of large public reservoirs.

CULTURE TECHNIQUES

The striped bass is a pelagic anadromous fish which has a fecundity of approximately one million eggs (Steven, 1964). Eggs hatch approximately 36 hours after spawning. Fry are very small and equipped with a large yolk sac, oil globule and undeveloped mouth parts. About five days after hatching the fry have developed mouth parts and are swimming horizontally. When seven days old they begin feeding on plankton. If food is not available at this time the fragile fish will succumb.

The mouth parts of a seven day old striped bass are too small to capture adult Copepods or Cladocerans. These fish apparently do not substantially utilize rotifers. The preferred natural food in culture ponds at seven to fifteen days after hatching are the instar stages of Copepods and Cladocerans. After fifteen days the striped bass begins feeding on adult zooplankters. They continue this practice until attaining three to four inches in total length (Harper, et al. 1968). Information obtained from a manuscript to be published (Harper, et al.) indicates that artificial food may be used to supplement the natural diet of striped bass fingerlings. Additional information from this study was used to outline the following culture practices used in production ponds on Oklahoma's State Fish Hatcheries in 1969:

A. Pond management techniques prior to the introduction of striped bass fry

1. Fill ponds with water and treat with 1½ pounds per surface acre diuron and ¼ part per million methyl parathion.
2. Alfalfa meal and inorganic fertilizer is applied two weeks later.

B. Timing of fry stockings.

1. Daily plankton samples are examined from each pond to select a "bloom" consisting chiefly of nauplii. This bloom can be manipulated by several methods common to warm water fish culture. If ponds' "blooms" are not suitable when fry are seven days old, they can be maintained in aquaria by feeding brine shrimp.

2. Stocking of fry should be accomplished with great care in acclimation. A portion of the fry (5%) should be placed in saran screen boxes for subsequent observation.

C. Pond Management

1. Feed is broadcast into each pond three times per day completely around the pond.

2. Fertilizer is added as needed to maintain a sufficient food source determined by frequent plankton samples.

3. Weekly checks are made of pond chemistry to determine dissolved oxygen levels.

D. Pond Harvest

1. Harvest by draining ponds results in substantial loss of fish. Also it was discovered that striped bass fingerlings can be herded to a small area in a culture pond and encircled with a seine. Therefore, harvesting is accomplished by using two 100′ x 8′ x ⅛″ mesh seines. Several "beaters" are used to drive the fish to the point of encirclement.

2. Striped bass fingerlings must be handled as little as possible. Care must be taken to keep the fish in water at all times. To get an accurate count, fish are dipped into a preweighed tub of water and a representative sample counted and weighed.

3. Fish should be transported in 0.5% salt and ¼ ppm Quinaldine.

HATCHERY PROCEDURES

The three fish hatcheries participating in the striped bass program have only thirteen permanent employees. In addition to striped bass, these hatcheries produce largemouth bass, channel catfish, and bluegill sunfish for private farm ponds and management stockings. Also, flathead catfish and grow-out channel catfish were reared. This effort put a great strain on the personnel at these hatcheries. The decision was made to place the primary effort on the culture of striped bass and only rear other species if time was available.

Prior to the striped bass culture program, fish were delivered to farm pond owners near their farms and the fish were usually advanced fingerlings. Due to the manpower and pond shortages caused by needs for striped bass, it was decided to discontinue delivering fish and disperse them in the advanced fry stage. This automatically cut back the number of requests made for farm pond fish.

The thirteen permanent employees were supplemented by two additional types of employees. Where possible, college students were hired on a part-time basis. These proved to be very satisfactory due to their interest in the project and ability to retain technical instructions. The other type of employees used were management biologists and their crews for assistance in harvesting and transporting fingerlings. All work was jointly supervised by the culture biologist and the supervisor of hatcheries.

All employees, by necessity, gave freely of their time to enable a successful season. From April 15 to July 15, 1969, all employees worked exceptionally long hours. When holding fry in aquaria, at least one employee was on duty 24-hours a day. Two employees at Durant and one each at Medicine Park and Holdenville worked on weekends on a rotation schedule. This was necessary to assure adequate feeding of ponds. No annual leave was granted from March 1 to August 1, 1969.

During June and July, the climate of Oklahoma requires that harvest procedures start at sunrise. In many instances, it was impossible to let employees off before normal quitting time. An effort was made to give employees reasonable compensatory time during winter months. This program was well received and we feel necessary to a continued interest in the program by an employee.

Some comment should be given about the quality of hatchery personnel necessary for successful culture of striped bass. Most hatcherymen start at a hatchery with no fish rearing experience and usually a high school diploma. It takes approximately five years to familarize an employee with the habits of fish. At this time, if the employee has an interest in rearing fish and is physically and mentally equipped to comprehend the complex details of fish culture he will be able to conduct a program with only minimal supervision.

DISCUSSION

Any state interested in rearing striped bass should consider several factors.

1. Is establishing the striped bass worth the emphasis that must be given to this program?
2. Are personnel available to conduct a complex detailed program?
3. Are personnel available with the interest to apply the necessary time needed for a striped bass program?
4. Are the hatchery facilities suitable for highly controlled fish culture?
5. Will equipment and supplies be available without delay when needed?
6. If fingerlings are reared, is a reservoir present in which striped bass have a reasonable chance for establishment?

During four years of striped bass culture in Oklahoma, we have determined this program can be successful only if operated as the primary project of a fisheries division. It cannot be successful when conducted as an additional or sideline project. For this reason, we recommend that any state contemplating this type of program conduct a thorough study to determine the benefits to be gained by the addition of striped bass to waters of a state prior to the initiation of this program.

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