

# **Red Drum Stock Enhancement in Georgia**

## **A Responsible Approach**

Prepared by

A.G. Woodward

Coastal Resources Division  
Georgia Department of Natural Resources  
One Conservation Way, Suite 300  
Brunswick, Georgia 31520-8687  
(912) 264-7218  
[spud\\_woodward@coastal.dnr.state.ga.us](mailto:spud_woodward@coastal.dnr.state.ga.us)

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## Executive Summary

The red drum, or spottail bass as it is known to many anglers, is an important component of Georgia's marine recreational fishery. Young red drum populate the estuaries and are highly desirable as both a sportfish and table fare. A seasonal catch-and-release fishery targets the adult fish, which may vary from 5 to 40 years of age and frequently weigh in excess of 30 pounds. In Georgia's territorial waters, anglers can harvest a maximum of five fish between 14-27 inches each day. No red drum can be harvested in the Exclusive Economic Zone (3-200 miles offshore).

The harvest restrictions on red drum should, by design, reduce the harvest rate so an adequate number of individuals from each year class will reach maturity. If successful, this approach will ensure that Georgia's red drum population will remain viable and continue to provide economic and social benefits for future generations. Despite the fact that the aforementioned harvest regulations have been in place for nearly a decade, Georgia's red drum stock is still considered to be overfished based on the most recent assessment of Atlantic coast red drum.

Advocates of Georgia's marine recreational fishery have suggested that Georgia, like some other southeastern states, use hatchery-reared red drum to help recover the native populations from overfishing. Unfortunately, the methods used to propagate and rear red drum in a hatchery are much better understood than the effectiveness of stock enhancement itself. There are many questions about the impacts to indigenous red drum populations. These vary from concerns about loss of genetic diversity to the possible introduction of diseases and parasites.

Likewise, there are many questions about the fate of released fish that are yet to be answered. What affects would a large-scale release of hatchery-reared red drum have on the ecology of Georgia's estuaries? Will propagating red drum in numbers sufficient to ensure survival be cost-prohibitive? Will adequate numbers of hatchery-reared red drum survive to adulthood thereby enhancing the status of the native population?

While simple in concept, a red drum stock enhancement program is a complex endeavor. From acquisition of broodstock to formulation of a stocking plan to evaluation of releases, each phase of the program must be carefully planned and executed. This will require a substantial commitment of human and fiscal resources and a willingness to apply the principles of adaptive management. Policy makers, fishery managers, scientists, and non-governmental organizations must work together in a science-based responsible approach to stock enhancement of red drum in Georgia.

## **Introduction**

Most marine fish species release hundreds of thousands of eggs during a single spawning event. But, because of the limitations of external fertilization and the fact that natural mortality is extremely high during the early stages of life, very few individuals survive to become juveniles in natural ecosystems. As coastal areas are urbanized, the degradation and loss of critical nursery habitat within these natural ecosystems becomes a limiting factor, as well. In many species, both juveniles and adults are subject to high mortality from fishing and environmental perturbations such as pollution and climatic extremes. This is particularly the case near human population centers. Consequently, many marine fish populations are in a state of decline.

The propagation and rearing of marine fishes, such as red drum, in the controlled environment of a fish hatchery, offers an opportunity to ameliorate the constraining effects of high natural mortality and, to some degree, habitat loss. However, the use of hatchery-reared fish must be carefully considered in the context of overall fishery and habitat management goals. The economic, social, and ecological costs of a stocking program must be thoroughly assessed before a prudent course of action can be determined.

Hatchery-reared fishes can be used for several reasons: (1) to restore extinct populations for economic or cultural reasons; (2) to rebuild depleted populations of recreationally and/or commercially valuable species; and (3) to enhance existing populations for recreational or commercial purposes. The term stock enhancement is generally used to describe a program that has any of the aforementioned purposes as an objective. One must be careful to distinguish a stock enhancement program from a stocking program whose purpose is the support of a put-and-take fishery, such as those that exist for salmonid trout in many freshwater lakes, impoundments, and streams.

## **Georgia's Red Drum Fishery**

Georgia's marine recreational anglers target a variety of estuarine and marine species. Foremost among these is the red drum, or spottail bass as it is locally known. Juveniles of this species reside in tidal rivers and creeks until the onset of maturity. Then, the young adults join other adults in schools of fish that range in age from 6 to 40 years of age and, presumably, number in the thousands of individuals. These schools move seasonally between estuarine waters and the open Atlantic Ocean.

Tagging studies in Georgia and other areas of the southeast have shown that immature fish often stay within the same estuary for the first five years of life, while adults will return to the same spawning grounds each year. So, Georgia's red drum stock is composed of two segments. The first is the populations of immature fish within the nine major estuaries, each of which is subject to different levels of natural and fishing mortality. The second segment is the population of mature fish. Apparently this population is comprised of several groupings of adults, each of which may use separate and distinct areas for spawning.

Anglers target immature red drum within the estuaries as a game and food fish. There is a seasonal catch-and-release fishery for adult red drum that is growing in popularity, particularly with the clientele of fishing guides. Overall, marine angling effort is on the increase based on the results of recent statewide surveys of fishing participation. In addition, technological advances in boats and fishing gear have greatly improved the ability of anglers to pursue red drum and other marine fishes. Consequently, managers must be continually vigilant with regard to the status of Georgia's red drum stock.

There is no directed commercial harvest of red drum in Georgia, primarily due to gear restrictions and lack of a commercial quota. All harvesters of red drum must abide by the same size and creel limits. Hence, most red drum are brought to markets and restaurants by anglers who sell them to offset trip costs. The reported landings of red drum for the purposes of sale have decreased substantially since the imposition of restrictive size and creel limits.

The interstate management goal is to have at least 30% escapement within the red drum fishery. Escapement is the ratio, expressed as a percent, of the number of fish at age four, compared to the number that would be present if there was no fishing. To meet this goal, a sufficient number of fish must survive to reach maturity and enter the spawning portion of the population. This is particularly difficult in a fishery that specifically targets immature fish.

Young red drum, especially those fish less than 2 years of age, school together densely in areas readily accessible to boating anglers. Thus, they are vulnerable to localized overfishing. The current slot size limit (14 to 27-in) and creel limit (5 fish per angler per day) was implemented to moderate the harvest of immature fish within Georgia's territorial waters. Adult fish (>27-in) are protected from harvest in state waters. There is also a ban on the harvest of all red drum in the Exclusive Economic Zone (3-200 miles offshore).

Despite the stringent measures implemented to recover Georgia's red drum stock from overfished status, the 1999 stock assessment for red drum in the region including South Carolina, Georgia, and the east coast of Florida revealed that survival to adulthood is still not adequate to eliminate the risk of a population collapse. Some individuals within the fishing community have suggested that Georgia follow the lead of other states and begin stocking red drum in the coastal estuaries. The stated reason for this suggestion is to expedite recovery of the wild stocks. However, many of these individuals have an expectation that size and creel limits will remain at status quo with a concomitant increase in angler catch rates.

### **A Responsible Approach to Marine Stock Enhancement**

The methods used to propagate and rear red drum in a hatchery environment are well defined. However, the effectiveness of using hatchery-reared red drum to enhance coastal fisheries is yet to be fully understood. Many states in the southeast United States have implemented a stock enhancement program for the species. Some are taking a methodical science-based approach,

while others are responding to political and public pressures by releasing large quantities of fingerling red drum with little regard for evaluation.

There are two basic aspects to any stock enhancement program. First must exist the physical facilities and state of knowledge to mass-produce the species in question. While the knowledge certainly exists, there are currently no facilities in Georgia that support the induced spawning of red drum in captivity or the rearing of offspring to a size suitable for release. The development and staffing of such facilities would demand a substantial capital investment, possibly into the millions of dollars. In addition, it will be difficult to find a suitable location to build such physical facilities due to restraints of the Coastal Marshlands Protection Act and Clean Water Act.

Secondly, there must be an effective mechanism to resolve the uncertainties about stocking effects and effectiveness. This is generally accomplished by restricting the scope of fish releases so as to facilitate experimentation to answer key questions related to survival. This requires a staff of scientists and supporting personnel capable of designing and implementing these experiments.

The state of Florida has adopted a “responsible approach” strategy based on the principles presented by Blankenship and Leber at the 2<sup>nd</sup> World Fisheries Congress in 1997. Each component of this approach is addressed in the context of the situation in Georgia. This should help fishery managers and advocates of Georgia’s marine recreational fishery better understand what steps must be taken to determine whether hatchery-reared red drum should be used as a tool to rebuild wild stocks and enhance the red drum fishery.

### **Prioritize and select target species for enhancement**

The first step in developing a stock enhancement plan involves identifying those fish populations that are depleted or depressed. The next step is to establish a list of priority species. Georgia’s red drum stock is classified as overfished based on a regional population assessment. However, the methods used to determine the status of red drum on a regional basis have limitations that make these results of marginal value for specifically defining the status of red drum within each of Georgia’s estuaries. So the true status of the stock remains in question. However, the best scientific data available indicate the population is still in an unhealthy condition and therefore makes the species eligible for consideration in any discussions about stock enhancement. But, in our zeal to rebuild the red drum stock, we should not ignore the fact that the marine recreational fishery in Georgia targets several species, the status of many of which is unknown. These other species must also be given due consideration. To date, there have been no criteria established for assigning priority to exploited marine fish species. This should be one of the first tasks to be completed in the development of a stock enhancement program.

### **Develop a species management plan**

The Atlantic States Marine Fisheries Commission (ASMFC) Red Drum Fishery Management Plan and the South Atlantic Fishery Management Council (SAFMC) Red Drum Fishery Management Plan are the basis for managing Georgia's red drum stock. The Georgia Department of Natural Resources (GADNR) follows the guidelines of these plans with respect to management of red drum within the state's territorial waters. Currently, neither of these plans addresses stock enhancement as a tool for rebuilding the Atlantic coast red drum stocks. Amendment 2 of the ASMFC plan, currently in development, will address the use of hatchery-reared red drum in the context of regional fishery management goals.

### **Develop realistic goals and objectives**

There are several factors that can contribute to the success or failure of a stock enhancement program. Handling and transportation related mortality, access to critical habitat, predators, food availability, competition for space and food, and water quality can affect survival, growth, and dispersal of hatchery-reared fish. In the dynamic environment of an estuary all of these factors interact on an ever-changing basis. Thorough and costly field studies, some of which are decades-long endeavors, are the only way to understand this complex interaction. Consequently, it may not seem practical to delay implementation of stock enhancement programs while we wait for all the answers.

A reasonable compromise is to restrict stock enhancement programs to small-scale pilot projects that provide an opportunity to gather the empirical data necessary to better understand the ecological aspects of a stock enhancement approach to managing red drum. States such as Florida and South Carolina have taken this approach and have better defined release protocols and methods. Likewise, Georgia should limit any red drum stock enhancement to small-scale projects so that any long-term plan is based on a solid footing of fact and not conjecture.

### **Define quantitative measures of success**

It is impossible to determine success when there is no measure of it. Therefore, it is important that indicators of success are well defined and measurable, preferably in the form of testable hypotheses. For example, the stated goal of the Florida Fish and Wildlife Conservation Commission (FWC) Tampa Bay project is to "increase the number of redfish caught by anglers in the fishery supported by the Alafia and Little Manatee Rivers by 25%". The increase in catch rate will be used as a measure to determine the survival rate of hatchery-reared fish following release. If a program is begun in Georgia there must be well-defined measures of success that are consistent with the overall management of the species.

The FWC uses creel surveys, fish population sampling, and angler participation to determine if the stated goal has been met at the end of a three-

year period. These monitoring programs must be funded in order for the FWC to ascertain if the stock enhancement program has been successful. Any red drum stocking program in Georgia must likewise be supported with adequate resources to monitor the performance of hatchery-reared fish. Currently, human and fiscal resources within the GADNR, Coastal Resources Division are woefully inadequate to monitor the status of wild red drum populations, much less document the fate of hatchery-reared fish.

### **Use genetic resource management**

The foundation of a responsible stock enhancement program is an understanding of the need for genetic resource management. The scientific community has made great advances in the methods needed to distinguish one population of fish from another of the same species. However, there has been virtually no work of this sort for the red drum populations within Georgia's coastal waters.

Any stock enhancement program must ensure preservation of the genetic integrity of native populations. Georgia's red drum populations have evolved in the presence of many biotic and abiotic factors, all of which have exerted selective pressure for a certain genetic identity (i.e. a wild red drum). The ability of the native stock to survive could be seriously jeopardized if genetic diversity was lost as a result of the reckless stocking of hatchery-reared red drum. One way to prevent this is adherence to breeding and stocking protocols similar to those used in other states that have red drum stock enhancement programs.

The responsible approach involves several steps ranging from establishing a baseline genetic identity for the wild stock to selection and maintenance of broodstock in the hatchery, as well as constant monitoring of the wild stock after the release of hatchery-reared fish. To ignore any of these steps would be highly irresponsible and could result in serious threats to the long-term health of the red drum fishery.

### **Identify released hatchery fish and assess stocking impacts**

The identification of hatchery-reared fish after release has been one of the greatest challenges associated with stock enhancement programs. However, recent advances in both science and technology have given biologists more options than ever before. Otolith marks, coded wire tags, passive integrated transponder tags, injected dyes, and genetic markers have been used successfully to identify even small fingerling red drum.

The ideal mark or tag is one that does not interfere with the life processes of the fish, persists throughout the life of the fish, and is easily detectable by scientists and anglers alike. Unfortunately, such an ideal mark does not exist, although there are reasonable compromises. Scientists with the SCDNR are using oxytetracycline (OTC) to mark the otoliths of fingerling red drum. The OTC shows as a florescent band when the otolith is examined under ultraviolet light.

Unfortunately, a red drum must be sacrificed before it can be examined for the mark.

In the case of red drum, one must define the overall objective of stock enhancement when deciding on the most appropriate means of marking the hatchery-reared fish. If that objective is for a portion of the hatchery-reared fish to ultimately become reproducing adults, then scientists must have a way of confirming presence of these fish in the spawning part of the population. A durable tag with a long life is a necessity. If the goal is to improve the angler catch rate, then the tag might need to have a short life span but be detectable by anglers so they can provide feedback for evaluation of the stock enhancement program.

Another purpose of identifying hatchery-reared fish is to elucidate their relationship with native fishes of the same species. It does little good to stock thousands of hatchery red drum only to find they are displacing their wild counterparts from the limited essential habitat. This level of understanding is necessary if managers are to determine that the stock has been truly enhanced and not replaced.

The release of hatchery-reared red drum will present a challenge to those scientists tasked with understanding the status of the wild stocks. In fact, the Atlantic Coast Red Drum Assessment Group, a committee of stock assessment scientists and red drum experts, has issued a position statement whose language cautions against the implementation of large-scale stocking programs. (Appendix A). If Georgia implements a program of red drum stocking, all fish should be marked in a manner that will facilitate their identification throughout their 40-year life span.

### **Use an empirical process to define optimum release strategies**

There are several factors related to the logistics of rearing, transporting, and releasing red drum that must be considered in any stocking program. Fish size at release, release habitat, season of release, time of day of release, and number of fish released all can determine success or failure. Technological advances in fish husbandry provide a powerful tool for optimizing success, but solid empirical data must be available on which to evaluate the utility of these advances.

Fortunately, there is an expansive body of knowledge on these factors. Several state agencies have been refining their methods over the past decade and any effort in Georgia should fully incorporate all of this information. However, the estuaries of Georgia have unique and defining characteristics so it is naïve to assume that methods established in places like Texas and the west coast of Florida are directly transferable. The work in South Carolina is the most applicable and should be used as the benchmark for any program in Georgia.

The GADNR and the South Carolina Department of Natural Resources (SCDNR) twice collaborated in experiments involving hatchery-reared red drum released in selected Georgia estuaries. However, neither of these projects involved the release of large numbers of fingerling red drum of the size typically

used in production stock enhancement programs. Therefore, any red drum stock enhancement program in Georgia must begin with a series of pilot releases of marked fish in an ecosystem that already supports an indigenous population of red drum and for which there is some baseline data on the abundance of the native population.

The goal of the first of these collaborative projects was to determine the fate of 1,150 phase III red drum tagged with internal anchor tags and released in the St. Simons and Hampton River estuaries. These fish averaged 250-mm (10-in) in length at the time of stocking and were recaptured by anglers from as soon as three days following release to three years after release. The recapture rate of these fish varied among the two release sites, indicating that either survival, angling effort, tag reporting, or all of these factors were different.

The second joint effort involved the release of 900 tagged red drum, whose minimum lengths were 356-mm (14-in) at six sites within the Wassaw and St. Simons estuaries. The purpose of this study was to determine the non-reporting rate for fish tags. The angler return rate for stocked red drum ranged from 13 to 41% depending on the specific release site. Tagged red drum from this stocking persisted in the fishery for at least two years after release.

### **Identify economic and policy objectives**

The true value of a stock enhancement program can be very difficult to determine given that the experience of catching a fish has different value to each angler. Even then anglers may place a different value on the experience of catching a hatchery-reared fish versus a wild fish. Despite the difficulties, a cost and benefits analysis must be included in the process of determining the success or failure of a stocking program. Projections about the economic benefits of stocking should not be overstated in an effort to gain public support for a stock enhancement program.

It is imperative that policy makers understand the need for a methodical and deliberate approach that allows for the inclusion of new technology and pilot release experiments. Otherwise, large sums of money could be spent in an attempt to meet unrealistic expectations. It is highly irresponsible for anyone, scientist or policy maker, to perpetuate a myth that the more fish stocked the better for anglers, the better for the fish population, and the better for the ecosystem as a whole.

In Georgia, there are only crude estimates of the value of marine recreational fishing. Consequently, it will be very difficult to predict the true economic benefits of a red drum stocking program with any accuracy. Fiscal resources to support existing wild fish monitoring programs and habitat protection/restoration efforts are extremely limited. Policy makers would be remiss in their responsibilities if they arbitrarily moved funding from these efforts to a stocking program in the hopes of a quick fix for perceived and actual problems.

### **Use adaptive management**

In no aspect of fisheries management are the principles of adaptive management more important than in stock enhancement. Each release of hatchery-reared fish must answer more than the simple question, "Did they leave the stocking truck alive?" A reasonable framework of research will provide an ongoing source of empirical data. These data will translate into new ideas and findings that can then be integrated into the process, allowing for improvement over time. For example, the cost per fish generally will decline as rearing methods and stocking protocols are refined for a particular set of circumstances.

### **Summary**

The red drum is an important component of Georgia's marine recreational fishery and must be managed in a comprehensive program that addresses all options. There is little doubt that the red drum populations within the estuaries are adversely affected by increasing angling effort and urbanization of the coast. Therefore, public interest in the use of stocked red drum will likely increase in the future.

It is important that policy makers, fishery managers, scientists, and non-governmental organizations work in concert to take a science-based responsible approach to stock enhancement of red drum in Georgia. This requires all of these groups to come to consensus on the goals and objectives of a red drum stocking program. A listing of the steps proposed for such a process is found in Appendix B.

It is imperative that all aspects of this approach receive equal priority and funding. Otherwise, a critical aspect of the process will be ignored and it will be impossible to determine success or failure. A stock enhancement program is more than simply dumping thousands of fingerlings into the water at the most convenient location in the hopes that a few survive.

## APPENDIX A

### **The Use of Cultured Atlantic Coast Red Drum For Stock Enhancement: Position Statement**

Atlantic Coast Red Drum Assessment Group  
April 2000

The red drum is a highly valuable sciaenid targeted by commercial and recreational fishers along the Atlantic coast. Management of this species is inherently difficult because of the life cycle and the fact that consumptive fisheries target immature fish within the natal estuaries. The current approach has been to control the harvest of immature fish with size and creel limits within the recreational fisheries and with size limits and quotas within the commercial fisheries. The harvest of adults is prohibited in the Exclusive Economic Zone and within state waters and the territorial sea from North Carolina southward to Florida. Despite drastic restrictions in the legal parameters for harvest, fishing mortality remains high and Atlantic coast red drum are still in overfished status.

The Atlantic States Marine Fisheries Commission (ASMFC) and the South Atlantic Fishery Management Council (SAFMC) both have fishery management plans for Atlantic coast red drum. These plans and their amendments contain numerous recommendations for rebuilding fisheries through harvest control, basic life history research, stock identification, and identification/protection of essential habitats. Neither body has evaluated or endorsed the use of cultured fish to restore the stocks of Atlantic coast red drum.

We believe that large-scale introductions of cultured red drum may not enhance the native stocks. In fact, there is a growing body of scientific evidence that indicates wild fish stocks, particularly salmonids, can be adversely affected by the large-scale introduction of cultured individuals of the same species. We are particularly concerned that large-scale introductions of cultured fish may confound our ability to determine the status of wild stocks of Atlantic coast red drum due to difficulties in isolating the size and age structure of native populations from those of cultured fish.

If red drum hatchery programs are instituted along the Atlantic coast then, at the very least, breeding and stocking protocols must be established to prevent the loss of genetic diversity. Additionally, guidelines should be developed which facilitate the identification of hatchery-reared red drum after release. Lastly, we must strive to determine if competition exists between wild and cultured red drum so that we can fully understand the impact of stocking.

Therefore, it is the position of this group that development of red drum stocking programs with the intent of rebuilding wild stocks is premature and may be contrary to the wise and prudent management of this species. We recommend the appointment of a subcommittee under the auspices of the ASMFC Red Drum Technical Committee whose task would be to further investigate this issue.

## APPENDIX B

- Step 1 Appoint a study committee of anglers, policy-makers, and scientists whose task is to further examine the role of stock enhancement in managing Georgia's marine recreational fishery for red drum.
- Step 2 Develop a stock enhancement mission statement and determine the goal of the program.
- Step 3 Formulate specific objectives pursuant to the goal.
- Step 4 Acquire funding to support program development
- Step 5 Develop breeding/stocking guidelines and protocols
- Step 6 Develop monitoring plan
- Step 7 Develop stocking plan
- Step 8 Determine best option for acquiring fish to stock
- Step 9 Present plan to public and policy makers
- Step 10 Acquire funding to implement program
- Step 11 Hire staff to accomplish objectives
- Step 12 Collect broodstock and begin propagation
- Step 13 Rear fish to target size for release
- Step 14 Mark fish prior to release
- Step 15 Conduct small-scale experimental releases of hatchery-reared red drum in selected Georgia estuaries
- Step 16 Conduct monitoring of effects and effectiveness of stocking
- Step 17 Determine success or failure of pilot releases
- Step 18 Disseminate findings to public and policy makers
- Step 19 Develop long-term plan for application of stock enhancement as a management tool
- Step 20 Acquire stable funding to support the goal of the program