Georgia Department of Natural Resources
Coastal Resources Division
Management Plan: Sheepshead
Updated June 2017

General Objective:

Manage Georgia's sheepshead fishery to ensure the maximum aggregate social, economic, and ecological benefits to the citizens of Georgia.

General Description:

Sheepshead are an oval, deep bodied, compressed fish with a base color in shades of gray, green or yellow with 5-7 black vertical bars with one present on the nape. They have 4 broad incisor-like teeth on both sides of the anterior jaw and also several posterior molar-like teeth. The scales on a sheepshead are finely serrated and the fins consist of 10-12 spines and 11 soft rays. They are primarily omnivores, feeding on bryozoans, oysters, decapods, shrimp and barnacles. Sheepshead are a euryhaline species that favor oyster reefs, piers, breakwaters, muddy shallows and wrecks.

Life History and Reproductive Biology:

Sheepshead are yearlong residents of estuarine and nearshore Atlantic Ocean waters along the Georgia coast. Each fall, a portion of the population that has been resident in the estuaries moves into the open Atlantic Ocean out to areas inshore of 15 fathoms. This movement coincides with declining water temperatures and the exodus of predators, such as barracudas and sharks. There is no evidence to indicate that sheepshead make large-scale latitudinal movements, such as those exhibited by truly migratory species such as tunas and jacks. Although the species is known to be a fractional spawner, the exact spawning frequency of sheepshead has not been determined. In Georgia, spawning occurs from January to May with peak spawning occurring in April. Sheepshead are a relatively long-lived species and reach ages in excess of 20 years. They begin to attain maturity at approximately 12-inches (305mm) fork length (FL), or 3 to 4 years of age, with 100% of a cohort mature by 16-inches (406mm). The length of a sheepshead is a poor predictor of age after it reaches 8-inches. In addition to size at age being highly variable, egg production is also variable by length and age.

Description of the Fishery:

Recreational Fishery

Sheepshead is a recreationally important species in Georgia. Anglers have consistently rated sheepshead in the top ten most targeted species based on NOAA Fisheries Marine Recreational Information Program (MRIP) angler intercept surveys. This estuarine fishery is prosecuted throughout the year by bridge, pier, private boat anglers, and for-hire fishers. The offshore fishery occurs during the winter and spring with effort expended by both private boat anglers and for-hire operators. According to the MRIP, the overall trend in landings is variable, with higher Harvest per Unit of Effort (HPUE) values in 2003 and 2011 (within the private/rental boat fishing mode, in which the majority of sheepshead are caught).

Commercial Fishery

The commercial fishery is predominately comprised of hook and line recreational fishermen and for-hire fishers that sell their catch. Landings have increased from 500 pounds in 1990 to over 2000 pounds in 1998, an increase of 300%. Although Georgia landings have increased in the last few years, they comprise a small portion of total reported South Atlantic landings. South Atlantic landings averaged over 300,000 pounds per year from 1990 to 1998.

Current Regulations:

Georgia Regulations
O.C.G.A 27-4-130.1

Minimum-size:	10-inch TL
Daily creel limit:	15 fish per person per day
Season:	Open year-round

Federal Regulations
Exclusive Economic Zone (3 - 200 miles offshore)

No minimum-size restriction	
Daily creel limit:	20 fish per person per day*
Season:	Open year-round

*Sheepshead are included in the 20 fish daily aggregate creel for species in the snapper grouper complex which do not have specific creel limits.

Chronology of Georgia Regulations:

1957: Gill nets prohibited in state waters.

1989: The Georgia Legislature established O.C.G.A. 27-4-130.1, Open seasons, creel limits, and minimum size limits for certain finfish species. For sheepshead no closed season was established. Furthermore, the legislature authorized the Board to manage sheepshead size limits between eight and 16 inches and to establish a maximum daily creel not to exceed 50 fish (b)(9).

1989: The Board of Natural Resources adopted Rule 391-2-4-.04, Saltwater Finfishing. Specifically for sheepshead, it established a year round season ((3)(i)), a 25 sheepshead per person daily creel and possession limit (4)(i), and an eight-inch total length minimum size (5)(i).

2001: The Board of Natural Resources amended Rule 391-2-4-.04, Saltwater Finfishing. Specifically for sheepshead, it reduced the creel and possession limit to 15 sheepshead per person (4)(i), and increased the minimum size to 10-inches total length (5)(i).

2012: The Georgia Legislature repealed O.C.G.A. 27-4-130.1 and moved those species therein to O.C.G.A. 27-4-10. Sheepshead (a)(39) parameters were set at 0 to 20 inches and fifteen fish. Further, the board was authorized to set size limits, open seasons, creel and possession limits and possession and landing specifications on a state-wide, regional and local basis. Finally, the Commissioner of the Department was empowered to close waters to recreational and commercial fishing by species for a period of up to six months within a calendar year.

2012: The Board of Natural Resources implemented the necessary requirements of the Legislative repeal while keeping sheepshead management intact, with the exception of resorting/renumbering of species; sheepshead became 391-2-4-.04(3)(s).

Prioritized Issues of Concern:

1. The population of coastal Georgia continues to increase with concomitant urbanization of areas adjacent to the estuary.
2. Inland land and water use patterns are changing such that the quality and quantity of freshwater entering the estuaries may be altered to the point of compromising ecosystem function.
3. There is currently no consensus on the appropriate biological reference point to use in managing for Optimal Sustainable Yield (OSY).
4. There are no current estimates of total mortality, fishing mortality, or natural mortality for sheepshead. Also, there are no index values for these parameters.

5. There are no accurate species-specific estimates of the impact of the recreational fishery on the economy of Georgia. With these kinds of estimates, an accurate value could be assigned to the recreational sheepshead fishery.
6. An estimate for the economic impact of commercial fishery could be made using the reported landings, but it is very likely that reported landings do not represent all sheepshead harvested for sale in Georgia.
7. There is no estimate of reproductive output (eggs) of the spawning biomass or of the total spawning biomass (weight). Additionally, the relationship between fishing mortality, spawning biomass, and recruitment is unknown.
8. Sheepshead aggregate on nearshore artificial reefs and live bottom areas such as Grays Reef National Marine Sanctuary for the purpose of spawning. Private boat anglers and for-hire fishers target the offshore aggregations during the spawning season. However, we have no understanding of how this effort affects spawning activity or concentrates fishing mortality.
9. Though not confirmed, it is assumed that juveniles move into estuarine habitats after a period in nearshore waters. However, nothing is known about this settlement period, the essential nursery habitats used by juvenile sheepshead, or their residence times in those habitats.
10. There is no knowledge of the post-release mortality for undersize sheepshead and/or post-hooking/release mortality of tagged sheepshead. The effectiveness of existing or proposed harvest regulations can only be fully evaluated with this knowledge.
11. The stock structure of sheepshead in Georgia waters is unknown. State-specific management actions may be largely ineffective if a single stock exists within the South Atlantic Bight, whose range extends beyond state boundaries. Likewise, uniform regulations within Georgia may be ineffective if multiple substocks exist within Georgia waters.
12. The impact of the commercial fishery, albeit appearing to be small, on Georgia's sheepshead stock is unknown. A shift by commercial fishermen from other overfished or closed fisheries to sheepshead is possible. All landings of sheepshead may not be reported because they are not being sold to wholesale seafood houses or may not be landed in Georgia.

Current Data Sources:

Fishery Dependent Data Sources

Marine Recreational Information Program (MRIP)

Since March 2000, biologists with the Coastal Resources Division of the Georgia Department of Natural Resources (CRD) have been working in conjunction with the NOAA Fisheries to conduct a survey of recreational saltwater anglers in coastal Georgia. The MRIP survey, entitled the Access Point Angler Intercept Survey (APAIS), produces estimates of recreational finfish catch (including fish released as well as those retained as harvest). Additionally, the NOAA Fisheries conducts surveys to estimate numbers of recreational saltwater anglers (participation) and

numbers of fishing trips (effort). These data are necessary for determining appropriate regulations (e.g., creel and length limit laws), provide catch data for fishery management plans, and track trends in angler participation and landings. Figure 1 below shows the annual sheepshead landings and effort from the MRIP survey from 2002-2016. Figure 2 shows the annual sheepshead landings per unit effort from 2002-2016. These data represent landings and effort estimates from only the private/rental (PR) vessel fishing mode. The majority of total catch and total harvest are from the PR fishing mode.

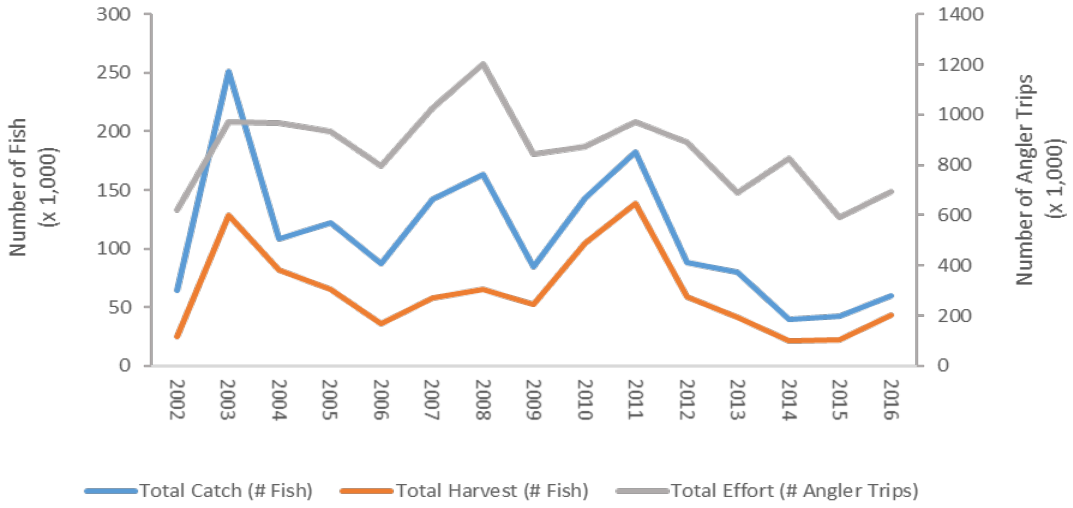

Figure 1. Annual sheepshead recreational landings & effort from the MRIP survey for 2002-2016. These data represent landings and effort estimates from only the private/rental (PR) vessel fishing mode. The majority of total catch and total harvest are from the PR fishing mode.

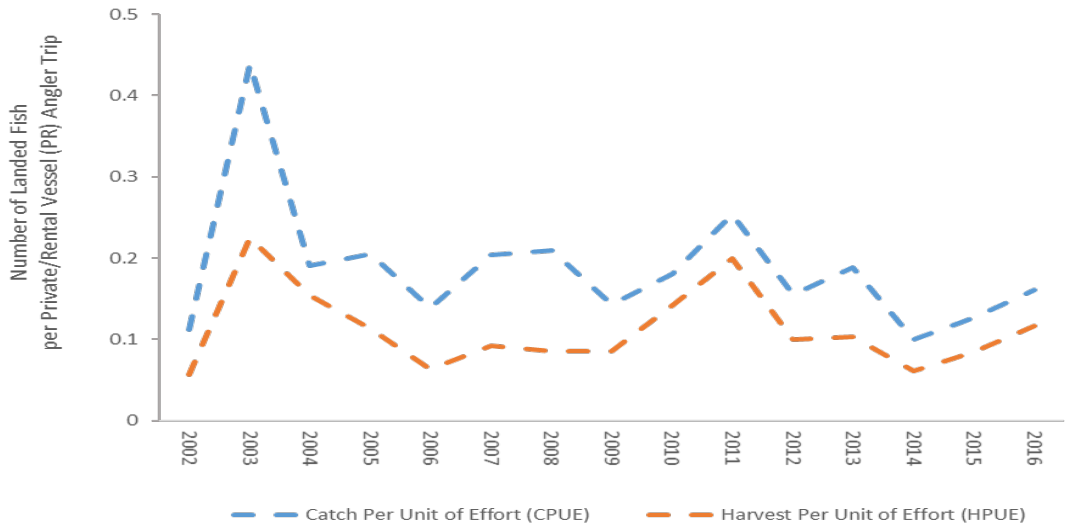

Figure 2. Annual sheepshead recreational landings per unit of effort from the MRIP survey for 2002-2016.

Carcass Recovery Project (CRP)

Discarded fish carcasses provide invaluable data for fishery managers. Recognizing this opportunity, staff with the Marine Fisheries Section developed a project (CRP) to gather these fish carcasses. The information provided by fish carcasses is used in a variety of analyses, all of which help allow for the evaluation of stock status for Georgia's coastal fish populations. These data can be used in a descriptive manner to examine trends in the size and age structure of a population or used in more sophisticated analyses.

Since the autumn of 1997 chest freezers have been placed and maintained near the fish cleaning stations at selected locations along the Georgia coast. Each freezer is marked with an identifying sign and a list of target fish species. Inside the freezer is a supply of plastic bags, information cards, and pens. Cooperating anglers are instructed to place the filleted carcasses (with head and tail intact) in a bag, fill out and include a completed angler information card, and then place the bag in the freezer. Participants are given an incentive award for donating three bags of fish carcasses. Figure 3 presents the number of sheepshead collected by year through CRP from 2002-2016.

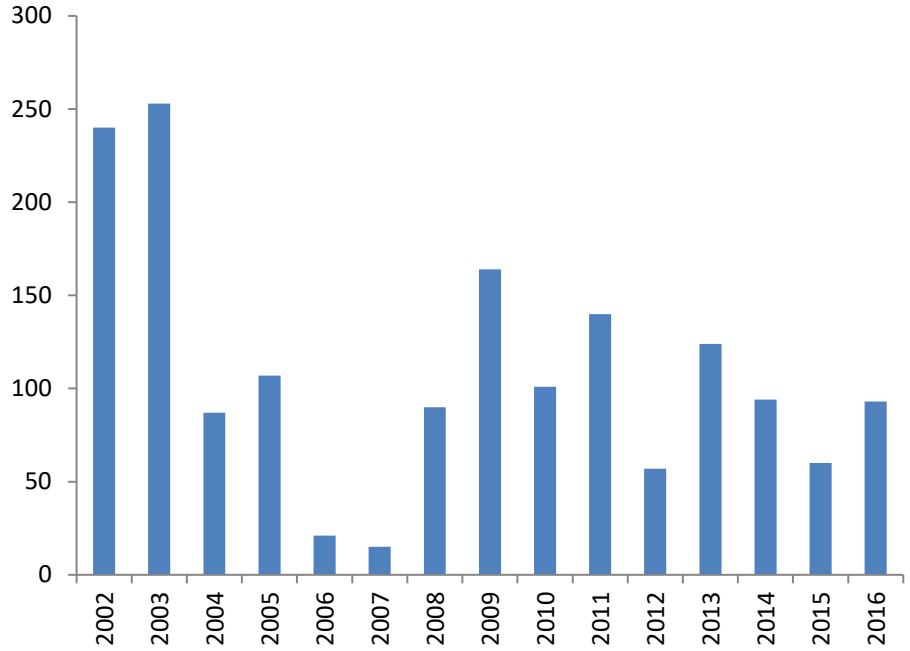

Figure 3. Numbers of sheepshead collected by year through CRP for 2002-2016.

Fishery Independent Data Sources

Marine Sportfish Population Health Surveys (MSPHS)
Coastal Resources Division has management responsibility for more than 40 species of saltwater fish, ranging from sharks to sheepshead. Although federal agencies such as the NOAA Fisheries provide the information used to manage some of these species, the responsibility for determining the health of Georgia's populations of sheepshead, tripletail, red drum, spotted seatrout rests solely on CRD.

The Wassaw/Altamaha River Delta and Cumberland systems have been identified as the estuaries that should be surveyed annually. A biologist/technician team is required for each system. They conduct field operations, fish sample processing, fish age determination, and data analysis/interpretation. Federal Aid in Sportfish Restoration funds are used to support both the Wassaw and Altamaha River Delta activities. At the present time, the Cumberland system cannot be surveyed because of lacking funds.

The following tasks are accomplished through these surveys: (1) utilizing entanglement gear, collect biological data from estuarine fishes of recreational importance; (2) characterize the essential habitats needed by the various life history stages of these fishes; (3) analyze these data to determine the health of marine sportfish populations; and (4) summarize this information in stock

assessments and other status reports which will be available to fishery managers, policymakers, and the public.

Goals and Objectives for Management:

1. Define and manage for an Optimal Sustainable Yield (OSY).
2. Control fishing mortality (F) to prevent recruitment overfishing.
3. Prevent localized overfishing of offshore (nearshore) aggregations during the winter and spring.
4. Identify and Protect Essential Fish Habitat (EFH) and Habitats Areas of Particular Concern (HAPC).

Prioritized Research and Monitoring Needs:

1. Develop accurate maturity schedules.

   Field Methods
   Collect tissue samples from both fishery dependent and independent sources and process in a suitable method for histological analysis. Ovarian tissue samples will be processed and interpreted by an outside contractor with the requisite equipment and expertise to properly prepare histological samples. Samples will be collected in appropriate sizes to determine when individual cohorts reach maturity.

   Analytical Methods
   An appropriate maturity model will be applied to the data to develop an accurate maturity curve for Georgia sheepshead. This will be accomplished by determining the maturity for individuals as a function of age and size. This will allow for accurate estimation of the percent of mature fish in the harvest.

2. Quantify post hooking/tagging mortality.

   Field Methods
   Collect samples at various depths using hook and line gear, tag individuals and release into holding tanks or cages to determine short-term post-hooking mortality. Deploy divers to observe and quantify immediate post-hooking/tagging mortality in fish not retained in holding tanks.

   Analytical Methods
   Estimates of hooking mortality would be calculated from the results of the mortality study. These estimates would be used to tune total mortality estimates based on catch. Use Vemco Acoustic tags and receivers to monitor long-term release survival.

3. Identify estuarine nursery habitats and quantify residence times of juvenile sheepshead.

   Field Methods
   Develop efficient methodology for collecting juvenile sheepshead. Conduct annual abundance survey employing developed collection methodology.

   Analytical Methods
   Use survey data to identify and classify sheepshead essential nursery habitat, estimate residence times and develop a sheepshead juvenile index of abundance.

4. Determine if Georgia has a unit stock of sheepshead that is reproductively and/or behaviorally isolated from populations in adjacent waters.

   Field Methods
   Tagging studies would be used to determine the seasonal movements of sheepshead in Georgia. This study would require intensive sampling in various locations, both within the estuaries and at offshore locations, to produce an adequate sample size of marked fish to determine and characterize sheepshead stock identity in Georgia waters. The feasibility of using otolith microchemistry should be investigated as an alternative to tagging studies.

   Analytical Methods
   The analysis for the tagging study would involve using spatial statistical techniques in conjunction with GIS software. Otolith microchemistry analysis would be subcontracted to an agency with expertise in this field.

5. Estimate population abundance.

   Field Methods
   Conduct a long-term tagging study (minimum of three years). This approach would require additional research to estimate post-hooking /tagging mortality, tag retention, tag non-reporting, and the adequate sample size of tagged individuals. Conduct fisheries independent sampling using hook and line, spearguns, traps, and/or other appropriate gear to generate estimates of population abundance.

   Analytical Methods
   The methods listed above would be used to develop a relative index of abundance-based on numbers of individuals per unit of effort, either capture or observation. These investigations must be conducted on a temporal and spatial scale sufficient to provide useful information.

6. Estimate age specific total mortality.

Field Methods
Conduct fishery-independent sampling using hook-and-line, spear fishing, or an alternative gear to produce age-length keys. Utilize fishery-dependent angler intercept and effort survey data from the NOAA Fisheries MRIP and GA DNR carcass program to construct a catch-at-age matrix. Conduct annual intensive known age mark-recapture experiments.

Analytical Methods
A cross-sectional and cohort–based catch curve would be produced from fishery-independent and -dependent surveys to estimate overall and year-class specific rates of total annual instantaneous mortality. A virtual population analysis (VPA) would be performed using fishery-dependent based catch matrix to estimate age specific rates of instantaneous mortality. Depletion estimation using fishery-independent age, gear-specific indexes of relative abundance would be used to estimate overall and age specific rates of total annual instantaneous mortality. Brownie mark-recapture models would be used to estimate age specific F from tag-return data.

7. Characterize socioeconomic aspects of the recreational sheepshead fishery in Georgia.

Method
Contract with the appropriate service provider to conduct species-specific socioeconomic studies of Georgia's marine recreational fishery.

Analytical Methods
The methods will be chosen as appropriate to provide a thorough understanding of the social and economic aspects of recreational fishing in the coastal waters of Georgia.

8. Describe, assess, and monitor the commercial fishery for sheepshead.

Field Methods
Combine trip ticket reporting, TIP sampling, and other supplemental methods to accurately assess the commercial sector of the fishery in Georgia. Assessment should describe the magnitude, in terms of participation/effort and annual harvest, and nature, gears employed and temporal/spatial extent, of the commercial fishery.

Analytical Methods
Yield per recruit analysis, virtual population analysis, and other methods will be used to analyze the data collected from the commercial fishery.

Proposed Activities for FYs 2017 - 2022:

Collect catch/harvest/effort data from the recreational sheepshead fishery.

Purpose
To describe the size distribution and quantity of sheepshead caught and landed by recreational anglers.

Method
Continued participation in the NOAA Fisheries MRIP.

Process sheepshead carcasses collected through the Marine Sportfish Carcass Recovery Project (CRP).

Purpose
To collect biological data from sheepshead harvested by recreational anglers.

Method
Anglers will be encouraged to donate the filleted carcasses of sheepshead. Chest freezers are located at selected public access points along the Georgia coast.