



Purpose

The purpose of this document is to improve the understanding and transparency of the Commission's stock assessment process and results. It is the first of several that will be developed throughout 2010. We welcome input and comments on its usefulness.

Introduction

This document presents a basic summary of the 2009 red drum stock assessment. The assessment, which was peer-reviewed through the SouthEast Data, Assessment, and Review (SEDAR) process, represents the latest and best information on the status of Atlantic coast red drum stocks and provides the scientific basis for continued management of the species (refer to the SEDAR 18 report for more details).

Management Overview

Red drum are managed solely by the Atlantic States Marine Fisheries Commission through Amendment 2 to the Interstate Fishery Management Plan for Red Drum. The Amendment requires states to implement recreational creel and size limits to achieve the fishing mortality target, including a maximum size limit of 27", and maintain existing commercial regulations. A harvest moratorium and Presidential Executive Order prevents any harvest or sale of red drum from federal waters (3 – 200 miles from shore).

In 2008, total red drum landings — recreational and commercial combined — from New Jersey through the east coast of Florida are estimated at 1.8 million pounds. This represents a 15% decline from the total harvest in 2007, and a 5% decline from the previous ten-year (1998-2007) average. Commercial and recreational fisheries harvested 13% and 87% of the total, respectively. In 2008, the majority of landings came from the South Atlantic region (67%), where the fishery is almost exclusively recreational.

The Commission assesses red drum relative to a benchmark known as the spawning potential ratio (SPR). SPR measures the reproductive potential of a fished stock relative to that of an unfished stock. The overfishing threshold is an SPR of 30%; an SPR below 30% indicates that overfishing is occurring, because not enough fish are surviving to reproduce and contribute to the population. The target SPR is 40%.

What Data Were Used?

The red drum stock assessment used both fisheries-dependent and fisheries-independent data, including information on red drum biology and life history. Fisheries-dependent data come from recreational and commercial fisheries, while fisheries-independent data are collected through scientific research and surveys. Red drum are divided into two management areas along the Atlantic coast, a northern region (from New Jersey to North Carolina) and a southern

region (from South Carolina to Florida). This division is based on differences in life history traits (such as growth rates and maximum observed ages) between the two regions, and information from tagging studies, which show that red drum rarely move between regions. Separate stock assessments were performed for each region.

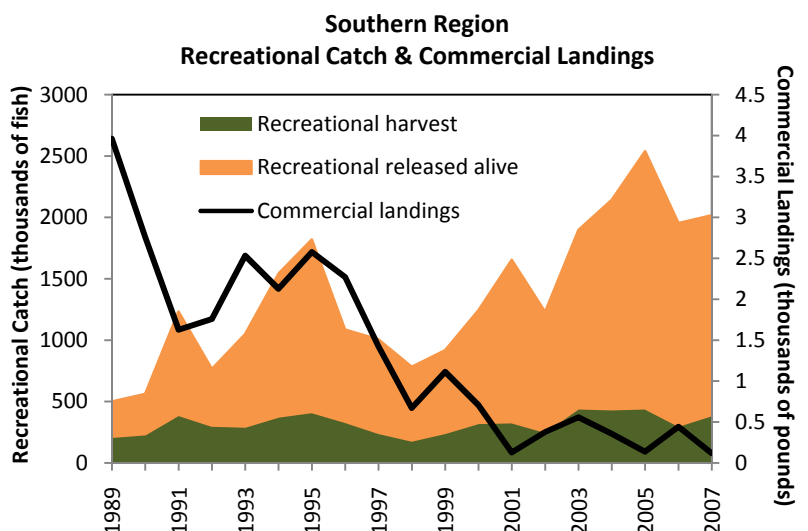
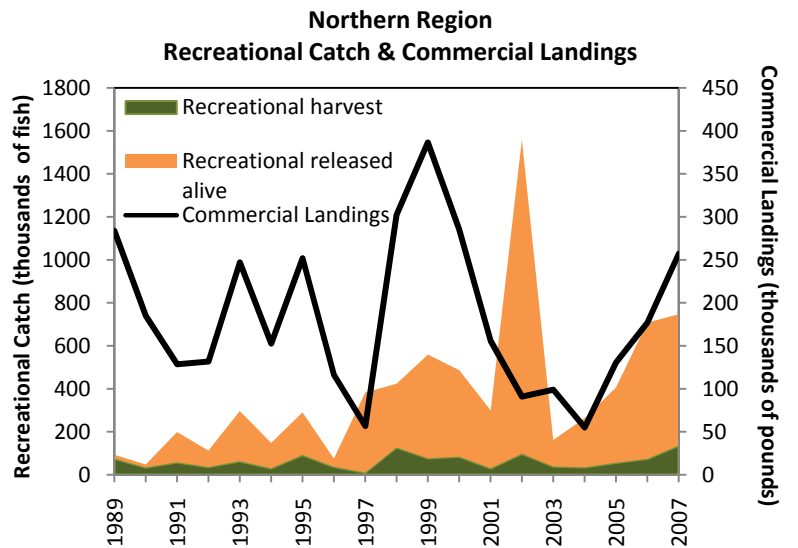
Life History

Atlantic red drum may be encountered from Massachusetts to Key West, but landings from states north of New Jersey are negligible. Adult red drum spawn at night in the summer and fall in nearshore waters, and juveniles are most abundant in estuarine waters and inlets. Depending on the area, males mature between ages one and four, at a size of 20 – 28 inches total length. Females mature between ages three and six, at a size of 31 - 36 inches total length. Red drum are long-lived – they may live to be 60 years old and reach 60 inches (more than 90 pounds) in size. After they mature, they spend less time in estuaries and more time in ocean waters. It is thought that fish older than age four spend most of their time in deep offshore waters, where they are less vulnerable to fishing pressure. As a result of this life history pattern and the regulations that restrict the harvest of larger fish, there is very little information on the offshore adult portion of the population.

Commercial Data

Since 1988, commercial landings in the southern region have been very low, making up less than 3% of total coastwide landings, as South Carolina and Florida enacted regulations that prevented red drum’s commercial harvest. Prior to 1988, commercial landings in the southern region mostly came from Florida’s gillnet and line fisheries. In the northern region, North Carolina accounts for more than 90% of regional landings in recent years, mostly from gillnets. North Carolina provided on-board observer data that was used to estimate the number of red drum that were discarded from the gillnet fishery; most fish were discarded dead, and the assessment assumed 5% of fish discarded alive died.

Biological samples were taken from the commercial catch in Florida, North Carolina, and Virginia: fish were measured and weighed, and otoliths (the fish’s inner ear bones) were collected to age them. These samples were used to calculate the number of fish of each age in the commercial catch (the catch-at-age). Although the data on the commercial catch go back to



1950, the biological sampling was only adequate to describe the catch-at-age from 1989 onwards; therefore, the model only uses data from 1989 – 2007.

Recreational Data

The red drum assessment used recreational catch and effort data from the Marine Recreational Fisheries Statistics Survey (MRFSS) for 1989 – 2007. Recreational catches are divided into Type A catch (fish that are landed and able to be measured), Type B1 catch (fish that are killed but unavailable to be measured – filleted, discarded dead, etc.), and Type B2 catch (fish that are released alive). MRFSS surveyors measure the Type A fish they encounter to develop a length-frequency of the recreational catch which can then be used to make recreational catch-at-age.

In both the northern and southern regions, anglers have released alive an increasingly large percentage of their catch, going from about 4% of fish released alive coastwide in 1982 to over 80% in recent years. Based on several studies of survival rates, the assessment assumed that 8% of all fish released alive die as a result of being caught. In addition to catch information, the assessment also used estimates of number of angler-trips to calculate the yearly catch-per-unit-effort (CPUE). This annual CPUE was used as a fishery-dependent index to provide information on trends of relative abundance in each region.

Fishery-Independent Surveys

The red drum assessment used a number of different fishery-independent datasets that provide information on trends of relative abundance for different age classes. In the northern region, the assessment used two surveys from North Carolina: a gillnet survey that caught ages 1 and 2, and a seine survey that caught fish that were less than one year old. In the southern region, the assessment used six fishery-independent surveys: a Florida small seine survey, a Georgia trammel net survey, and a South Carolina electro-fishing survey that caught age 1 fish; a Florida haul seine survey and a South Carolina trammel net survey that caught age 2 and 3 fish; and a South Carolina longline survey that caught adult red drum age 6 and older.

Why Greater Uncertainty for Southern Region?

The northern stock assessment had a lower degree of uncertainty because the tagging data provided important external information on fishing mortality. Similar information was not available for the southern stock. The southern model was more sensitive to changes in the assumptions and input data, making the results more uncertain. This uncertainty can be seen in the width of the confidence intervals in the SPR figures on the next page.



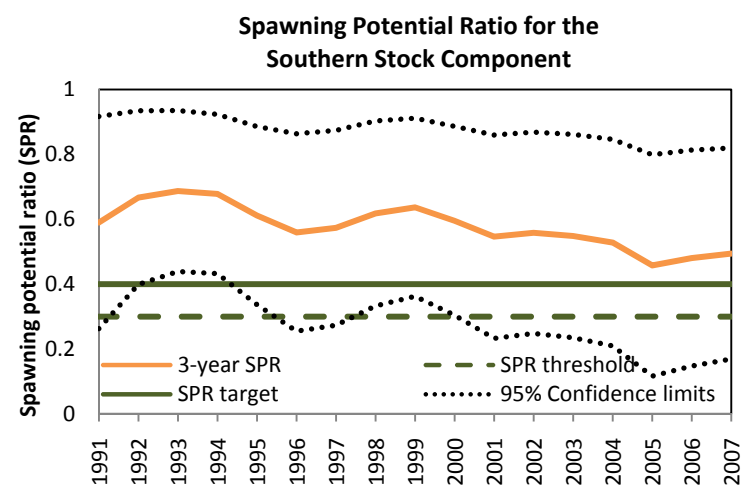
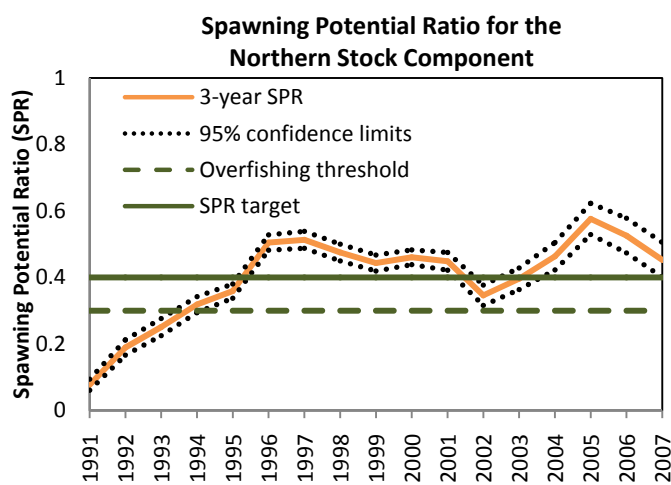
Tagging Data

In the northern region, previously published analyses of North Carolina's extensive tagging program provided important information about fishing mortality and the age composition of the fish released alive by recreational anglers. These data proved essential to the assessment, helping to reduce uncertainty in the northern region. Although tagging data exist for the southern region, the necessary analyses were not available to provide similar information for the south.

What Models Were Used?

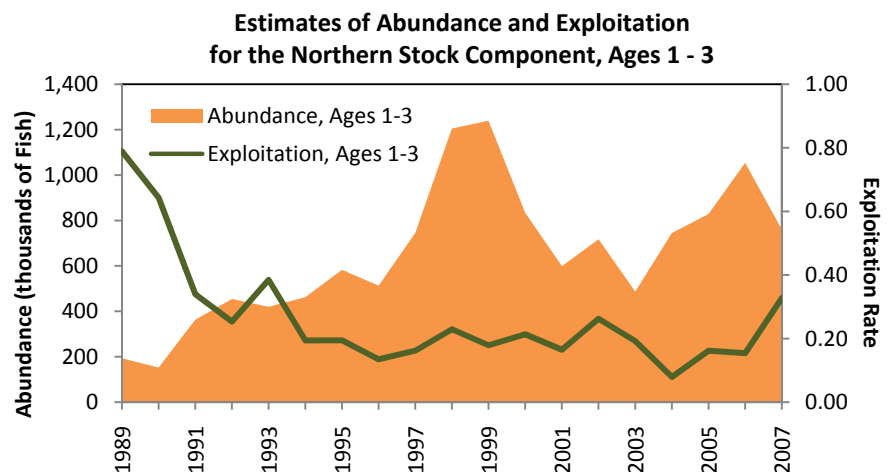
A statistical catch-at-age (SCA) model was used to assess the red drum stocks. An SCA model combines the catch-at-age data from the commercial and recreational fisheries with information from fishery-independent surveys and biological information such as growth rates and natural mortality rates to estimate the size of each age class and the exploitation rate on the population. The model also provides the information that is used to calculate the SPR; the 3-year average of the SPR was used to determine the status of the stock. Because of the limited data on adults, the model groups all fish age seven and older into a single "plus group."

The previous assessment (Vaughan and Carmichael, 2000) used a virtual population analysis, or VPA, model to assess red drum. One of the drawbacks of the VPA model is that it assumes that the catch-at-age is known without error. The SCA does not make this assumption, making it a better model for red drum.

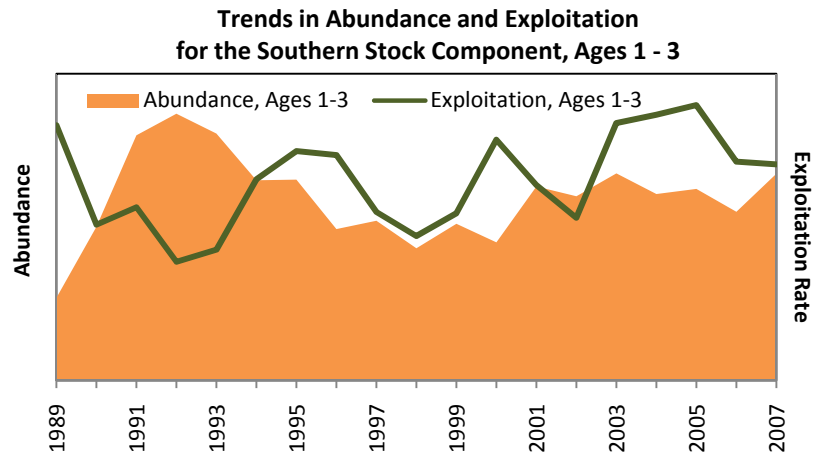


What is the Status of the Stock?

The assessment determined that overfishing was not occurring in either the northern or the southern stock. The 3-year average of the SPR was above the overfishing threshold of 30% SPR in both regions, indicating sufficient numbers of young fish are surviving to join the adult spawning population. The 3-year average of SPR in the north was 45.3%, above both the overfishing threshold and the target SPR. The 3-year average of the SPR in the south was 49.5%, but due to the higher degree of uncertainty in that estimate, it could not be determined whether that stock was above the target as well.



The abundance of young fish (ages 1 – 3) increased in the early 1990s and has stabilized somewhat in both regions. However, because there was so little information on the adult population (age 4 fish and older), the assessment could not determine the total abundance of the stocks or whether the stocks were overfished. Additionally, the assessment only provided estimates of relative abundance for the southern region, not absolute values, due to the higher degree of uncertainty in that assessment.



The exploitation rate – the percentage of the population removed each year by fishing – showed different patterns in the northern and southern regions. The exploitation rate in the northern region decreased from 1989 and has remained low, although it may have increased in recent years. In the southern region, the exploitation rate decreased through the early 1990s but the trend reversed after that, and the exploitation rate has fluctuated with a slight increasing trend since then. Again, the results of the southern region have more uncertainty, and the assessment only provided information on the trends in the exploitation rate, not absolute values.

Research Needs

More information on the abundance and age composition of the adult population (ages 4 and older) is critical to improving the red drum stock assessment. A carefully designed fishery-independent survey could provide these data. Additionally, tagging data were very important to the northern assessment, and a similar analysis of tagging programs in the south could help reduce uncertainty in that region.

Whom Do I Contact For More Information?

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Glossary

Age class: all of the individuals in a stock that were spawned or hatched in the same year. This is also known as the year class or cohort.

Catch-at-age: the number of fish of each age that are removed in a year by fishing activity.

Confidence Interval: a statistically-calculated probability that a given estimated number will be between an upper and lower limit.

Exploitation rate: the percentage of a stock that is removed by fishing over the course of a year

Fishing mortality: the instantaneous rate at which fish are killed by fishing

Length frequency: a summary of the different lengths of the fish in the stock or the catch that is used to describe the size composition of the stock or the catch

Marine Recreational Fishing Statistics Survey (MRFSS): a national survey conducted by the National Marine Fisheries Service (NMFS), often in conjunction with state agencies, to collect information on the catch, effort, and length frequencies of marine recreational fisheries

Natural mortality: the instantaneous rate at which fish die because of natural causes (predation, disease, starvation, etc)

Otoliths: the inner ear bones of a fish. They form rings as they grow which can be counted to assign an age to the fish.

Spawning potential ratio (SPR): the reproductive potential (the amount of eggs or biomass that a fish could produce over its lifetime) of a fished stock compared to the reproductive potential of an unfished stock. This is also referred to as the static spawning potential ratio or sSPR.

Statistical catch-at-age (SCA) model: an age-structured stock assessment model that works forward in time to estimate population size and fishing mortality in each year. It does not assume that the catch-at-age is known without error.

Virtual population analysis (VPA): an age-structured assessment model that back-calculates the past population sizes and fishing mortality rates that must have existed to produce the current observed catches. It assumes that the catch-at-age is known each year without error.

References

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Note: The data source for all graphs is SEDAR 18 Atlantic Red Drum Stock Assessment Report.