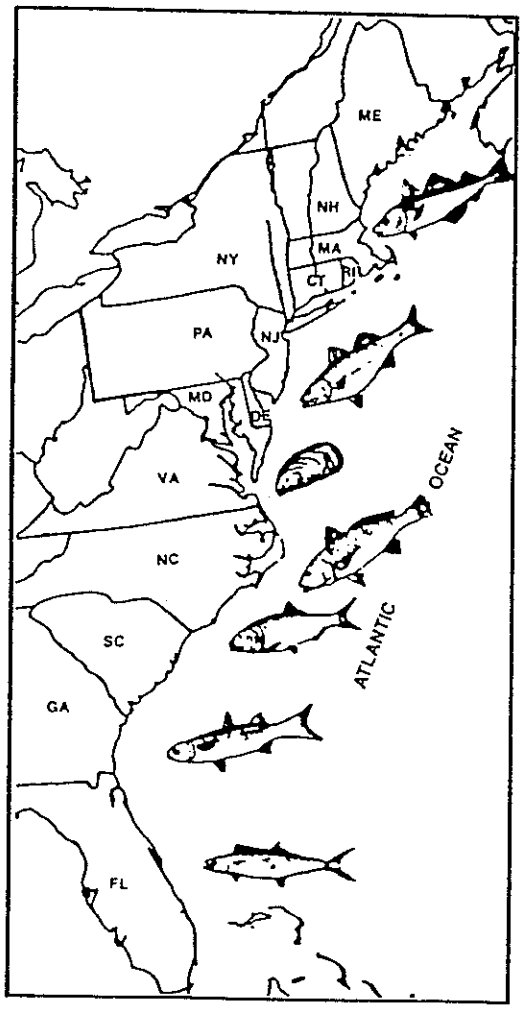
Fisheries Management Report No. 19

of the

ATLANTIC STATES MARINE FISHERIES COMMISSION



FISHERY MANAGEMENT PLAN FOR RED DRUM: AMENDMENT #1

October 1991

FISHERY MANAGEMENT PLAN FOR RED DRUM - AMENDMENT #1

prepared by
the
Atlantic States Marine Fisheries Commission
(ASMFC)

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Editor

Fisheries Management Report No. 19

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ACKNOWLEDGEMENTS

This plan was developed by the Atlantic States Marine Fisheries Commission (ASMFC) through the Red Drum Management Board and Technical Committee of the ASMFC Interstate Fisheries Management Program. Much of the text for this red drum fishery management plan (FMP) was adopted from The Atlantic Coast Red Drum Fishery Management Plan prepared by the South Atlantic and Mid-Atlantic Fishery Management Councils in 1990. The ASMFC would like to express their gratitude to the authors of the Councils' FMP for contributing large portions of text that are incorporated in this document. In addition, Doug Vaughan, National Marine Fisheries Service and Roger Pugliese, South Atlantic Fishery Management Council provided updated stock assessments and management analyses that are greatly appreciated by the ASMFC. Finally, this plan was produced in cooperation with the U.S. Fish and Wildlife Service and partially funded under Cooperative Agreement No. 14-16-0009-90-1212.

1.0 PREFACE

The ASMFC Fishery Management Plan for Red Drum - Amendment #1 replaces an earlier ASMFC plan that was developed in 1984. Amendment 1 updates ASMFC management strategies for red drum in state waters and is coordinated with South and Mid-Atlantic Fishery Management Council planning for red drum in federal waters. This document includes The Atlantic Coast Red Drum Fishery Management Plan that was prepared by the Councils and provides expanded information on state fisheries in the Plan Summary (section 3.0), Environmental Impact Statement (section 4.2), Habitat Preservation Recommendations (section 6.6), Summary of State and Local Laws (section 7.2), and Recommendations to States (section 11.7). The document also contains two appendices that supply: 1) possible future management alternatives for states as outlined by the South and Mid-Atlantic Councils; and, 2) a 1991 stock assessment report. The numbering system and format in the Council and ASMFC plans are identical. The management information in both plans is based on detailed scientific, technical and other supportive documentation contained in a red drum fishery management plan source document that is available from the South Atlantic Fishery Management Council. For additional copies of this plan, contact the ASMFC, 1400 16th St. NW, Suite 310, Washington, DC 20036.

1.1 Definitions and Abbreviations

Escapement- The ratio of survival of one recruit from 0.5 years of age to 6 years of age with fishing mortality > 0 versus fishing mortality = 0 (M =0.44 for ages < 6).

Exclusive Economic Zone (EEZ)- An area extending from the seaward boundary of the States' territorial seas to 200 nautical miles from the baseline from which the territorial sea is measured.

Environmental Impact Statement (EIS)- Required by the National Environmental Policy act of 1969 whenever major Federal actions may significantly affect the quality of the environment, including the human environment. A draft (DEIS) and a final (FEIS) environmental impact statement are prepared.

Fork length (FL)- The measurement of a fish, from the most anterior tip of the head (snout) to the center of the fork of the tail (caudal fin) (see diagram on page v)

Maximum Sustainable Yield (MSY)- The largest quantity (by weight) of fish that can be harvested annually from a resource without reducing its long-term productive potential.

Optimum Yield (OY)- Optimum yield for the Atlantic coast red drum fishery is the amount of harvest that can be taken by U.S. fishermen while maintaining the spawning stock biomass per recruit level at or above 30% of the level that would result at a fishing mortality rate of F=0.

Overfishing- Overfishing is defined as a fishing mortality rate that will, if continued, reduce the spawning potential ratio below 30% of the level that would exist at equilibrium without fishing. The Atlantic coast red drum stock will be considered overfished when the SPR is below 30% of the level that would have existed in the absence of fishing. The 1990 stock assessment report indicates that the red drum stock is overfished with a present SPR between 2% and 3%.

Regulatory Impact Review (RIR)- An assessment of the economic impacts of proposed management measures and alternatives considered in an FMP.

Spawning Stock Biomass (SSB)- The weight of all adult females in the population, calculated from the following: In each age class, the number of individuals left alive (times) the percent of those that are mature (times) the average weight of the individuals.

Spawning Stock Biomass Per Recruit (SSBR)- The total contribution of a cohort to the SSB over its lifetime is found by summing the cohort's contributions at each age. This total value can be scaled by the original number of recruits (R), as SSBR, to provide a general case regardless of the absolute number of recruits. Maximum spawning stock biomass per recruit is obtained under the conditions of no fishing mortality. Combinations of instantaneous fishing mortality (F) and the average age at which the cohort becomes subjected to fishery exploitation (t_c) give rise to lower levels of spawning stock biomass per recruit; all of these can be expressed as percentages of the maximum.

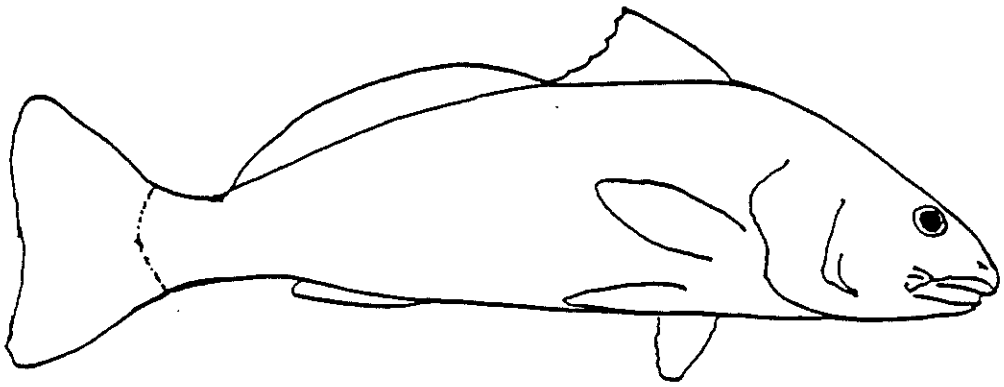
Spawning Stock Biomass Per Recruit Ratio or Spawning Potential Ratio (SPR)- A measure of reproductive potential of a fish stock and is defined as the ratio of spawning stock biomass per recruit of its fished magnitude ($SSBR_{fished}$) to its unfished magnitude ($SSBR_{unfished}$).

Standard Length (SL)- is the measurement of a fish, from the most anterior tip of the head (snout) to the base of the tail (caudal fin) (see diagram on page v).

Total Length (TL)- is the measurement of a fish, from the most anterior tip of the head (snout) to the most posterior tip of the tail (caudal fin) (see diagram on page v).

Total Allowable Level of Foreign Fishing (TALFF)- Only that portion of optimum yield which will not be harvested by U.S. fishermen.

LENGTH MEASUREMENTS



I---------- total length ---------- I
I---------- fork length ---------- I
I---------- standard length ---------- I

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3.0 SUMMARY

A Fishery Management Plan for Red Drum - Amendment 1 is part of a coordinated effort to manage red drum along the Atlantic coast. Amendment 1 revises a 1984 ASMFC plan that applies to fisheries in state waters (out to 3 miles from shore). In addition, this plan integrates management with The Atlantic Coast Red Drum Fishery Management Plan of 1990 prepared by the South and Mid-Atlantic Fishery Management Councils for red drum in the Exclusive Economic Zone (3-200 miles from shore). The ASMFC and the Councils have identical management goals and objectives for red drum. The management unit is defined as the population of red drum (Sciaenops ocellatus) occurring along the U. S. Atlantic coast from the east coast of Florida to the New Jersey/New York line.

Problems in the fishery include: 1) Intense fishing mortality on juvenile red drum, predominantly in state waters, has resulted in significantly decreased recruitment to the spawning stock. The 1990 stock assessment report indicates that the red drum stock is overfished with a present SSBR ratio between 2% and 3%. In addition, the potential exists for development of a directed Exclusive Economic Zone (EEZ) fishery which could result in rapid reduction of the spawning stock. High juvenile mortality, alone, or in combination with the development of a directed EEZ fishery, could eventually contribute to recruitment failure; 2) Lack of Federal regulations, in addition to inconsistency and incompatibility among state regulations, makes enforcement difficult and may result in inadequate protection of the red drum resource; and 3) There is a need for additional biological, economic and sociological data to effectively monitor and assess the status of the resource and management efforts.

Plan Goal and Objectives

The goal of this plan is to attain optimum yield from the red drum fishery. Optimum yield in the Atlantic coast red drum fishery is the amount of harvest that can be taken by U.S. fishermen while maintaining the spawning stock biomass per recruit level at or above 30% of the level that would result at a fishing mortality rate of F=0.

Objectives of the plan are to: 1) Maintain a spawning stock biomass sufficient to prevent recruitment failure by cooperatively working with the States to provide escapement of juvenile red drum to the spawning stock and control fishing mortality to achieve at least a 30% spawning stock biomass per recruit level; 2) Provide a flexible management system to address incompatibility and inconsistency among state and federal regulations which minimizes regulatory delay while retaining substantial ASMFC, Council, and public input into management

decisions and which can adapt to changes in resource abundance, new scientific information and changes in fishing patterns among user groups or by area; and 3) Promote cooperative collection of biological, economic and sociological data required to effectively monitor and assess the status of the red drum resource and evaluate management efforts.

Council Management Measures

Management measures for this plan incorporate existing Council management measures and include: 1) A fishing year of January 1-December 31 to complement ongoing state and federal efforts in the collection of commercial and recreational fishery statistics; 2) A procedure for preparation and review of stock assessments to support specification of total allowable catch (TAC) and allocations in the EEZ by plan amendment. This procedure will provide a mechanism whereby the NMFS will provide, at the request of the Council, an Atlantic coast red drum stock assessment. The Council's appointed stock assessment review group will compute an ABC for the EEZ based on the assessment and risk analysis. The Council subsequently may modify TAC for the EEZ through plan amendment; 3) The prohibition of harvest or possession of Atlantic red drum in or from the EEZ until a 30% SSBR ratio is attained, and until such time as a TAC is specified by plan amendment that provides for harvest; and 4) States are requested, through adoption of an amended ASMFC Red Drum Fishery Management Plan, to achieve the needed level of escapement of juvenile fish to the adult stock by reducing fishing mortality through such actions as gear restrictions, closed seasons, quotas, size limits and bag limits. States are requested to annually report to the Council the level of escapement of juvenile fish to the adult stock from their state waters and what actions they have taken to achieve the needed level of escapement.

ASMFC Recommendations for State Management

Escapement refers to the survival of juvenile red drum to adulthood. It is defined as the ratio of survival of one recruit from 0.5 years of age to 6 years of age with fishing mortality >0 versus fishing mortality = 0. Thus, fishing mortality on juveniles (ages 0.5 to age 6) in inshore state waters has a direct effect on levels of escapement. In addition to conserving juvenile fish, there is a need to reduce fishing mortality on adult populations.

In order to reduce overall fishing mortality, increase juvenile escapement, and reach the 30% target SSBR level, it is recommended that specific management measures be implemented in a series of steps. Management measures that will attain an SSBR level above 10% should be implemented as a first step in the overall management strategy. Annual stock assessments will be conducted during the first step of management, and if necessary, further adjustments in management measures will be recommended by

the ASMFC.

There are numerous combinations of size limits and daily possession limits to attain desired levels of SSBR. Recommended measures for the first step of management include either of two scenarios:

	Minimum Size	Maximum Size	Possession Limit
1.	18 inches TL	27 inches TL	5 fish, including one fish exceeding 27 inches TL
2.	14 inches TL	27 inches TL	5 fish, with no fish exceeding 27 inches TL

(TL = Total Length)

Research Recommendations

Research priorities include the following list from the stock assessment for Atlantic coast red drum: 1) Improve catch, effort and length frequency statistics from the recreational and commercial fisheries; 2) Direct additional effort in intercepting recreational fishermen through the MRFSS who fish nighttime hours; 3) Increase tagging efforts on three to five year old red drum with directed effort to recapture subadult and adult red drum to determine if disappearance is due in part to offshore emigration; 4) Standardize sampling of the Atlantic coast subadult red drum population to develop a long-term index of recruitment; 5) Develop a more reliable maturity schedule for population level analyses; 6) Determine relationships between annual egg production and female length or weight for Atlantic coast red drum; and 7) Develop a more reliable estimate of natural mortality through directed sampling of the adult population.

Other research needs identified in Section 5.7 of the Source Document for the Atlantic coast red drum fishery management plan include: 1) Determine (more precise estimates of) escapement levels of juvenile red drum to the spawning stock by state; 2) Determine natural and fishing mortality rates for Atlantic coast red drum; 3) Determine stock structure; 4) Determine survival rate of released red drum; 5) Develop a fishery independent index of relative abundance; 6) Determine inshore/offshore, as well as, coastwide migration patterns through enhanced mark-recapture studies, aerial surveys and sonic tagging efforts; 7) Determine spawning areas; 8) Determine the economic value of the Atlantic coast recreational (and commercial) red drum fishery; 9) Assess and modify, as needed, MRFSS procedures to more accurately survey red drum recreational catch and effort; 10) Document and

characterize schooling behavior for Atlantic coast red drum; and 11) Encourage the current efforts to continue collection of socioeconomic data in the MRFSS and to collect socioeconomic data in the commercial fishery, where available.

Habitat research needs include: 1) Identification of optimum red drum habitat and environmental conditions; 2) The quantitative relationships between red drum production and habitat; 3) Effects of water quality degradation on red drum production; 4) Identification of areas of particular concern for red drum; 5) Determination of habitat conditions that limit red drum production; 6) Methods for restoring red drum habitat and/or improving existing environmental conditions that adversely affect red drum production; 7) Encourage research in developing bio- or photo-degradable plastic products to reduce impact as refuse on the inshore, nearshore, offshore marine environments utilized by red drum at various stages of development; 8) Quantify impacts of acid rain on estuarine systems vital to red drum production; 9) Research that could be incorporated into a biological and socioeconomic impact assessment quantifying the effects of oil, gas and mineral exploration, development or transportation on red drum, their essential offshore, nearshore and estuarine habitat and the Atlantic coast red drum fishery; and 10) Determine impacts the dredging of nearshore and offshore sand bars for beach renourishment would have on red drum spawning activity. In addition, the impacts of any type of dredging activity on all life history stages of red drum.

4.0 ENVIRONMENTAL IMPACT STATEMENT

This environmental impact statement is required for all Council fishery management plans and was prepared by the South Atlantic Council for The Atlantic Coast Red Drum Fishery Management Plan. It is included in this ASMFC plan to provide additional information and references for the reader.

( ) Draft (X) Final

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Name of Action:

(X) Administrative

( ) Legislative

Abstract:

The proposed action will result in management of red drum, Sciaenops ocellatus, along the U. S. Atlantic coast from the east coast of Florida to the New Jersey/New York line. Problems in the fishery include: 1) Intense fishing mortality on juvenile red drum, predominantly in state waters, has resulted in significantly decreased recruitment to the spawning stock. The 1989 stock assessment report indicates that the red drum stock is overfished with a present SSBR ratio between 2% and 3%. In addition, the potential exists for development of an EEZ fishery which could result in rapid reduction of the spawning stock. High juvenile mortality, alone, or in combination with the development of a directed EEZ fishery, could eventually contribute to recruitment failure; 2) Lack of Federal regulations, in addition to incompatibility and inconsistency among state regulations makes enforcement difficult and may result in inadequate

protection of the red drum resource; and 3) There is a need for additional biological, economic and sociological data to effectively monitor and assess the status of the resource and management efforts. Objectives are to: 1) Maintain a spawning stock biomass sufficient to prevent recruitment failure by cooperatively working with the States to provide 30% escapement of juvenile red drum to the spawning stock and control fishing mortality to achieve at least a 30% spawning stock biomass per recruit level; 2) Provide a flexible management system to address incompatibility and inconsistency among state and federal regulations which minimizes regulatory delay while retaining substantial Council and public input into management decisions and which can adapt to changes in resource abundance, new scientific information and changes in fishing patterns among user groups or by area; and 3) Promote cooperative collection of biological, economic and sociological data required to effectively monitor and assess the status of the red drum resource and evaluate management efforts. Optimum yield for the Atlantic coast red drum fishery is the amount of harvest that can be taken by U.S. fishermen while maintaining the spawning stock biomass per recruit level at or above 30% of the level that would result at a fishing mortality rate of F=0. Management measures proposed include: 1) A fishing year January 1 -December 31; 2) A procedure for preparation and review of stock assessments to support specification of total allowable catch (TAC) and allocations in the EEZ by plan amendment and 3) The harvest or possession of Atlantic red drum in or from the EEZ is prohibited until a 30% SSBR is attained and until such time as a TAC is specified by plan amendment that provides for harvest. In addition the SAFMC, utilizing the data and conclusions indicating the current mortality and disappearance rates of juveniles from state waters, recommends that States achieve 30% escapement of juveniles needed to achieve at least a 30% SSBR. States are requested, through adoption of an amended ASMFC Red Drum Fishery Management Plan, to achieve 30% escapement of juvenile fish to the adult stock by reducing the rate of fishing mortality through such actions as gear restrictions, closed seasons, quotas, size limits and bag limits. States are requested to annually report to the Council the level of escapement of juvenile fish to the adult stock from their state waters and what actions they have taken to achieve the needed level of escapement. Management actions will be implemented under the Magnuson Fishery Conservation and Management Act of 1976 (16 U.S.C. 1801, et seq.).

4.1 LIST OF CONTRIBUTORS - COUNCIL PLAN

The Council portion of this document contains all elements of the Fishery Management Plan (FMP) for offshore fisheries (3-200 miles), the Environmental Impact Statement (EIS) and a Regulatory Impact Review (RIR). The FMP, RIR and EIS were prepared by the South Atlantic Fishery Management Council in cooperation with the Mid-Atlantic Fishery Management Council and was prepared with principal input from Council staff:

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John Gauvin, Fishery Economist

National Marine Fisheries Service

Douglas S. Vaughan, NMFS SEFC
Rod Dalton, NMFS Plan Coordinator

The source document, which contains the detailed scientific, technical and other supportive documentation on which this management plan is based, was prepared by staff of the South Atlantic Fishery Management Council, a Plan Development Team and other fishery experts. The source document is available from the South Atlantic Council.

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List of Agencies, Organizations and Persons to Whom Copies of the Council EIS Statement were Sent:

Atlantic Coast Conservation Association
Atlantic States Marine Fisheries Commission
U.S. Army Corps of Engineers
U.S. Department of Commerce
    Office of Coastal Zone Management
U.S. Department of the Interior
    Bureau of Land Management
    Fish and Wildlife Service
    National Park Service
U.S. Department of State
U.S. Department of Transportation
    Coast Guard
U.S. Environmental Protection Agency, Region IV
Center for Environmental Education
Conservation Council of Angling Clubs
Regional Fishery Management Councils
Florida League of Anglers
Gulf & South Atlantic Fisheries Development Foundation
Marine Advisory Agents
Marine Mammal Commission
Mid-Atlantic Fisheries Development Foundation
National Coalition for Marine Conservation
National Fisheries Institute
North Carolina Fisheries Association, Inc.
Organized Fishermen of Florida
Southeastern Fisheries Association
Sportfishing Institute
State Coastal Zone Management Agencies (New Jersey through Florida)
State Resource Agencies

New Jersey	North Carolina
Delaware	South Carolina
Maryland	Georgia
Virginia	Florida

Draft Statement to EPA: March 30, 1990

4.2 LIST OF CONTRIBUTORS - ASMFC PLAN

A Fishery Management Plan for Red Drum - Amendment 1 was prepared by the ASMFC Red Drum Board and Technical Committee and was adopted by the ASMFC on October 10, 1991.

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5.0 DESCRIPTION OF STOCK

5.1 Description and Distribution

5.1.1 Identity

Red drum (Sciaenops ocellatus) is one of 22 members of the family Sciaenidae found along the Atlantic and/or Gulf coast of the United States. This family is commonly known as the drums since many of its members, including red drum, produce drumming sounds by vibrating their swim bladders with special muscles. Other common names include: channel bass, puppy drum, redfish, bull redfish, bass, red bass, sea bass, spotted bass, spottail bass, spottail, rat red, pescasdo colorado, drum, branded drum, sweet William and billy bass.

5.1.2 Morphology

Adult red drum are elongate, silvery red fish with a distinguishing black spot at the base of the caudal fin above the lateral line. The head is long, with a blunt snout and large subterminal or inferior mouth, a possible adaptation to the shallow water, surf zone habitat. Younger fish may have multiple spots distributed over each side and, with time, the spots fade leaving only the one main black spot at the base of the caudal fin. This characteristic is the basis for the common name "spottail bass" that is used frequently in South Carolina and Georgia.

5.1.3 Distribution

5.1.3.1 General Distribution

Red drum occur in a variety of habitats distributed from Massachusetts to Key West, Florida on the Atlantic coast and from extreme southwest Florida along the Gulf coast to Tuxpan, Mexico. Red drum historically have been found as far north as Massachusetts with concentrations great enough to support a moderate commercial fishery in New Jersey in the early 1930s. Commercial red drum landings have generally declined along the mid-Atlantic coast with none being reported north of the Chesapeake Bay since 1950. The distribution of red drum along the Atlantic coast in recent years, as indicated from recreational and commercial landings, extends from the Chesapeake Bay area through Florida.

5.1.3.2 Differential Distribution

The distribution of red drum between estuarine habitat and oceanic waters is dependent mainly on stage of development and temporal and environmental factors. Red drum are euryhaline. Adult and subadult red drum are most often found in diluted/concentrated seawater of 20 to 40 ppt and rarely above 50 ppt, while juveniles range into the freshest parts of estuaries.

Eggs and newly hatched larvae require salinities above 25 ppt. Spawning is thought to occur in or near passes of inlets with larvae being transported into the upper estuarine areas of low salinity. As larvae develop into juveniles and sub-adults, they utilize progressively higher salinity estuarine and beachfront surf zones. Red drum move out of estuarine areas as adults and occupy the high salinity surf zone nearshore and offshore coastal waters. In North Carolina and Virginia, large, adults move into estuaries during summer months.

Red drum are eurythermal, occurring over a temperature range of 2-33 C, although they usually move into deeper water at extremes. Larger juveniles and adults are more susceptible to the effects of winter cold waves than small fish. High red drum mortality during freezes occurs and has the ability to decimate large portions of juvenile year classes. Thermal optimum is dependent on salinity, a characteristic of euryhaline fish.

5.1.3.2.1 Eggs, Larvae and Juveniles

Red drum spawn in the ocean along beaches and in the vicinity of inlets and passes and possibly in high salinity estuaries. Red drum spawn at night and produce planktonic, spherical eggs between 0.86 mm and 0.98 mm in diameter. Eggs are clear with a single, gold-colored oil droplet. Environmental requirements for optimum incubation were determined in the laboratory as a salinity of 25-35 ppt below which the eggs would sink and above which the eggs would clump together. In addition, optimum spawning occurred at temperatures of 22-30 C. Red drum eggs and larvae are carried through tidal and current movement into estuarine systems. Increased spawning activity is associated with new and full moon periods during the spawning season.

Juvenile red drum have a pronounced seasonal pattern of distribution in Chesapeake Bay and North Carolina moving into deeper areas of estuaries or the ocean in the fall and winter. Juveniles have been collected throughout Chesapeake Bay from September to November and through December in North Carolina. In North Carolina, juvenile one and two year old red drum occur year round in estuaries, both in mainland bays and rivers, and along the grass flats behind barrier islands. A portion of these cohorts migrate into the ocean after their first year and occur along beaches during the late fall through early spring. Peak recruitment of young fish generally occurs September through November in North Carolina estuaries.

5.1.3.2.2 Adults

After maturation, adult red drum spend less time in the estuaries and more time in the ocean. They migrate seasonally along the coast, inshore and/or north in spring and offshore and/or south in fall. Chesapeake Bay red drum are taken through October and are most abundant during spring and fall. Large schools of adult red drum were identified during aerial surveys

conducted as part of the Atlantic Marine Gamefish Research Program. The annual survey encompassed 12 monthly flights over the continental shelf from Cape Cod, Massachusetts to Miami, Florida to measure sea surface temperature and record sightings of all fish and other surface life. Large schools of adult red drum were identified offshore south of Hatteras, North Carolina in April. Additional sightings of red drum offshore were noted to occur north of Hatteras in May and June. Large numbers of red drum are occasionally gigged in North Carolina sounds in the winter.

Annually, the best catches of large red drum occur around the eastern shore of Virginia and in the lower Chesapeake Bay in May-June and September-October. Largest catches of adult red drum along the Outer Banks are made from late March through May and from October through November. Large schools of red drum have been observed in Pamlico Sound, North Carolina during the summer. In winter, red drum have been caught in the trawl fishery and in trawl surveys at depths of 10 to 40 m. Red drum have been reported off South Carolina in 13-26 m of water in the winter and early spring.

In addition, large red drum were captured by shark gillnet fishermen in the EEZ offshore of Folly Beach, South Carolina in May 1989. Recreational fishermen in South Carolina have identified large schools of adult red drum nearshore feeding along bars during rising tides at night. In Georgia, red drum older than four years are generally found along beaches and in offshore waters. Recent sonic tagging studies conducted by Georgia Department of Natural Resources have resulted in field verification of red drum surface schools offshore in the EEZ.

5.1.4 Reproduction

Red drum are dioecious (i.e., distinct males and females) and fertilization occurs externally. Larval sex ratios do not differ significantly from 1:1. Red drum are primarily late summer and fall spawners, but spawning sometimes extends into winter. Spawning along the Atlantic coast may begin in July or possibly earlier and continue through December, with a peak in late September or October. Spawning success and year class strength may be adversely affected by a decrease in nearshore water temperatures early in the fall.

Size and age at maturity differs between sexes with males maturing at smaller sizes and younger ages than females. Atlantic coast red drum mature at between 22.6 in TL (574 mm) and 37.6 in TL (955 mm) for females and between 14.0 in TL (356 mm) and 33.3 in TL (846 mm) for males. The length at which 50% are mature (L_{50}) has been estimated at 36.4 in TL (923 mm) for females and 20.9 in TL (531 mm) for males. Red drum are prolific spawners and have, through hormone induced strip spawning, produced one to three million eggs in a single spawn.

5.1.5 Age and Growth Patterns

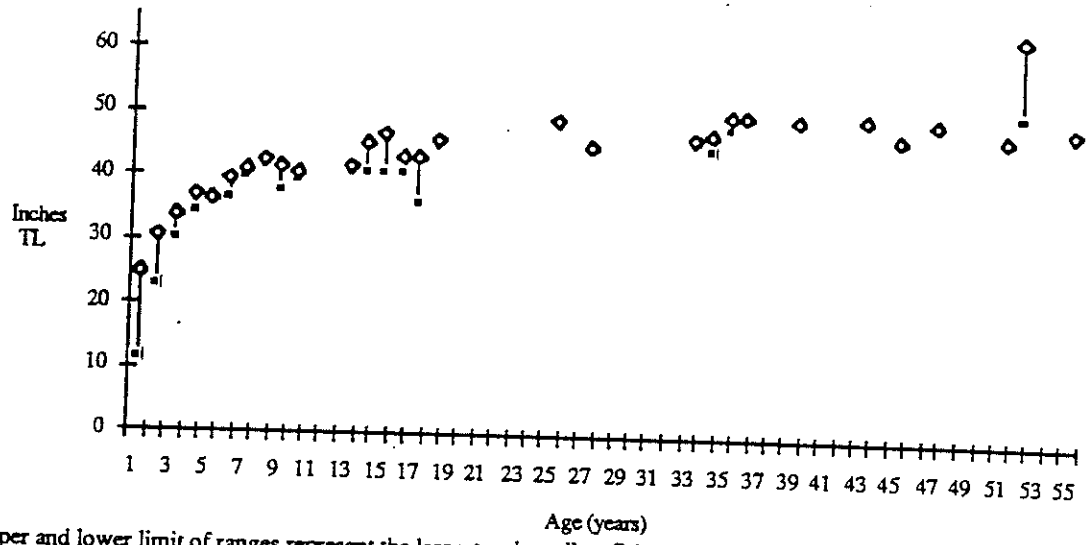
Daily growth rates are as follows: embryonic growth, 0.24-0.46 mm TL; early juvenile growth, 0.53-1.70 mm TL; Age I+ growth, 0.57-0.85 mm TL; Age II+ growth 0.37-0.41 mm TL; and Age III+ growth, 0.20-0.35 mm TL. Length at age from a variety of studies is presented in Figures 1 and 2.

A double von Bertalanffy function was used to describe growth (Table 1) in the Atlantic coast stock assessment. Use of the double von Bertalanffy growth curve is more appropriate than the single von Bertalanffy because it is able to fit the rapid growth at earlier ages as well as describe the slower growth in later years, joined by transition age. The transition age for red drum on the Atlantic coast was computed to be approximately five years and corresponds with the age that males are fully mature and females are beginning to mature (Murphy and Taylor 1986).

In Murphy and Taylor (1986) maximum attainable length of Atlantic coast red drum was estimated to be 46.2 in (1,174 mm) TL and if one assumes one opaque band is formed annually on otoliths, the maximum age sampled was 33 years old. In North Carolina, a 1,137 mm FL fish was 51 years old; a 1,220 mm FL fish was 52 years old, a 1,165 mm FL fish was 55 years old and the world record red drum measuring 1,499 mm FL (94 lb; 42.6 kg) was 52 years old (Ross and Stevens 1989). Red drum in the Gulf of Mexico have been aged through 37 years at Louisiana Coastal Fisheries Institute where red drum otoliths have been collected and analyzed since 1985. In summary, Atlantic coast red drum have been aged as old as 33 years on the Florida Atlantic coast, 39 years along Georgia and about 55 years along the North Carolina coast based on opaque benching patterns visible on otolith sections. Recaptures of oxytetracycline injected adults in Florida have validated opaque bands as annuli.

5.1.6 Movement Patterns

Adult red drum migrate seasonally along the Atlantic coast. Reports from fishermen and menhaden spotter pilots indicate that red drum typically arrive at Cape Hatteras, North Carolina between March and April, some entering Pamlico Sound and others proceeding up the coast. Red drum are expected about a week later at Oregon Inlet and three weeks to a month later in Virginia, some entering Chesapeake Bay. Apparently in times of high abundance and proper environmental conditions, red drum averaging 13-14 kg (33-36 lb) were present along the New Jersey coast from May to October. Red drum leave Virginia in most years by October and fall fishing along the North Carolina coast starts in September and usually ends in November.



* upper and lower limit of ranges represent the largest and smallest fish measured with the same otolith determined age.

Figure 1. Otolith determined ranges for total length at age 1 to 55 for red drum collected from coastal North Carolina in 1987 and 1988 (Source: Ross and Stevens 1989).

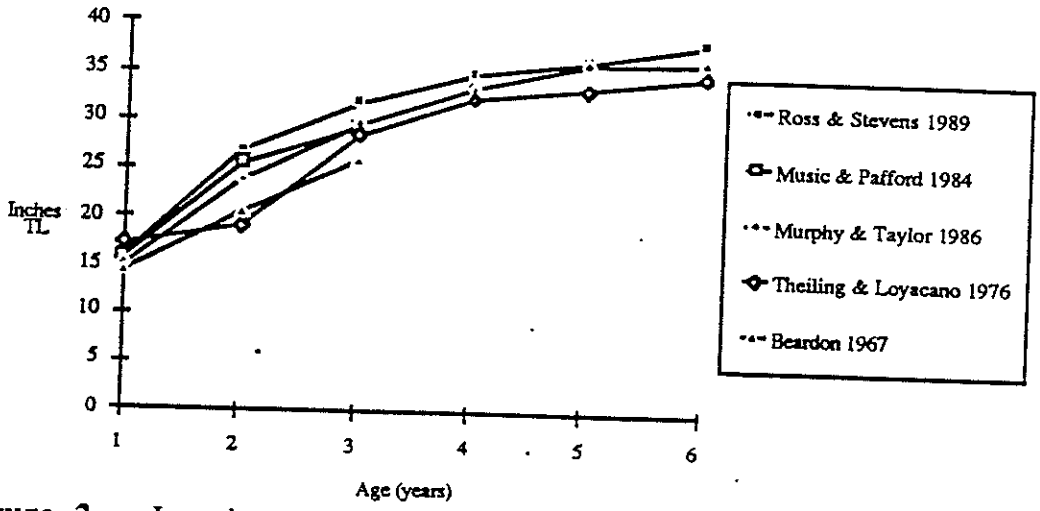


Figure 2. Length at age 1 to 6 for red drum sampled along the Atlantic coast.

Table 1. Estimates of double von Bertalanffy parameters for red drum by year and South Atlantic State (Vaughan and Helser 1989).

State	L_{max}	K_1	K_2	T_1	T_2	T_x
North Carolina	1,168.2	0.26	0.07	-0.80	-15.9	4.7
South Carolina	1,041.9	0.29	0.07	-0.61	-18.1	5.7
Georgia	1,148.1	0.24	0.03	-1.88	-44.6	3.9
Florida	1,037.0	0.30	0.14	-1.15	-7.5	4.7

L_{max} = The asymptotic length of the average fish in the population.
K_1 = Growth rate for fish in the population less than the transition age.
K_2 = Growth rate for fish in the population greater than the transition age.
T_1 = Theoretical age at which length is 0 for fish less than transition age.
T_2 = Theoretical age at which length is 0 for fish greater than transition age.
Tx = Transition Age $= \frac{(K_2 * T_2) - (K_1 * T_1)}{(K_2 - K_1)}$

After their first or second year some red drum move along the barrier island beaches during fall and spend winter in deep holes or sloughs, while others winter in the estuary. As they get older, they spend spring, early summer and fall along the beaches and winter offshore. As spring approaches, these adult fish move from offshore wintering grounds towards the beaches with concentrations showing up around Ocracoke, Hatteras and Oregon Inlets, North Carolina. They occur along beaches near inlets for one to two months and move inside Pamlico Sound in summer. In August they school up around inlets to spawn and remain there and along the beaches through November, then move offshore again.

Red drum also exhibit a north/south movement pattern as follows: A large body of fish moves inshore and north along the beaches in the spring up to the Chesapeake Bay and Virginia barrier islands. Also a large number of fish, generally 5-25 lb, spend their summer around shoals off Cape Hatteras, Cape Lookout and the four inlets north of Cape Lookout.

One consistent pattern that can be drawn from Atlantic coast red drum tagging studies is that red drum tend to stay in the same general estuarine system from post larval stages through their third or fourth year of life. They then move out of the estuarine system into the spawning stock associated with nearshore and offshore areas. Some large fish move into bays, sounds and harbor systems, even after maturity, and are susceptible to capture. The majority of tagging conducted along the Atlantic coast has been directed toward smaller red drum, less than four years old. Large red drum are being tagged through efforts of recreational fishermen participating in sport fish tagging programs conducted by state fishery agencies. Returns of large fish (>32 in TL) have been very low and many of these returns have occurred at the same general time. Thus movement of these fish can be cited as the minimum distance traveled, not accounting for possible migration and return to spawning grounds (such as specific inlet mouths or bar systems associated with these high energy areas).

5.1.7 Mortality Rates

Estimates of total mortality (Z), natural mortality (M) and instantaneous rates of fishing mortality (F) are presented in Table 2. Murphy and Taylor (1986) calculated instantaneous rates of fishing mortality from commercial and recreational catch in Tampa Bay on the Florida Gulf coast and from the Indian River Lagoon on the Atlantic coast. Using length-at-age keys developed from otolith analysis of subsamples from each coast, they determined the relative abundance of each age group and from this estimated annual total mortality (A) using three different methods. Florida Gulf coast estimates were much higher than for the Atlantic coast, possibly indicating higher fishing mortality. This difference may be an artifact resulting from the strong Age II group in the Florida Gulf coast data (US DOC 1986). Total

mortality for adults in the Gulf of Mexico was estimated to be 0.213. Since there is very little fishing mortality on adults most of this is the result of natural mortality estimated to be 0.20 (Goodyear 1989a).

Table 2. Estimates of instantaneous rates of mortality for red drum (Source: Vaughan and Helser 1989).

State	Area	Author	M	F	Z	Comments
Florida	Mosquito Lagoon/ Indian River	Murphy & Taylor (1986)			1.05[a]	FDNR trammel net (1987-1988)
					1.08[b]	
					1.05	
		Vaughan & Helser (1989)			(0.68-1.35)[c]	
					(0.87-1.69)k	
Florida	Everglades National Park	Rago & Goodyear (1986)	0.56[e]	0.40[e]	0.96[d]	mark-recapture
			0.28[f]	0.34[f]	0.62[d]	
			0.48[g]	0.33[g]	0.81[d]	
Florida	Everglades National Park/Florida Bay	Tilmant et al. (1989)	0.46	1.37	1.87	average of 1984-1985 rates on VPA analysis
Georgia	estuaries	Woodward(pers. comm)	0.22	0.77	0.92[k]	mark-recapture
Georgia	estuaries	Vaughan and Helser (1989)			(0.84-1.78)[k]	GDNR trammel nets (1984-1988)
						GDNR recreational tagged fish (1986-1988)
South Carolina	estuaries	Vaughan and Helser (1989)			(1.72-2.83)[k]	SCWMRD stop nets (1986-1987)
					(1.23-1.26)[k]	SCWMRD recreational tagged fish (1986-1987)
South Atlantic		Vaughan and Helser (1989)	0.83[d]	0.82[h]	1.65[k]	SCWMRD tagging
			0.53[i]	1.12[d]	1.65[k]	
			0.44[j]	1.21[d]	1.65[k]	
			0.93[d]	0.88[h]	1.81[k]	MRFSS data base
			0.53[j]	1.28[d]	1.81[k]	
			0.44[j]	1.37[d]	1.81[k]	

Methods:

[a] Heincke (1913)
[b] Robson & Chapman (1961)
[c] catch curve
[d] from Z=M+F
[e] days at large
[f] contour plot
[g] maximum likelihood
[h] Ricker (1975) based on SC tagging studies
[i] Pauly's method (1979) single von Bertalanffy- sub-adults
[j] Pauly's method (1979) on K1 -double von Bertalanffy
[k] cohort based catch curve

In the Atlantic coast stock assessment, Vaughan and Helser (1989), estimated local total mortality (Z) using a catch curve analysis on red drum sampled from specific State-supplied data sets such as trammel nets in Georgia, stopnets in South Carolina and from the Marine Recreational Statistics Survey (MRFSS) data set (Table 2). A coastwide estimate of Z was obtained using a cohort-based catch curve analysis and produced rates of instantaneous total mortality ranging from 0.81 to 2.10. Estimates tended to be high and may reflect losses due to emigration or reduced availability as well as deaths. Apparent mortality in the estuary may contain a component that is really escapement to the offshore stock (emigration) which cannot be distinguished in tagging programs or age frequency analysis from mortality.

Natural mortality may vary from area to area and year to year because of differences in food availability, predation, parasites or environmental factors such as temperature and salinity. Natural mortality can be expected to vary with age, not only because a marine organism has fewer predators as it grows but also, in this species, because adults occupy habitat is entirely different from that of juveniles and subadults.

5.2 Ecological Relationships

5.2.1 Food

A dietary analysis of red drum (5-300 mm SL) stomach contents was conducted by Daniel (1988) Prey varied with fish size. Copepods were predominant prey by volume for fish 5-15 mm SL, representing 27% of the total volume. Mysids comprised 34% of the total volume of prey for fish 16-30 mm. The highest level of fish consumption occurred in juvenile red drum in the 76 and 100 mm size class (72% by volume) found in 70% of the individual samples. Fish were also a major component of juvenile red drum in both the 100-125 mm SL (51% by volume) and the 125-150 mm SL (60% by volume) size classes. A shift in composition of prey species was observed for red drum 200-300 mm SL. The predominant species observed in this size class included decapods (mainly mud crabs and fiddler crabs) accounting for 96% by volume and 95% of the (83) individuals analyzed. Music and Pafford (1984) analyzed the stomach contents of red drum which ranged from 101 mm to 1,100 mm collected in Glynn County Georgia from January 1979 through June 1982. Red drum 300-600 mm in length were found to have 17% fish, 72% arthropods and 11% plant material, with fiddler crabs (16%) and white shrimp (11%) being the predominant food item by occurrence. Red drum 601-1,100 mm in length were found to have 36% fish, 59% arthropods and 5% plant material, with fiddler crabs (14%) and mud crabs (11%) being the predominant food item by occurrence.

5.3 Abundance and Present Condition

5.3.1 Abundance

Catch per unit effort (CPUE) was calculated by utilizing the total estimated weight of red drum landed or caught and total numbers of red drum landed or caught and dividing by the total number of nominal red drum trips (see Figure 5). Indices of abundance or CPUE were developed based on MRFSS data (1980-1987) for the South Atlantic region.

Directed effort for red drum was expressed in numbers of nominal red drum trips and calculated by determining the proportion of all intercept trips where red drum were the primary or secondary target species or identified in the catch (Figure 3). This figure was expanded to represent the total number of trips for all species to determine the total nominal red drum trips. Directed effort, as defined, showed an average of 5.9% of all trips between 1980 and 1987 were for red drum or resulted in red drum capture (Table 3). The highest number of red drum trips (2,085,711) occurred in 1987, which represents approximately 10% of all trips. The lowest level occurred in 1981 with 402,305 trips targeting or catching red drum.

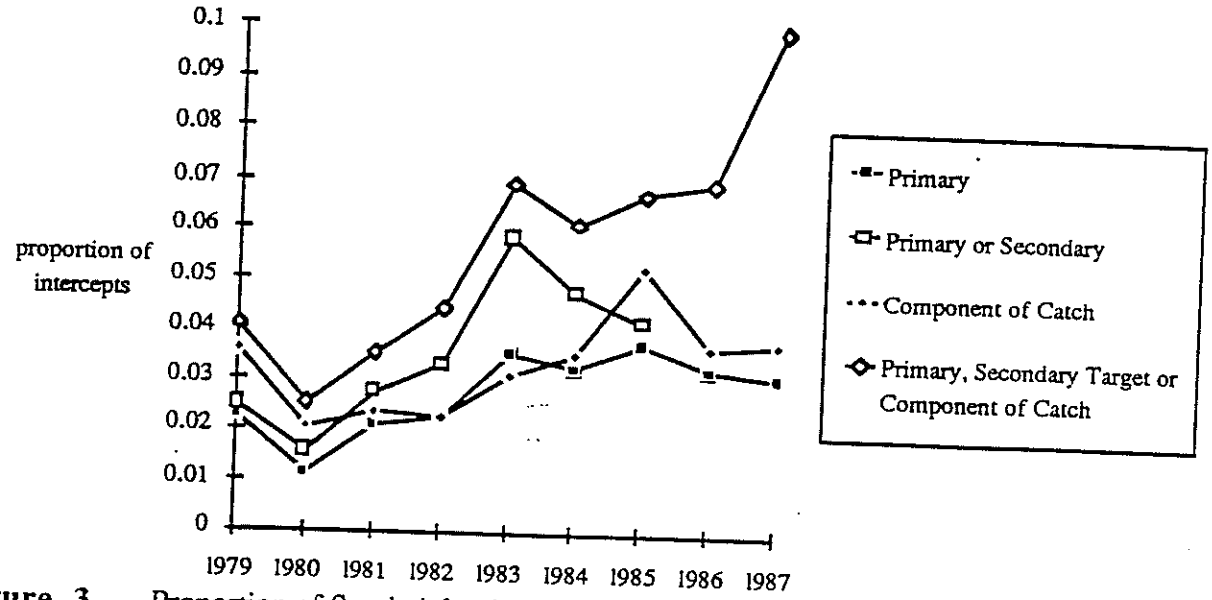


Figure 3. Proportion of South Atlantic intercept trips by year that either identified red drum as the primary or secondary target species or identified red drum in catch regardless of species targeted (Source: MRFSS).

Imposition of state regulations has affected landings and CPUE of red drum. In 1956 North Carolina adopted a 14 in TL minimum size limit and 2 fish over 32 in TL maximum size limit for red drum. The states of Georgia and South Carolina adopted the same regulations in 1986 and 1987 respectively. The State of Florida originally had a 12 in TL size limit on red drum which was raised to 18 in TL in 1985. (Note: Current Atlantic coast State regulations are presented in Figure 6.)

Table 3. South Atlantic recreational fishing trips for all species compared to nominal red drum trips as derived from MRFSS intercept data.

Year	Total Trips (All Species)	Nominal* Red Drum Trips	Proportion of Nominal Red Drum Trips to All Species Trips
1980	16,898,000	419,914	0.02485
1981	11,345,000	402,305	0.03546
1982	15,648,000	691,767	0.04421
1983	15,928,000	1,103,350	0.06927
1984	17,840,000	1,098,369	0.06157
1985	19,840,000	1,312,940	0.06739
1986	14,783,000	1,028,817	0.06959
1987	20,924,000	2,085,711	0.09968

*Nominal red drum trips are defined as trips where red drum were the primary or secondary target species or were caught (Source: MRFSS 1980-1987).

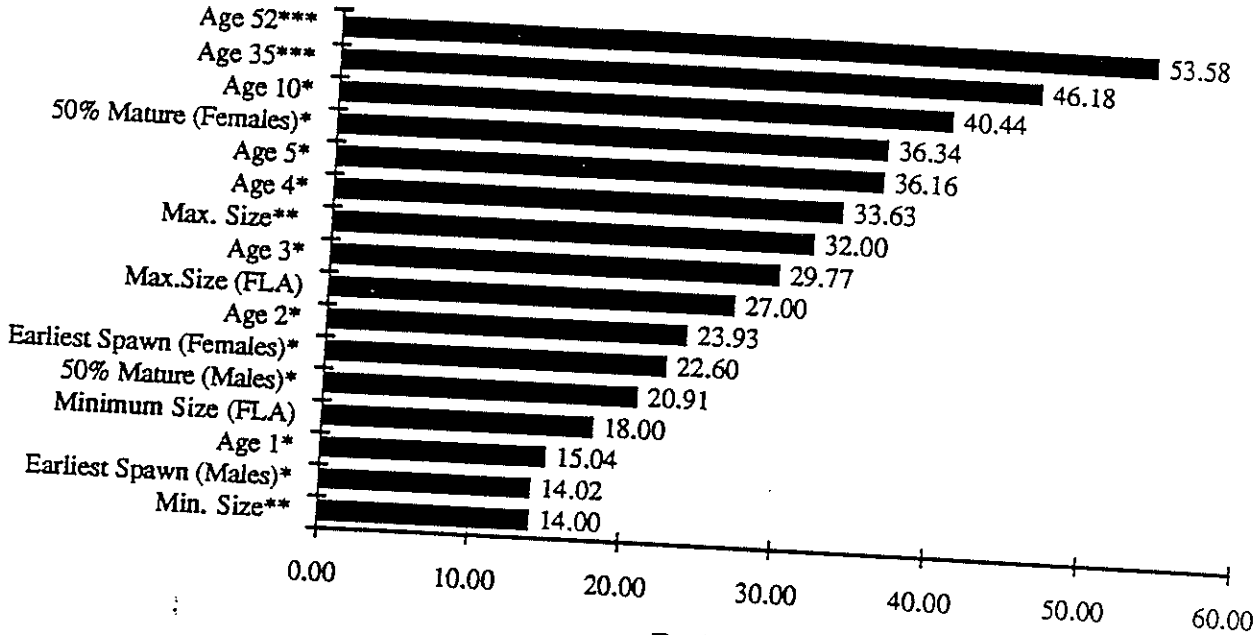
5.3.2 Present Condition

The Atlantic stock of red drum is believed to be overfished. Present SSBR is between 2% and 3% of the level that would occur without fishing. Very high rates of exploitation by fishermen are believed to have reduced present recruitment to the spawning stock to very low levels.

Recreational red drum catches along the Atlantic coast, mainly in the South Atlantic region, are at their highest recorded levels, with approximately 1.5 and 1.3 million fish being caught by recreational fishermen in 1987 and 1988, respectively almost exclusively in state waters.

Commercial landings averaged 239,111 lb between 1962 and 1988. The highest commercial landings was 440,445 lb in 1980. Landings have risen in recent years with seven out of the last nine years exceeding the 26-year average (see Figure 7). Commercial landings of red drum from the EEZ have averaged less than 2,000 lb since 1985 and are, at present, a very minor portion of the total Atlantic coast harvest (see Table 11). In addition, recreational harvest of red drum from the EEZ has been minimal, representing less than 0.6% of the total catch in 1987. Recent events, such as the shark gill net catch in South Carolina and the tracking of red drum schools offshore in Georgia have confirmed the occurrence of spawning size red drum in the EEZ. However, to date, there is no directed commercial or recreational fishery for red drum in the EEZ.

Based on available information, recreational and commercial fisheries in state waters harvest a large portion of a year class as it enters the fishery. This is indicated by high recapture rates from tagging studies conducted off Atlantic coast states. For example, of the 1,459 juvenile red drum released in a study conducted by the North Carolina Division of Marine Fisheries (NCDMF) between August, 1986 and December 1987, 42.9% of fish tagged were recaptured. In recent years there have been a number of good year classes entering the fishery, but the concern is that not enough fish survive to enter the spawning stock. The majority of exploitation occurs on fish that are immature with existing minimum size limits in state waters being well below the age when 50% of females are estimated to be mature (Figure 4).



*Murphy and Taylor (1986)
**min size (NH,MA,VA,NC,SC,GA), max size (NH,VA,NC,SC,GA)
*** Ross and Stevens (1989)

Figure 4. Comparison of red drum length at age, length at first spawn, L_{50} and minimum and maximum size regulations for Atlantic coast States.

A stock assessment prepared by the National Marine Fisheries Service (NMFS) identified high levels of fishing mortality in each South Atlantic state as well as coastwide. Preliminary yield per recruit analysis for red drum in Mosquito Lagoon/ Indian River, Florida showed that maximum yield occurred when fish entered the fishery between 27-32 in (686 -813 mm) FL or when fishing mortality was significantly reduced from (81-83) 60% per year to about 30% per year (Frisbie et al. 1987).

Recreational CPUE indices show an increase starting in 81/82 until 85/86 followed by a decrease in 86/87. The indices are influenced to a degree by state restrictions imposed during the later part of the time sequence (Figure 5).

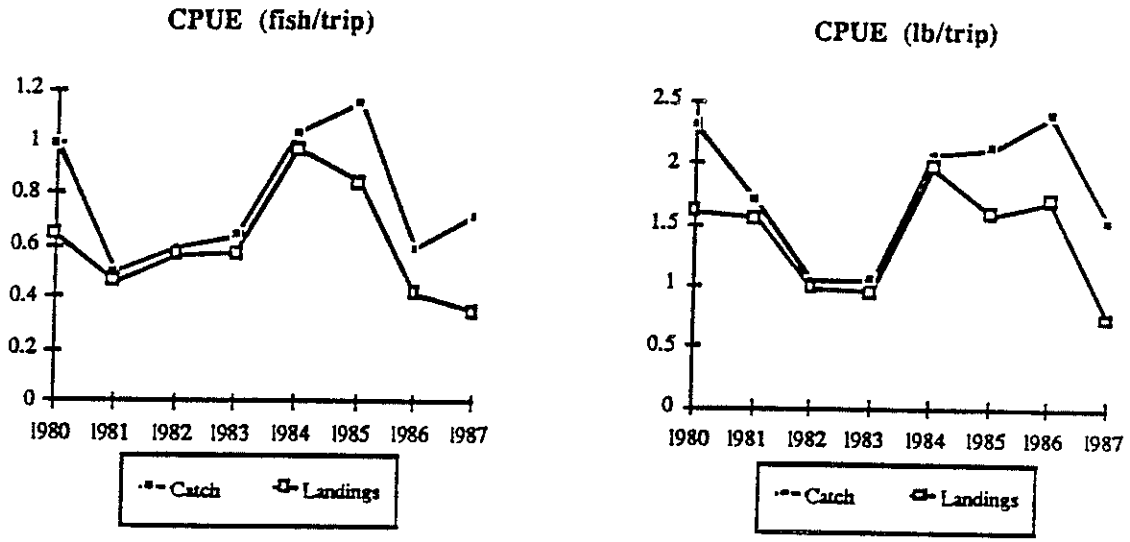


Figure 5. Indices of abundance (CPUE) derived from the expanded estimates of red drum recreational catch and landings, and directed effort (Source: MRFSS).

At the request of the SAFMC, NMFS Southeast Fisheries Center (SEFC) working cooperatively with the Red Drum Plan Development Team, compiled available data and developed a stock assessment for Atlantic coast Red Drum. The assessment confirms the high level of exploitation of juvenile red drum. SSBR for recent years (1986-1988) is estimated to be 2% to 3%. Present escapement of juveniles to the spawning stock (survival to Age VI) is between 2% and 3% (Vaughan and Helser 1989).

Two recent environmental perturbations, Hurricane Hugo which made land fall in Charleston, South Carolina in September 1989 and the December 1989 cold wave in the Southeast, have impacted the red drum stock. The Hurricane and anaerobic conditions that resulted in the primary estuarine nursery habitat for red drum may have destroyed a large portion of the year class occupying the system at the time and in the vicinity of landfall. The cold wave that followed in December resulted in an undetermined mortality of larger red drum occupying coastal waters in the Southeast.

5.3.2.1 Spawning Stock Biomass per Recruit (SSBR)

The basic assumption is that the likelihood of recruitment overfishing is greatly increased if the spawning stock is reduced below some minimum level. SSBR analyses are analogous to yield per recruit analyses and are used to evaluate the effects of age at first capture and rate of fishing mortality on the spawning potential of a cohort (year class) to spawn over its lifetime (Gabriel et al. 1984). This is the type of analysis done for red drum in the Gulf of Mexico. To compensate for decreasing spawning opportunity, a higher proportion of each spawner's offspring must survive to recruitment in relation to an unfished stock. Therefore, the observed number of recruits per unit must equal the SSBR. SSBR analyses reflect the potential biomass of spawners in a cohort and the rate of decline of cohort numbers and total numbers resulting from fishing mortality over time. Gabriel et al. (1984) noted that if age at first capture was below age at sexual maturity, as it is in the Atlantic coast red drum stock, some individuals would not survive to spawn even once. Further, a cohort's contribution to the spawning stock biomass would be much greater if some level of fishing mortality had been applied after most of a cohort had the opportunity to spawn at least once. Gabriel et al. (1984) noted the same level of SSBR can be obtained from several different combinations of fishing mortality and age at first capture, with low levels of fishing mortality beginning at early ages having the same effect on the SSB as higher levels beginning later. Unfortunately, with red drum very high levels of fishing mortality are experienced by the young ages.

Murphy (1988) presented a SSBR analysis for red drum in Florida, which suggested that SSBR levels were less than 1% of their unexploited levels, indicating a high likelihood of recruitment failure.

The stock assessment for Atlantic coast red drum determined that the best estimate of SSBR ratio for current (1986-1988) conditions ranged from 2% to 3% on the Atlantic coast (Vaughan and Helser 1989). The SAFMC Red Drum Plan Development Team and Scientific and Statistical Committee reviewed the assessment and concurred with the SSBR estimates as being the best available given the limitations of the data sets utilized.

5.4 Maximum Sustainable Yield

The potential yield that is available for harvest from the Atlantic coast red drum resource depends upon the biological productivity of the resource over long-term fluctuations in environmental conditions. The surplus production which is sustained may be removed by harvest. There currently is not an accepted estimate of MSY for Atlantic red drum, due primarily to lack of adequate data. Additional research will be necessary to determine MSY (as identified in Section 11.7.2) . MSY is usually presented as a point estimate but the National Standard Guidelines (49 FR 7409) state: "The determination of OY requires a specification of MSY. However, where sufficient scientific data as to the biological characteristics of the stock do not exist, or the period of exploitation or investigation has not been long enough for adequate understanding of stock dynamics, or where frequent large scale fluctuations in stock size make the concept of limited value, the OY should not be based on a fabricated MSY but on the best scientific information available."

5.5 Probable Future Condition

The Atlantic coast red drum stock is currently very heavily exploited, with estimated fishing mortality rates in 1988 ranging between F= 0.82 and F= 1.37. It must be pointed out that these estimates are high and may reflect losses due to emigration or reduced availability as well as deaths. Spawning stock biomass per recruit is currently between 2% and 3%. At these high levels of F and low levels of SSBR, there is a very high probability of recruitment failure in the future if harvest patterns continue. High levels of fishing mortality are expected to continue or increase as the population continues to relocate in coastal areas.

The red drum fishery as presently prosecuted almost exclusively in state waters, consists of two main components: a fishery that targets mainly juveniles to three years old (14 in-32 in; 356 mm-813 mm) and a trophy fishery that targets large red drum, age four through fifty five years old (32 in-54 in; 356 mm-1,372 mm). The majority of commercial and recreational fishing effort targets juveniles. Coastwide tagging studies indicate that

fishermen harvest the a large portion of a year class as it enters the fishery. Good year classes have entered the fishery every couple of years giving an illusion of stability. Subsequently, the spawning stock, which theoretically could consist of 50 or so year classes, may have been reduced over time, as occurred in the Gulf of Mexico, due to low or minimal escapement of juveniles to the spawning stock. Another complicating factor is the increased quantity of accessible habitat. The amount of inaccessible estuarine and nearshore habitat, which could have provided high escapement to the spawning stock, has been and continues to be reduced due to rapid population growth in the South Atlantic region. Red drum, due to limited movement during juvenile stages of their life history, are susceptible to such rapid growth in effort.

The second component of the fishery is the recreational trophy fishery. This fishery is mainly a rare event fishery with fishermen harvesting fish that vary from age 4 to 55 but only range in size from 32 in to 55 in. As prosecuted, surf and boat fishermen pursuing large red drum do not expect to catch large fish every time they fish.

The stability of the Atlantic coast stock is uncertain. Maintained by sporadic, good, year classes, the fishery continues to exploit the fish at high levels, with most escapement to the spawning stock originating from unfished or lightly fished habitats. The trophy fishery continues to be prosecuted on a smaller and smaller range of year classes, but the delineation between these classes is not readily apparent due to their similarity and overlapping ranges of length at age. Theoretically, this decline most likely has continued despite the importance of the fishery and the imposition of minimum and maximum size limits in the fishery. The 14 in TL minimum size limit recommended by ASMFC is recognized as well below age at first spawn. Historical ranges have already been reduced due possibly to high fishing mortality, environmental factors and loss or degradation of suitable estuarine habitat. Another more recent source of mortality on spawning size red drum has been documented in South Carolina as discarded bycatch in the offshore gill net shark fishery. The increasing demand and directed fishing effort for shark may also affect the bycatch of red drum. Theoretically, if harvest practices continue and additional mortality on the spawning stock occurs, the long term potential of the Atlantic coast red drum stock may never be attained. If current fishing mortality continues the stock will continue to be overfished and may eventually result in recruitment failure.

6.0 DESCRIPTION OF THE HABITAT

6.1 Description of the Habitat

Red drum are distributed along the Atlantic coast, in the ocean and estuarine areas in relation to their stage of maturity. Juvenile red drum utilize the shallow backwaters of estuaries as nursery areas and remain there until they move to deeper water portions of the estuary associated with river mouths, oyster bars and front beaches. Estuarine wetlands are especially important to larval red drum. The types of estuarine systems vary along the Atlantic and subsequently, the preferred juvenile habitat also varies with distribution. Young red drum are found in quiet, shallow, protected waters with grassy or slightly muddy bottoms. Shallow bay bottoms or oyster reef substrates are preferred by subadult and adult red drum. Red drum utilize the oceanic system which is the area of the Atlantic ocean from the beachfront seaward. Large red drum are thought to migrate along the Atlantic coast and are subjected to man's alterations of the natural system. Nearshore and offshore bar and bank areas such as Gaskins and Joiner Banks in South Carolina have been identified as areas where concentrations of red drum could be located. Nearshore artificial reefs along the Atlantic are also known to attract red drum as they make their spring and fall migrations. In the fall and spring red drum concentrate around inlets, shoals, capes, and from the surfzone to several miles offshore, moving among these areas.

6.2 Condition of the Habitat

Offshore areas used by adults appear to be the least affected by habitat alterations and water quality degradation. Currently, the primary threat to red drum comes from oil and gas development and production, offshore dumping of dredged material, disposal of chemical and other wastes, and the discharge of contaminants by river systems. However, no studies are available indicating that these activities have adversely affected red drum in their offshore habitat.

Nearshore areas as a whole appear to be in good condition, but local problem areas exist. For example, water quality may be reduced in areas affected by plumes of major rivers. Local disturbances occur during construction related to periodic beach nourishment, dredging and dredged material disposal. Some areas also are affected by thermal effluents and sewage outfalls.

Estuarine nursery areas appear to be the most impacted. Natural and man-induced alterations of the fragile environment have altered much of the area that would be considered suitable habitat. The amount of remaining wetlands suitable for red drum production along the Atlantic coast has not been quantified; however, only about 5.6 million acres or 46% of salt marsh, fresh marsh, tidal flats and swamp wetlands in the United States are

estimated to remain. For the last 25 years, coastal wetlands within the United States have been depleted at a rate of 20,000 acres per year.

6.3 Habitat Areas of Particular Concern

Habitat areas of particular concern are all of those habitats required during the life cycle of the species, but especially the estuarine nursery grounds. Other areas of specific concern are barrier islands in each state, as these structures are vital to maintain estuarine conditions needed by larval and juvenile stages. Passes between barrier islands into estuaries also are very important, as the slow mixing of sea water and fresh water is generally regarded as being of prime importance in the productivity of any estuary. A rapid change may cause environmental stresses too great for many estuarine organisms to withstand.

Seagrass beds or submerged aquatic vegetation (SAV) prevalent in the Chesapeake Bay and the sounds and bays of North Carolina and Florida are also critical areas for red drum, particularly for 1 and 2 year old fish (>750 mm or 29.5 in FL). Seagrass beds, shallow areas of estuarine rivers and mainland shorelines, are where many red drum reside during the summer. Based on a preliminary aerial survey in North Carolina there are approximately 200,000 acres of SAV distributed in Core Sound and eastern Pamlico Sound, making North Carolina second only to Florida in abundance of this type of fisheries habitat.

The states of South Carolina and Georgia lack seagrass beds; the preferred habitat of juveniles (<75mm) based on sampling efforts by Daniel (1988) in Charleston, South Carolina, may be high marsh areas with shell hash and mud bottoms. In South Carolina, smaller juveniles remain in the marsh system until they are around 150 mm, moving into the main creeks and river channels and lower harbor areas as they become larger. In addition, there is seasonal movement out of the marsh and into deep holes and creek channel adjoining the marsh system during the winter months. Therefore, the area of particular concern for early growth and development is seasonal and size dependant encompassing the entire estuarine system from the lower salinity portions of the river systems through the inlet mouth or lower harbor areas.

The various inlets, adjoining channels and outer bars of ocean inlets are critical areas for spawning activity as well as feeding and daily movements and may be affected by constant dredging, jettying or excessive boat traffic. Adult red drum spend a lot of time in these areas during spring and fall with large concentrations located near the least trafficked inlets.

6.4 Habitat Protection Programs

6.4.1 Coastal Zone Management

New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina and Florida, through federally approved Coastal Zone Management Programs, and Georgia through the Department of Natural Resources, direct coastal development using permit review and identification of critical habitat.

The National Estuarine Reserve Research System

Section 315 of the Coastal Zone Management Act of 1972, established the National Estuarine Reserve Research System to provide financial assistance awards on a fifty-fifty percent matching basis to states, to acquire, develop and operate estuarine areas as natural field laboratories. The System protects hundreds of thousands of acres of estuarine waters, marshes, shorelines and adjacent uplands, with education and research being the primary goals of the program. Currently, 18 Reserves throughout the U.S. and its territories are operating with long-term scientific and educational programs that provide information essential to coastal management decision making. Reserves contained in the management unit include Sapelo Island, Georgia, Albemarle-Pamlico Sound, North Carolina and Chesapeake Bay, Maryland. In addition, The Ashepoo, Combahee and South Edisto (ACE) river basins in South Carolina, North Inlet, South Carolina, areas in Delaware and Chesapeake Bay, Virginia are proposed for inclusion into the System. Reserves provide indoor and outdoor classrooms for educators and students and offer several advantages to researchers including natural field stations, an existing environmental monitoring database, onsite support facilities and staff assistance and protected status for long-term projects and comparative studies.

6.4.2 Federal Programs

The NMFS, the U.S. Fish and Wildlife Service (USFWS) and the Environmental Protection Agency (EPA), are the federal agencies that analyze projects proposing wetland alterations for potential impacts on resources under their purview. Recommendations resulting from these analyses are submitted to the U.S. Army Corps of Engineers where they are included in a public interest review that determines whether or not a permit will be issued for a proposed alteration. Pursuant to Section 404 of the Clean Water Act, EPA is the only agency that has veto authority over the issuance of a permit by the Corps of Engineers.

Other federal agencies involved in habitat matters affecting red drum are directed by legislation discussed in Section 7.0 Fisheries Management Jurisdiction, Laws and Policy. The Office of Ocean and Coastal Resource Management may aid in establishing standards for approval to designate estuarine sanctuaries. The

National Park Service also may establish coastal and nearshore national parks and monuments, such as Everglades National Park. The EPA may protect fish habitat by regulating discharge of pollutants; the Corps of Engineers also regulates dredging, construction, and discharge of spoil and disposal materials in wetlands covered under their programs. Conservation of red drum habitat relies heavily on whether recommendations of agencies such as the NMFS, USFWS, EPA and SAFMC are incorporated into permitting decisions. Although granted input under Section 404 statutes, the NMFS, USFWS, SAFMC and state regulatory and management agencies are not granted veto power in the permitting process. They are, however granted commenting and "persuasive" conditioning authority on applications for federal agency permits pursuant to the Federal Fish and Wildlife Coordination Act.

6.4.3 The SAFMC's Habitat and Environmental Protection Committee and Advisory Panels

The SAFMC is directed by the MFCMA to consider protection of habitat essential to fisheries under Council jurisdiction. The MFCMA allows the SAFMC to address habitat concerns in two fashions: 1) through the expansion of habitat sections of fishery management plans; and 2) through commenting directly to agencies regarding ongoing or proposed activities affecting essential habitat. The agency is required by law to supply a substantive written response to the Council within 45 days of receiving such notification of position.

To address habitat concerns,the SAFMC has established a Habitat and Environmental Protection Committee composed of Council members who meet to review and comment on specific proposals or projects that may affect critical habitat. The Committee relies on coordination between Council staff, NMFS SERO and SEFC habitat conservation divisions as well as the Council's Habitat and Environmental Protection Advisory Panel.

The Advisory Panel is composed of sub-panels from North Carolina, South Carolina, Georgia and Florida. Sub-panel members represent the following groups: 1) State fishery management agencies; 2) Agencies responsible for coastal zone management; 3) District representatives for the USFWS; 4) Conservationists; 5) Commercial fishermen; and 6) Recreational fishermen. There are two members who sit on all sub-panels: a representative of the NMFS SERO, Habitat Conservation Division and a representative from EPA Region IV.

6.4.4 The MAFMC's Habitat Committee

The Mid-Atlantic Fishery Management Council has formed a Habitat Committee to address activities that may affect habitat of the fisheries under management. The MAFMC, pursuant to the MFCMA, uses existing authorities to support state and federal environmental agencies in their habitat conservation efforts and directly engages the regulatory agencies on commenting on

specific actions, policies or regulations that affect habitat of species being managed. Public hearings and building of administrative record also may be conducted to assure adequate disclosure of facts and public participation in actions affecting habitat.

6.5 Pollution and Habitat Degradation along the Atlantic Coast

6.5.1 Concerns in South Atlantic by State

Impacts of pollution on the red drum stock are not well documented, yet generally it can be assumed that degradation of water quality and sediments in estuarine, nearshore and offshore environments utilized by red drum will result in various degrees of mortality on adults, juveniles, larvae and eggs. Pollutant-related stresses may affect population levels by reducing fecundity or viability of ova; decreasing survival of larvae, post-larvae, juveniles and adults; increasing vulnerability to disease and predation; and reduction in growth rates.

The SAFMC's Habitat and Environmental Protection Advisory Panel has developed a list of major concerns relative to fishery habitat in each state. Issues which were identified as major concerns relative to fisheries habitat preservation are listed below.

North Carolina

- Non-point source pollution (i.e. nutrient loading).
- Impacts of high density development on barrier islands and ocean outfalls for island development.
- Marina development.
- Ulcerative mycosis and its occurrence in virtually all species in specific parts of the estuarine system.
- Identification of critical habitats such as nursery habitats.
- Hydrologic changes in instream flow.
- Land use changes resulting in freshwater impacts changing salinity regimes, phosphate mining and loss of 404 wetlands.
- Chemical discharges from offshore phosphate mining.
- Impacts of peat mining.

South Carolina

- Dredged material disposal for port development.
- Increased barrier island development.
- Impacts of beach renourishment projects.
- Non-point source pollution.
- Impoundment of wetland areas.
- Lack of chemical water quality standards.
- Designation of Charleston Harbor in the national estuary program.
- Instream flow and aquaculture in pumping water from the estuarine system.

Georgia

- Freshwater drainage from Silvaculture.
- Changing time period of water affecting low salinity nursery areas.
- Siting of marinas.
- Port development.
- Dredge disposal.
- Increased salinity of Savannah River.

Florida

- Impoundments for mosquito control and need to pursue increased rotational impoundment management.
- Impacts of beach renourishment.
- The designation of a marine sanctuary in the Indian River Area.
- Dredge and fill operations.
- Freshwater inflow alterations.
- Water pollution.
- Seagrass dieoffs.
- Extensive coastal development and related problems.

6.5.2 Habitat Loss

Degradation of the estuarine, nearshore and offshore environments is in direct conflict with attempts to maintain optimal habitat conditions for red drum spawning, survival and growth. The loss of SAV in Chesapeake Bay, Virginia and in North Carolina and Florida has reduced preferred habitat areas available to larval, juvenile and adult red drum. These losses are due partly to dredge and fill operations, but the decline in SAV also has resulted from increased turbidity caused by discharges of waste materials and suspended solids into the estuarine systems. The point at which reduction in red drum nursery grounds impacts the stock is not known, but with a large portion of the Chesapeake Bay, Florida's East coast and North Carolina's SAV being impacted, this reduction of habitat may force the species into direct conflict with other species utilizing the same habitats as nursery areas. Additionally, the entire Atlantic coast has had a large portion of the saltmarsh and brackish marsh estuarine systems degraded or lost to development through dredge and fill operations. As South Carolina and Georgia lack SAV equivalent to the other Atlantic States, the value of marsh systems for primary and secondary nursery areas increases dramatically. Other activities that are in direct conflict with maintaining optimal red drum habitat include: impoundment of unaltered estuarine wetlands and the reimpoundment of wetlands which have transformed back to productive estuarine wetlands; open water disposal of dredged material in shallow water estuarine bottom; and agricultural practices that result in rapid introduction of pesticides into the marine environment . Man-made alteration of inlet areas and nearshore bar systems where most spawning activity occurs may disrupt spawning activity of red drum; however, necessary research has not been conducted to substantiate this theory.

6.5.3 Plastic Pollution (Persistent Marine Debris)

The production of plastic resin in the U.S. increased from 6.3 billion lb in 1960 to 47.9 billion lb in 1985. This increased production, utilization and subsequent disposal of petro-chemical compounds known as plastics has created the serious problem of persistent marine debris. Marine ecosystems have, over the years, become the final resting place for a vast variety of plastic originating from many ocean and land-based sources including the commercial fishing industry, merchant shipping vessels, the U.S. Navy, passenger ships, recreational vessels, the petroleum industry, plastic manufacturing/processing activities, sewage operations, solid waste disposal, degradation of docks and marinas, and littering by the general public.

Effective January 1, 1989, disposal of plastics into the ocean is regulated pursuant to Plastic Pollution Research and Control Act of 1987 implementing Marpol Annex V (see Table 16 in

the Source Document for specific disposal restrictions). Recognizing worldwide concern for preservation of our oceanic ecosystems, the Act prohibits all vessels, including commercial and recreational fishing vessels from discharging plastics in U.S. waters and severely limits the discharge of other types of refuse at sea. This legislation also requires ports and terminals receiving these vessels to provide adequate facilities for in-port disposal of non-degradable refuse.

6.5.4 Oil and Gas Exploration

Oil and gas exploration is presently under way to locate resources offshore on the outer continental shelf of the Atlantic coast. Three offshore planning areas are being investigated in the Atlantic Region: North, Mid and South. There are 19 active lease tracts totaling 108,171 acres in the South Atlantic region. The adverse effects associated with offshore petroleum production include development effects from the construction of the pipeline, chronic small spills, catastrophic crude spills and catastrophic spills of refined products. Impacts associated with drilling include the introduction of large amounts of drilling muds into the marine environment. Secondary impacts can be the proliferation of on shore support facilities near the water resulting in greater pressure to develop wetlands. If a pipeline is constructed from the site to the mainland, it is estimated that approximately one to three million cubic yards of dredge material will result from laying 150 to 320 miles of line. A large oil spill can be lethal to sea birds, marine mammals, marsh vegetation, fish and benthic life forms with small marine life and shore vegetation suffering from smothering or toxicity. Benthic marine life and larval fishes are often eliminated. In addition to leases previously mentioned, pre-sale information and Environmental Impact Statements have been prepared for Mid-Atlantic Sale 121 and South Atlantic Sale in the exploration of oil and gas offshore of Hatteras, North Carolina. Mobile Oil is currently planning on drilling an exploratory well off of North Carolina's Outer Banks for possible gas concentrations. Should gas or oil be found, the laying of pipe to North Carolina's shoreline facilities would likely have to go through wetlands and/or barrier island grass flats. Since juvenile red drum occur along most shoreline habitats, local production could be adversely affected by dredging and pipeline laying activities. Further, such increased industrial activities could affect adult fish migrations and behavior, since they do react to man made disturbances. The SAFMC has developed a policy statement on oil and gas exploration, development and transportation which is presented in Section 6.6.4.

6.5.5 Atmospheric Nitrogen and Sulfur Deposition (Acid Rain)

Acid rain occurs when atmospheric precipitation has a chemical composition that includes oxides of sulfur and nitrogen. Man's burning of fossil fuels is the main contributor to acid

rain yet other sources include, seaspray, volcanic activity and the bacterial and chemical decomposition of organic matter. Acid rain can have deleterious effect on materials, structures and man-made objects such as commercial and recreational fishing vessels and gear. The effects of acid deposition on marine ecosystems have been difficult to quantify, yet drastic changes in pH may cause fish kills or additional nutrients from the rain may result in eutrophic condition due to the increased nutrient loads in an estuarine system.

The deposition of nitrogen as nitrates into coastal watersheds from the atmosphere results mainly from nitrogen oxide emissions from fossil fuel combustion. Nitrogen oxide production has increased continuously since the 1900s. In a recent study evaluating nitrogen inputs into the Chesapeake Bay, researchers determined that 25% of the nitrogen entering the Bay system resulting from human activity originated from acid rain (Fisher et al. 1988). Problems that have resulted from such large depositions include the acidification of sensitive freshwaters and some headwaters of the Chesapeake Bay. It is predicted that nitrogen emissions will increase 40-60% in the next 40 years.

The National Audubon Society monitors rainfall in 41 states in the U.S. and in July 1988, 17 states were identified as being exposed to highly acidic rainfall. Normal rainfall is generally slightly acidic (pH=5.6) and the designation of high levels of acid rain are assigned when rainfall is almost 100 times as acidic (pH >4.0). All coastal New England and Mid-Atlantic states showed acid concentrations to be high, with South Carolina being the most southern state to show a high level of acid rain for May, June and July of 1988. Officials with the South Carolina Department of Health and Environmental Control noted that the acidity has also increased due to the extended drought conditions occurring in the southeast, allowing pollutants to be more concentrated in the rainfall.

6.5.6 Ocean Dumping

The western Atlantic Ocean, including state territorial seas and the EEZ off the eastern United States, have been historically and continue to be used for disposal of wastes including but not limited to dredged material, sewerage sludge, chemical waste, plastic waste and radioactive material. The SAFMC has adopted a policy statement on ocean dumping that is presented in Section 6.6.2.

6.5.7 Additional Threats to Red Drum Habitat

Additional major, man-induced activities that impact environmental gradients in the estuarine zone include: construction and maintenance of navigation channels; discharges from wastewater plants and industries; dredge and fill for land use development; agricultural runoff; ditching, draining or

impounding wetlands; oil spills; thermal discharges; mining, particularly for phosphate and peat and drilling for petroleum; entrainment and impingement from electrical power plants; dams; marinas; alteration of freshwater inflows to estuaries; saltwater intrusion; mandatory boating access encroaching on critical red drum habitat; and non-point source discharges of contaminants. Most Atlantic coast estuarine systems have, to varying degrees, been impacted by one or all of the previously mentioned activities.

Restriction of access to nursery grounds through impoundment of wetlands for spoil and waste containment, roadways and causeways, aquaculture and mosquito control limits the amount of nursery area available to red drum. Management of water levels and exchange in tidal marshes often severely restricts the accessibility of that marsh to juvenile red drum when water levels are stabilized during waterfowl and fur harvesting seasons in the fall and early winter. Daniel (1988) noted that juvenile red drum move from shallow marsh areas to deeper portions of the estuary where they are associated with river mouths, oyster bars and front beaches in the fall; therefore, impoundment of water in and around tidal marshes during waterfowl harvesting and wintering could adversely impact red drum production.

One method of control of wetland losses involves mitigation of losses through restoration, generation or enhancement of habitat. Mitigation, however, often may not be desirable since some mitigation technologies are poorly understood and implemented. Wetland creation technology is an emerging science that requires more development before it can be routinely applied. Moreover, optimum habitat and environmental conditions must be determined for each estuary so that the best habitat conditions can be created when the methodologies are adequately developed.

6.5.8 Relationship of Habitat Quality to the Ability to Harvest Red Drum

Preservation of quantity and environmental quality of estuarine, nearshore and offshore habitat in the Mid-Atlantic and South Atlantic regions is essential to the Atlantic coast red drum stock. Discharge of pollutants may result in direct mortality of red drum at various stages of their life history. In addition, exposure and concentration of such chemicals in red drum could limit the desirability or the possibility of consumption as occurred in bluefish with PCBs. Presently there is limited information on the concentrations or occurrence of chemicals such as PCBs or Dioxin in red drum coastwide. Research is underway and as information becomes available, the Council will readdress the issue and include information in subsequent amendments to the FMP.

6.6 Habitat Preservation Recommendations

6.6.1 SAFMC Habitat and Environmental Protection Policy

Recognizing that red drum are dependent on the quantity and environmental quality of their essential habitats, it is the policy of the SAFMC to protect, restore and develop habitats upon which red drum fisheries depend, to increase their extent and to improve their productive capacity for the benefit of present and future generations. For purposes of this policy, habitat is defined to include all those things physical, chemical and biological that are necessary to the productivity of the species being managed. Objectives of the SAFMC policy as applied to red drum are to protect the current quantity, environmental quality and productive capacity of habitats supporting red drum fisheries along the Atlantic coast. This objective will be accomplished through the recommendation of no net loss or significant environmental degradation of existing habitat. The SAFMC will pursue, through state, federal and local levels, the restoration and rehabilitation of the productive capacity of habitats which have already been degraded, in addition to recommending the creation and development of productive habitats where increased fishery production will benefit society. The Council shall assume an aggressive role in the protection and enhancement of habitats important to red drum. It shall actively enter Federal decision-making processes where proposed actions may otherwise compromise the productivity of fishery resources of concern to the Council.

6.6.2 SAFMC Policy Statement on Ocean Dumping

The SAFMC is opposed to ocean dumping of industrial waste, sewerage sludge and other harmful materials, and until ocean dumping of these materials ceases: The SAFMC strongly urges state and federal agencies to control the amount of industrial waste, sludge and other harmful materials discharged into rivers and the marine environment and for these agencies to increase their monitoring and research of waste discharge. The SAFMC requests that the Environmental Protection Agency continue to implement and enforce all legislation, rules and regulations with increased emphasis on the best available technology requirements and pretreatment standards. The SAFMC requests that EPA require each permitted ocean dumping vessel (carrying the above described material) to furnish detailed information concerning each trip to the dump site. This might be in the form of transponders, locked Loran C recorder plots of trips to and from dump sites phone calls to the EPA when a vessel leaves and returns to port or other appropriate methods to ascertain that vessels dump only in the 106 area. Also the EPA should take legal action to abate illegal (short or improper) dumping. The SAFMC will take appropriate steps under the Magnuson Act and any other federal laws or regulations to assure the required responses to its concerns about and opposition to dump site 106. The SAFMC requests that fishermen and other members of the public report to

the EPA, Coast Guard and the Councils any observance of vessels dumping other than in approved dump sites. The SAFMC supports current measures being considered to cease ocean dumping of the above described materials by a date certain.

6.6.3 SAFMC Policy Statement on Open Water Disposal of Dredged Materials into Aquatic Waters

The SAFMC is opposed to the open water disposal of dredged material into aquatic systems which may adversely impact habitat upon which fisheries under Council jurisdiction are dependant. The Council urges state and federal agencies, when reviewing permits considering open water disposal in aquatic systems, to identify the direct and indirect impacts such projects could have on habitat upon which fisheries under Council jurisdiction are dependant. The SAFMC concluded that the conversion of one naturally functioning aquatic system at the expense of creating another (marsh creation through open water disposal) must be justified, given best available information.

6.6.4 SAFMC Policy Statement on Oil and Gas Exploration, Development and Transportation

The SAFMC urges the Secretary of Commerce to uphold the 1988 coastal zone inconsistency determination of the state of Florida for the respective plans of exploration filed with Minerals Management Service (MMS) by Mobil Exploration and Producing North America, Inc. for Lease OCS-G6520 (Pulley Ridge Block 799), and by Union Oil Company of California for Lease OCS-G6491/6492 (Pulley Ridge Blocks 629 & 630). Both plans of exploration involve lease blocks lying within the lease area comprising the offshore area encompassed by Part 2 of Lease Sale 116, and south of 26 degrees North latitude. The Council's objection to the proposed exploration activities is based on the potential degradation or loss of extensive live bottom and other habitat essential to fisheries under Council jurisdiction.

Policy:

The Council has expressed concern to the Outer Continental Shelf Leasing and Development Task Force about the proposed area and recommends that no further exploration or production activity be allowed in the areas subject to Presidential Task Force Review (the section of Sale 116 south of 26 degrees North latitude).

The SAFMC recommends the following to the MMS where considering proposals for oil and gas activities for previously leased areas under Council jurisdiction: 1) That oil or gas drilling for exploration or development on or closely associated with live bottom habitat, or other special biological resources, essential to commercial and recreational fisheries under Council jurisdiction, be prohibited; 2) That all facilities associated with oil and gas exploration, development and transportation be designed to avoid impacts on coastal wetlands and sand sharing

systems; 3) That adequate spill containment and cleanup equipment be maintained for all developments and transportation facilities and be available on site within the trajectory time to land and have industry post a bond to assure labor or other needed reserves; 4) That exploration and development activities should be scheduled to avoid Northern Right Whales in coastal waters off Georgia and Florida as well as migrations of that species and other marine mammals off South Atlantic States; and 5) That the EIS for lease Sale 56 be updated to address: impacts from activities related to specifically natural gas production, safety precautions which must be developed in the event of a discovery of a "sour gas" or hydrogen sulfide reserve, the potential for southerly transport of hydrocarbons to nearshore and inshore estuarine habitats resulting from the cross-shelf transport by Gulf Stream spin-off eddies, the development of contingency plans to be implemented if problems arise due to the very dynamic oceanographic conditions and the extremely rugged bottom, and the need for and availability of onshore support facilities in coastal North and South Carolina and an analysis of existing facilities and community services in light of existing major coastal developments.

The SAFMC recommends the following concerns and issues be addressed by the MMS prior to agency approval of any application for a permit to drill any exploratory wells in Lease Sale 56. In addition the SAFMC recommends these concerns and issues also be included in the Environmental Impact Statement for the Outer Continental Shelf (OCS) Leasing Plan for 1991-1996. 1) Identification of the on site fisheries resources, including both pelagic and benthic communities, that inhabit, spawn, or migrate through the lease sites with special focus on those specific lease blocks where industry has expressed specific interest in the pre-lease phases of the leasing process. Particular attention should be given to critical life history stages. Eggs and larvae are most sensitive to oil spills and seismic exploration has been documented to cause mortality of eggs and larvae in close proximity; 2) Identification of on-site species designated as endangered, threatened, or of special concern, such as shortnose sturgeon, striped bass, blueback herring, American shad, sea turtles, marine mammals, pelagic birds and all species regulated under a Federal Fishery Management Plan; 3) Determination of impacts of all exploratory and development activities on the fisheries resources prior to MMS approval of any applications for permits to drill (ADPs), or in the Exploratory Unit area, including effects of seismic survey signals on fish behavior, eggs and larvae; temporary preclusion from fishing grounds by exploratory drilling; and permanent preclusion from fishing grounds by production and transportation; 4) Identification of commercial and recreational fishing activities in the vicinity of the lease or Exploratory Unit area, their season of occurrence,and intensity; 5) Determination of the physical oceanography of the area through field studies by MMS or the applicant, including on site direction and velocity of currents and tides, sea states, temperature, salinity, water quality, wind

storms frequencies and intensities and icing conditions. Such studies must be required prior to approval of any exploration plan submitted in order to have an adequate informational database upon which to base subsequent decision making on site specific proposed activities; 6) Description of required existing and planned monitoring activities intended to measure environmental conditions and provide data and information on the impacts of exploration activities in the lease area or the Exploratory Unit area; 7) Identification of the quantity, composition, and method of disposal of solid and liquid wastes and pollutants likely to be generated by offshore, onshore, and transportation operations associated with oil and gas exploration development and transportation; 8) Development of an oil spill contingency plan which includes: oil spill trajectory analyses specific to the area of operations; dispersant-use plan including a summary of toxicity data for each dispersant; identification of response equipment and strategies; establishment of procedures for early detection and timely notification of an oil spill including a current list of persons and regulatory agencies to be notified when an oil spill is discovered; and well defined and specific actions to be taken after discovery of an oil spill; 9) Studies should include detailing seasonal surface currents and likely spill trajectories; 10) Mapping of; environmentally sensitive areas (e.g. spawning aggregations of snappers and groupers); coral resources and other significant benthic habitats (e.g. tilefish mudflats) along the edge of the continental shelf (including the upper slope); the calico scallop, royal red shrimp and other productive benthic fishing grounds; other special biological resources; and Northern Right Whale calving grounds and migratory routes, and subsequent deletion from inclusion in the respective lease block(s); 11) Planning for oil and gas product transport should be done to determine methods of transport, pipeline corridors and onshore facilities. Siting and design of these facilities as well as onshore receiving, holding and transport facilities could have impacts on wetlands and endangered species habitats if they are not properly located; 12) Develop understanding of community dynamics, pathways and flows of energy to ascertain accumulation of toxins and impacts on community by first order toxicity; 13) Determine shelf-edge down-slope dynamics and resource assessments to determine fates of contaminants due to the critical nature of canyons and steep relief to important fisheries (swordfish, billfish and tuna); 14) Discussion of the potential adverse impacts upon fisheries resources of the discharges of all drill cuttings that may result from activities in, and all drilling muds that may be approved for use in the lease area or the Exploration Unit area: including physical and chemical effects upon pelagic and benthic species and communities including their spawning behaviors, and effects on eggs and larval stages; effects upon sight feeding species of fish; and analysis of methods and assumptions underlying the model used to predict the dispersion and discharged muds and cuttings from exploration activities; and 15) Discussion of secondary impacts affecting fishery resources, associated with on-shore oil and gas related development such as storage and

processing facilities; dredging and dredged material disposal; roads and rail lines; fuel and electrical transmission line routes; waste disposal; and others.

6.6.5 MAFMC Habitat Policy

The MAFMC opposes any loss of aquatic habitat or wetlands which contributes to the conservation of fish stocks. Where loss of habitat is unavoidable locally, the Council endorses recreation of quantitatively and qualitatively equivalent habitat. The Council recognizes the multiple resource base of our coastal areas and recognizes the need to accommodate other natural resource management objectives of fishery management. The intent of the Council is to support no net loss of fishery habitat while minimizing all detrimental alterations to these essential habitats.

This policy will allow the MAFMC to optimize management of fisheries in the Mid-Atlantic EEZ through a concerted effort to establish quality habitat and seek to reverse the serious problems affecting reproduction, frequency and distribution of fish. The MAFMC will accomplish this through participation in the review of private and government projects which would adversely affect fish production. The MAFMC will also become involved in review of activities which adversely affect the safety of fish products which are intended for direct or indirect human consumption. (Note: Habitat is defined to include all physical, chemical and biological factors important to the success of species being managed by the Council.)

Additional detail regarding the Mid-Atlantic Council's fisheries habitat activities is contained in a Habitat Position Statement adopted by the MAFMC on August 4, 1989 (Appendix 7 in Source Document).

6.6.6 ASMFC Habitat Policy

The Atlantic States Marine Fisheries Commission (ASMFC), recognizing the requirement for improved coordination, has agreed to actively implement a unified marine habitat policy statementpresented on May 16, 1990 in Washington, D.C. with final revision dated November 7, 1990. The statement was also signed by the Atlantic Regional Fishery Mangement Councils and various federal agencies and is included below.

Joint Statement To Conserve Marine, Estuarine And Riverine Habitat

The undersigned parties agree to use available mandates and to expand interagency efforts to minimize adverse effects of human activities on marine, estuarine, and riverine species and their habitats. This statement offers general guidance to states, federal agencies and regional bodies that share responsibility for fish habitats through their respective roles in decisions on

research, management, and specific human activities. All decisions related to habitat conservation and use must accommodate the ecological needs of living natural resources in marine, estuarine, and riverine systems.

Objectives:

1. To minimize avoidable adverse impacts to fish stocks and their habitat. Our shared intent is to grant these valuable resources an appropriate level of management concern that reflects their tremendous socioeconomic-cultural value to the Nation. Any determination of public interest should balance these values with other uses.

2. To conserve, restore, and enhance fish habitats for the long-term benefit of all users. This applies equally to habitats of existing fish stocks and the historic ranges of stocks covered by a restoration plan. Aggressive action may be warranted to recover lost benefits.

3. To promote innovative programs that will increase our knowledge of management strategies that may reduce habitat loss or augment fish stocks, including:

   a) Beneficial uses of dredged material;

   b) Mitigation techniques for specific habitats accomplished in a manner that does not adversely impact the habitat needs of other important living natural resources; and

   c) Restoration measures for specific stocks.

4. To improve our use of existing authorities and adopt new interagency procedures that will improve our habitat management efforts, including:

   a) Policies, guidelines, and/or regulations regarding "no net loss" of wetlands;

   b) Recognition, support, and promotion of ecologically responsible wetland enhancement and management techniques that will add benefits for living resources of special concern while maintaining values for other important living resources; and,

   c) Early identification procedures to accord special recognition to deserving habitats; and,

   d) Incorporating all agencies into such efforts as fishery management plans (with the Fishery Management Councils established under the Magnuson Fishery Conservation and Management Act and with the Atlantic States Marine Fisheries Commission).

5. To foster greater interagency cooperation and collaboration, including:

a) Shared priority statements, policies and management plans that will improve overall awareness of habitat programs in other agencies;

b) Joint research and management initiatives to address common issues and needs; and,

c) Improved decision-making protocols, including mechanisms to incorporate best-available information into decisions affecting living resources and their habitat in ecological units within meaningful bio-geographic regions rather than administrative or political jurisdictions.

Recommended Actions:

Our shared responsibilities for marine, estuarine, and riverine habitats invite frequent opportunities for collaboration, including:

1) Share general information, recommendations, and decisions for other important living resources that relate to habitats or related resources, e.g., habitat policies or habitat discussions in Fishery Management Plans;

2) Collaborate with other parties on actions that relate to habitat or living resources, e.g., management plans or mitigation protocols; and,

3) Initiate new agreements to improve our efforts to conserve and manage living resources and their habitat, e.g. development and implementation of strategic multi-objective resource plans to address issues in resource or habitat management.

This statement of intent to conserve and manage marine, estuarine and riverine habitat is endorsed by the following agencies, states, and regional bodies: the 15 ASMFC member states, National Marine Fisheries Service, U.S. Fish and Wildlife Service, New England Fishery Management Council, Mid-Atlantic Fishery Management Council, South Atlantic Fishery Management Council, Army Corps of Engineers, Environmental Protection Agency, Federal Highway Administration, U.S. Coast Guard, Washington DC Fisheries Management Program

6.6.7 Habitat Research

Habitat research recommendations are contained in Section 11.7.2.3.

7.0 FISHERY MANAGEMENT JURISDICTION, LAWS AND POLICIES

7.1 Management Institutions

7.1.1 Federal Management Institutions

7.1.1.1 Regional Fishery Management Councils

Under the MFCMA, the SAFMC and the MAFMC are charged with preparing FMPs for fisheries within their area of management authority, from the Florida East coast to the New Jersey/New York Border. The Councils prepare FMPs that cover foreign and domestic fishing efforts and submit them to the Secretary of Commerce for approval and implementation. Once implemented, it is the responsibility of the National Marine Fisheries Service (NMFS) and the U.S. Coast Guard to enforce the laws and regulations. Inter-Council coordination occurs with the MAFMC having input into the development and deliberations of the red drum FMP through two voting members on the SAFMC red drum steering Committee. This complements existing procedures on a number of other fisheries (e.g. summer flounder, bluefish and sea scallops).

7.1.1.2 NMFS

The NMFS under the National Oceanic and Atmospheric Administration (NOAA) collects commercial and recreational fishery statistics, develops fish stock assessments and provides technical expertise to facilitate the Regional Council's conservation and management of fisheries through the development of fishery management plans.

7.1.1.3 Office of Coastal Zone Management

The Office of Coastal Zone Management (OCZM) asserts authority through National Marine Sanctuaries, pursuant to Title III of the Marine Protection, Research and Sanctuaries Act. Several sites have been designated Marine sanctuaries along the Atlantic coast and are discussed in Section 7.3.2. OCZM, in addition to the designation of sanctuaries, influences fishery management by establishing standards for approving and funding state coastal zone management programs.

A fishery management plan is forwarded to states to determine if the plan is consistent to the maximum extent practicable with their approved coastal zone management program. States have 45 days in which to agree or disagree with the Councils' evaluation. If a State fails to respond within 45 days, the State's approval may be presumed.

This plan was distributed to and reviewed by the state coastal management programs of New Jersey, Delaware, Maryland,

Virginia, North Carolina, South Carolina and Florida. Coastal management programs from the States of New Jersey, Delaware, Maryland and South Carolina have found the implementation of the management plan consistent to the maximum extent possible with their coastal zone management programs. The States of Virginia and Florida did not respond therefore, the States' approval has been presumed. The State of North Carolina has reviewed the draft FMP but does not issue a statement of consistency on draft documents. The State of Georgia does not participate in the coastal zone management program.

7.1.1.4 National Park Service

The National Park Service (NPS) under the Department of Interior (DOI), through the establishment of coastal and nearshore national parks and monuments such as the Everglades National Park, retains authority to regulate fishing practices within their area of jurisdiction.

7.1.1.5 U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS) under DOI manages fish pursuant to the Endangered Species Act (Section 7.3.6) and the Fish and Wildlife Coordination Act (Section 7.3.8). The USFWS reviews and comments on proposals for work affecting navigable waters that are sanctioned, permitted, assisted or conducted by federal agencies focusing on negative impacts to fish, wildlife and their habitat.

7.1.1.6 Environmental Protection Agency

The Environmental Protection Agency (EPA) regulates the discharge of pollutants into marine waters through granting National Pollutant Discharge Elimination System (NPDES) permits. The conditioning of these permits by EPA may provide protection to the environmental quantity of essential red drum habitat.

7.1.1.7 Corps of Engineers

The U.S. Army Corps of Engineers (COE), pursuant to the Clean Water Act and the MPRSA, regulates the disposal of dredged material. The COE can prevent or reduce impacts on the red drum stock if recommendations on proposed permits, made by reviewing agencies (NMFS, USFWS, EPA, SAFMC and Atlantic coast state fishery management agencies) are adopted.

7.1.1.8 U.S. Coast Guard

The U.S. Coast Guard (USCG) under the Department of Transportation, shares the responsibility, with the NMFS, for enforcing regulations promulgated pursuant to the MFCMA and the Lacey Act.

7.1.2 Atlantic States Marine Fisheries Commission

The Atlantic States Marine Fisheries Commission (ASMFC) Interstate Fishery Management Program (ISFMP) was initiated through a cooperative agreement with the NMFS in 1980 and promotes cooperative management of marine, estuarine and anadromous fisheries in east coast state waters. The USFWS is an active participant and an important component of the ISFMP program. The ISFMP determines priorities for territorial sea fisheries management; develops, maintains and reviews management plans for high priority fisheries; recommends to States, Regional Fishery Management Councils and the Federal government, management measures to benefit such fisheries; provides a means of conducting short term research essential to facilitate preparation or review of fishery management plans; and provides an organizational structure for effective and timely administration of the ISFMP. The ISFMP Board is comprised of fisheries administrators from the fifteen member states from Maine to Florida, a representative from NMFS and a representative from the USFWS. This policy making board guides the program and through their efforts has directed the organization of 25 species management boards, scientific committees and citizens advisory panels to develop and monitor ASMFC FMPs.

The ASMFC completed a FMP for red drum in 1984 which recommended a minimum size limit of 14 in TL with a comparable mesh size regulation in directed fisheries (defined as containing at least 60% red drum by weight), a daily possession limit of two fish exceeding 32 in TL and a prohibition of purse seining for red drum. In a recent review of the ASMFC plan (Frisbie 1989), the Advisory Committee made the following recommendations: current sizes and possession limits be maintained at a minimum (but to achieve maximum yield per recruit and adequate spawning stock will require a minimum size limit over 14 in TL, combined with a reduced fishing mortality); States are encouraged to strengthen research efforts, especially monitoring adult spawning stock, determining offshore migrations and fishing mortality rates; more emphasis should be given to improving catch and effort data, particularly in states having substantial populations; red drum project leaders should meet annually to coordinate efforts and standardize sampling methodology; and the plan should be extended northward through Maine.

At the request of the ISFMP board, an ASMFC red drum plan review team, composed of State, Federal and Council representatives involved in red drum research and management was

selected and met in June 1990. This group utilized updated information contained in the coastwide stock assessment and Federal plan to assess the management recommendations in the 1984 ASMFC FMP. The group concurred with the previous Council finding that the ASMFC plan should be amended in order to achieve a 30% SSBR level.

7.1.3 State Management Institutions

7.1.3.1 New Jersey

The New Jersey Department of Environmental Protection, Division of Fish, Game and Wildlife, Marine Fisheries Administration, Bureau of Marine Fisheries is the administrative organization responsible for the regulation of marine fisheries in State waters.

7.1.3.2 Delaware

The Division of Fish and Wildlife, Department of Natural Resources and Environmental Control is the administrative organization responsible for the regulation of marine fisheries in State waters.

7.1.3.3 Maryland

The Maryland Department of Natural Resources, Tidewater Administration, Fisheries Division is the administrative organization responsible for the regulation of marine fisheries in State waters.

7.1.3.4 Virginia

The Virginia Marine Resources Commission is the administrative organization responsible for the regulation of marine fisheries in State waters.

7.1.3.5 North Carolina

The Division of Marine Fisheries, as an agency within the Department of Environment, Health and Natural Resources (DEHNR), is charged with stewardship of marine and estuarine resources in North Carolina. The Division is responsible for the maintenance, preservation, protection and development of all marine and estuarine resources and is required to administer and enforce all license requirements and taxes as set forth in Article 14 of Chapter 113 of the North Carolina General Statutes. The Division promulgates rules and regulations governing coastal fisheries, enforces them and administers programs in fisheries management, information, education and sportfishing.

The North Carolina Marine Fisheries Commission is a

regulatory agency composed of 15 members appointed by the Governor and is empowered to promulgate regulations to be followed in the management, protection, preservation and enhancement of marine and estuarine resources of the State including commercial and sport fisheries.

7.1.3.6 South Carolina

The South Carolina Wildlife and Marine Resources Department (SCWMRD), Division of Marine Resources, is responsible for the conservation and wise management of the State's marine resources through planning, research, management and public education. The Division subsequently is responsible for: management and development of South Carolina's commercial and recreational shellfish, crustacean and finfish resources; collecting and reporting on fisheries statistics, including catch, fishing effort and various biological and economic data on the seafood industry; review and evaluation of permits from the Coast Guard, Corps of Engineers and the South Carolina Coastal Council and development of environmental impact statements; and the development of marine recreational fisheries. The Department is also responsible for enforcement of fishery regulations.

7.1.3.7 Georgia

The Georgia Department of Natural Resources (GDNR), Coastal Resources Division, is charged with conservation and management of Georgia's estuarine and marine resources. The Georgia General Assembly, in 1989, passed Act 644 which empowered the Board of Natural Resources to adopt rules and regulations to control the harvest of seventeen species of marine fish including red drum. Provisions were included to regulate harvest through establishment of fishing seasons, creel limits, minimum size limits and prohibition of sale of these species, if appropriate. Enforcement of fishery regulations is the responsibility of the Georgia Game and Fish Division.

7.1.3.8 Florida

The Florida Department of Natural Resources (FDNR), Division of Marine Resources is charged with administration, supervision, development and conservation of natural resources within the State. The Florida Marine Fisheries Commission, created in 1983, is composed of seven members appointed by the Governor and Cabinet. The Commission was delegated full rule-making authority over marine life (except endangered species), subject to final approval by the Governor and Cabinet. The Commission is governed in the exercise of their authority by the policies and standards declared by the legislature in Fla. Stat. 370.025. Within FDNR the Marine Research Institute is empowered to conduct research directed toward fisheries management in the interest of all people of the State and to manage and protect marine and

anadromous fishery resources of the State of Florida. The Florida Marine Patrol is responsible for enforcement of all marine resource-related laws and all rules and regulations of the Department.

7.2 Summary of State and Local Laws, Regulations and Policies

The following figure depicts the most recent state minimum size, maximum size, and bag limit regulations adopted or proposed by Atlantic coast States for red drum (Figure 6).

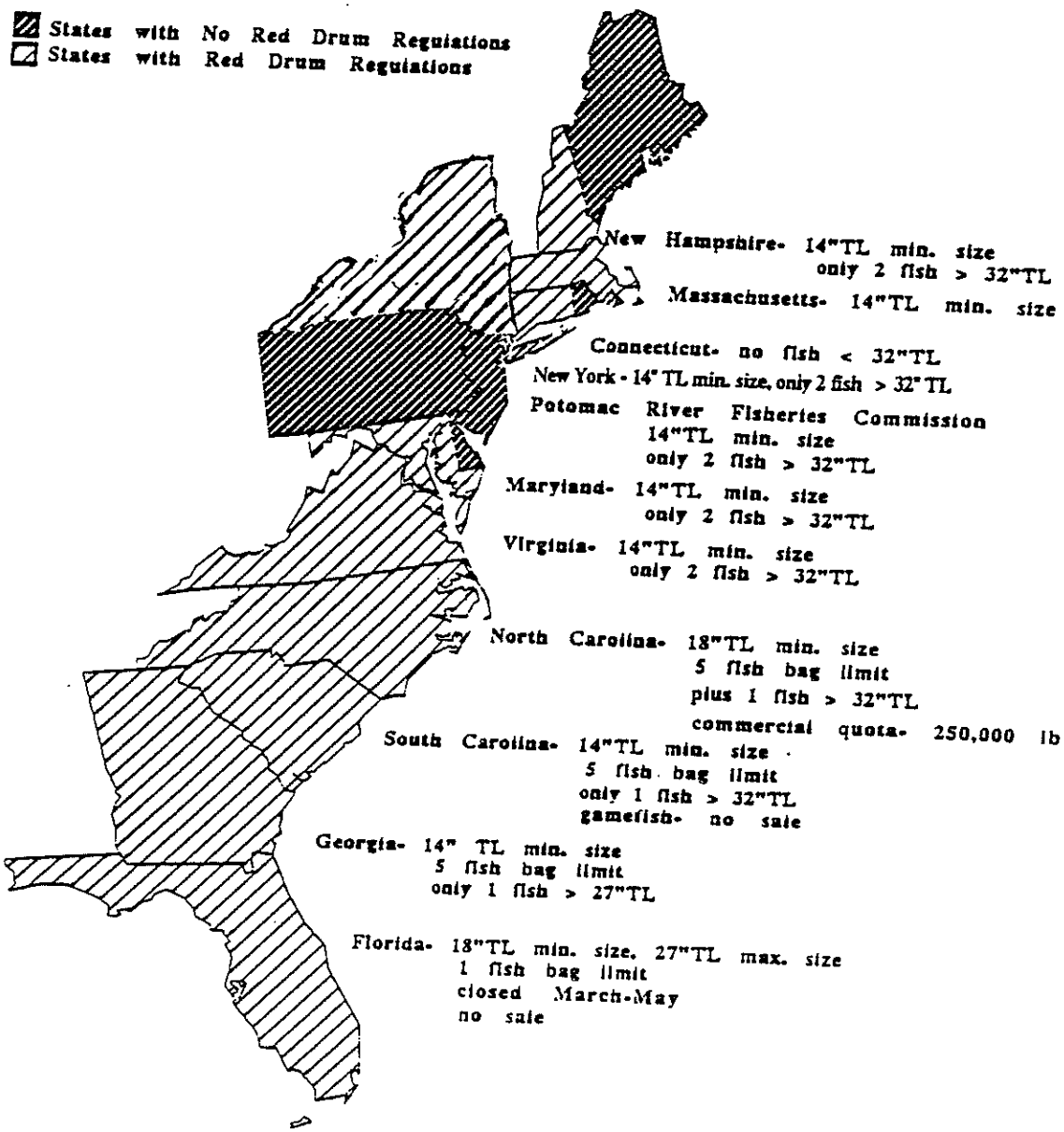


Figure 6. Current Atlantic coast state regulations for red drum.

7.2.1 New Jersey

Commercial gears are licensed and there is presently no marine recreational license. Gill nets may not exceed 2,400 ft in length from February 1 through May 15 and may not exceed 1,200 ft in length from May 16 through December 15. Purse seining, otter and beam trawling are prohibited within two miles of the coast with gill netting being limited to the Atlantic Ocean and Delaware Bay. Gill nets cannot be fished from December 16 through February 1.

7.2.2 Delaware

Commercial fishermen in Delaware, are required to have a State commercial food fishing license and food fishing equipment permits. Recreational hook and line fishermen are not licensed but if a person is fishing recreationally with a gill net, they must have a permit. Purse seines, power operated seines, trawls and run-around gill nets are prohibited in state waters. Gill nets may not exceed 200 yd and a series of gill nets may not exceed 500 yd. In addition, fyke nets cannot exceed 72 ft in diameter. Areas within a 0.5 mile sector at the mouth of all major tributaries to the Delaware River and Bay are closed to all fixed fishing gear with numerous other specific areas closed to commercial fishing. From April 1 to May 10 commercial fishermen cannot set over 1,000 yd of fixed gill net from one vessel; from May 10 to September 30 commercial fishermen cannot set over 1,000 yd of drifting gill net from one vessel; drift gill nets cannot be set from 2400 hours Friday through 1600 hours Sunday during this period; and there are specific seasonal closures for gill nets in certain areas.

7.2.3 Maryland

A commercial fishing license is required in addition to a separate license for the sale of catch. A marine sport fishing license is required to fish in Chesapeake waters. Present regulations include a minimum size limit of 14 in TL for red drum and a daily bag limit of two fish greater than 32 in TL. The use of monofilament gill net webbing is prohibited in state waters. There presently is a minimum 2.5 in gill net mesh requirement with a maximum net mesh of 6 in. Purse seines are prohibited and otter trawls are prohibited in Chesapeake Bay. In addition, otter and beam trawls are prohibited within 1.5 miles of the Atlantic coast. Anchor gill nets are prohibited from March 1 to May 31 within Chesapeake Bay and its tributaries north of the Bay Bridge.

7.2.4 Virginia

A commercial fishing license is required although, there is no state marine recreational license required. Present regulations in Virginia include a minimum size limit of 14 in TL

for red drum and a daily bag limit of two fish greater than 32 in TL. Purse seines, encircling gill nets and pound nets with mesh less than 2 in are prohibited. In addition, there is a mesh requirement of 3 in for haul seines and the use of trawls or drag nets is prohibited in the Chesapeake Bay.

7.2.5 North Carolina

The State of North Carolina requires a commercial fishing license. The Director of the North Carolina Division of Marine Fisheries, effective September 1, 1988, was delegated authority to implement controls on the state red drum fisheries through proclamation by imposing seasons, size limits, quotas, gear restrictions and designated fishing areas. North Carolina prohibits any person from taking, or, attempting to take, harm, possess or retain in possession more than one red drum exceeding 32 in TL in any one day. It is unlawful to take, harm, possess or retain in possession more than five red drum between 18 in and 32 in TL. In addition, a cap of of 250,000 lb has been placed on the commercial fishery. Purse seines for the taking of food fish and pair trawls are prohibited in State waters. The use of gill nets with mesh less than 5 in is prohibited in Albermarle Sound and its tributaries between the mouth of Roanoke, Middle, Eastmost and Cashie Rivers and U.S. 64-264 bridges from June 1 to September 30. It is also illegal to remove red drum from any type of net with the aid of any boat hook, gaff, spear, gig or similar device. In North Carolina, no person shall take any marine or estuarine species for scientific purposes which is out of season or otherwise protected unless he first secures a scientific collecting permit from the Secretary of DEHNR.

7.2.6 South Carolina

South Carolina, in 1987, declared red drum a gamefish and prohibited the sale of all but maricultured fish. Current regulations include a minimum size limit of 14 in TL for red drum and a bag limit of 5 fish per angler per day of which only one fish may be greater than 32 in TL. The designation of gamefish status for red drum has also limited the gear that can be used in harvesting the species. Red drum may only be harvested by rod and reel and gigging; with gigging or "striking" being prohibited during January and February. The State also prohibits the use of the following gears in state waters: trammel nets, pound nets, fyke nets, stop nets, purse seines and gill nets (with a stretch mesh greater than 3 in and a length longer than 100 ft) in the Atlantic Ocean or designated areas of bays or sounds.

7.2.7 Georgia

In order for an individual to sell their catch in Georgia they must attain a Georgia Department of Natural Resources Personal Commercial Fishing License for $10. A commercial fishermen utilizing a boat during the harvest, must also have a

DNR Commercial Fishing Boat License for trawling and/or non-trawling. The Georgia Department of Agriculture (DA) requires additional licenses to sell directly to the consumer. The Mobile Unit Meat and Seafood Regulatory License is required to sell seafood from a mobile unit such as a car, truck or vessel, and the Food and Sales Establishment License is required when selling seafood from a permanent establishment. In addition the fisherman who buys additional seafood to sell along with his own catch must have the required DNR licenses and the DA Wholesale Seafood License. A Georgia Department of Human Services Permit is also required if the fisherman plans to prepare or serve the seafood. The State of Georgia does not require a marine sport fishing license at this time. The State has a minimum size limit on red drum of 14 in TL and a limit of no more than 1 fish greater than 27 in TL per day. There is a daily creel limit of 5 red drum per angler. Any red drum caught while shad or sturgeon netting must be released. Gill netting for all other finfish is illegal.

7.2.8 Florida

A salt water products license is required to sell catch. One must have 25% of their income or $5,000, whichever is less, attributable to the sale of saltwater products to attain the license. In September 1985, the Florida Marine Fisheries Commission (FMFC) increased the minimum size limit for red drum in Florida from 12 in to 18 in. The FMFC, in July 1988, adopted revised management measures for red drum which were approved by the Governor and Cabinet and became effective January 1, 1989. The sale of native red drum is prohibited, a bag limit of one fish per angler per day between 18 in TL and 27 in TL was established and a closed season during the months of March, April and May was approved. The use of purse seines, purse gill nets and pound nets are prohibited in state waters. The use of treble hooks while fishing with natural baits is prohibited and red drum must be landed whole. The State, effective January 1, 1990, requires a saltwater fishing licences for recreational fishermen fishing from a boat. The annual licence is $12 for Florida residents and $30 for non-residents. In addition, a seven day non-resident licence is available for $15 .

7.3 Federal Laws, Regulations and Policies

7.3.1 Magnuson Fishery Conservation and Management Act of 1976; (PL 94-265 as amended)

The Act provides a national program for the conservation and management of fisheries to allow for an optimum yield (OY) on a continuing basis and to realize the full potential of the nation's fisheries resources. The MFCMA established the EEZ and a means to control foreign fisheries through Preliminary Fishery Management Plans (PMPs) and domestic fisheries through Fishery Management Plans (FMPs). Within the EEZ, the U.S. has exclusive

authority over all fish (meaning finfish, mollusks, crustaceans and all other forms of marine animal and plant life other than marine mammals, birds, and highly migratory species of tuna). The Act provides further exclusive authority beyond the U.S. EEZ for all continental shelf fishery resources and all anadromous species throughout the migratory range of each such species, except during the time they are found within any foreign nation's territorial sea or fishery conservation zone (or the equivalent), to the extent that such a sea or zone is recognized by the United.States. Under the Act, eight Regional Fishery Management Councils are charged with preparing FMPs for the fisheries within their areas of management authority. The Councils prepare management plans that cover foreign and domestic fishing efforts and submit them to the Secretary of Commerce for approval and implementation. Once implemented, it is the responsibility of the NMFS and the U.S. Coast Guard to enforce the laws and regulations.

7.3.2 Marine Protection, Research and Sanctuaries Act of 1972

The Marine Protection, Research and Sanctuaries Act of 1972 (16 U.S.C. 1431-1434) authorizes the Secretary of Commerce to designate as marine sanctuaries those areas of ocean waters within U.S. jurisdiction determined to be necessary for the purpose of preserving or restoring their conservation, recreational, ecological or esthetic values. On November 7, 1988 this Act was amended and reauthorized through 1992 by PL 100-627. Sanctuaries which have been established and are being proposed within the management area are as follows: 1) The USS Monitor Marine Sanctuary off North Carolina is designated on National Ocean Survey charts as a "protected area." Fishing is prohibited in this area; 2) Gray's Reef National Marine Sanctuary is located approximately 18 nautical miles off Sapelo Island, Georgia. Regulations governing the Sanctuary require permits for certain fishing activities, including bottom trawling and dredging and wire trap fishing; 3) Key Largo Coral Reef National Marine Sanctuary is located adjacent to the John Pennakamp Coral Reef State Park of Key Largo, Florida. Hook and line fishing is permitted in the Sanctuary; and 4) The Looe Key Coral Reef National Marine Sanctuary off Big Pine Key, Florida prohibits the use of wire fish traps in the Sanctuary. Proposed areas for inclusion are: 1) Commodore Barney Flotilla- Maryland. (State Nomination by August 1989); 2) Norfolk Canyon- Virginia. Draft EIS to be issued by June 1989; and 3) Alligator Reef, Sombrero Reef and American Shoal- Florida. Investigation and Congressional Review for possible designation by September, 1991.

PL 100-627 adds additional sections which require the Secretary of Commerce through NOAA to: 1) Promote and coordinate the use of national marine sanctuaries (Section 309); 2) Provide the Secretary with authority to issue special use permits to establish access to sanctuary resources; 3) Promote public use and understanding of sanctuary resources (Section 310); 4) Allow the Secretary to enter into cooperative agreements with non-

profit organizations to promote the Program's interpretive, historical, scientific or educational activities; 5) Accept donations of funds, property and/or services for use in designating and administering national marine sanctuaries; and 6) Requires damage payments from those responsible for harm to or destruction of sanctuary resources. NOAA is required to recover funds and ensure payments are applied to repair damage regardless of source or cause (Section 312).

7.3.3 Oil Pollution Act of 1961; (as amended 33 U.S.C 1001-1016)

The Oil Pollution Act regulates intentional discharge of oil or oily mixtures from ships registered in the U.S. and thus provides some degree of protection to fishery resources. Tankers cannot discharge oil within 50 nm (92 km) of the nearest land. Ships other than tankers must discharge as far as practicable from land. The quantity of oil which can be discharged is also regulated.

7.3.4 Coastal Zone Management Act

The Coastal Zone Management Act of 1972 (16 U.S.C. 1451) establishes a national policy placing responsibility for comprehensive land and water management of the coastal zone upon the coastal states. Federal actions directly affecting a state's coastal zone must be consistent (to the maximum extent possible) with approved state coastal zone management plans. Fifteen East and Gulf coast states and two U.S. territories have programs approved by the Secretary of Commerce: Maine, Massachusetts, Rhode Island, New Jersey, Connecticut, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, South Carolina, Florida, Alabama, Louisiana, Mississippi, Puerto Rico and the Virgin Islands.

7.3.5 Endangered Species Act of 1973; (as amended 16 U.S.C. 1531-5143)

The Endangered Species Act (ESA) provides for the listing of plant and animal species as threatened or endangered. Once listed as threatened or endangered species, taking (including harassment) is prohibited. The Act establishes a process which seeks to insure that projects authorized, funded or carried out by federal agencies do not jeopardize the existence of these species or result in destruction or modification of habitat determined by the Secretary to be critical.

7.3.6 National Environmental Policy Act; (42 U.S.C 4321-4361)

The National Environmental Policy Act (NEPA) requires that all federal agencies recognize and give appropriate consideration to environmental amenities and values in the course of their decision making. In an effort to create and maintain conditions under which man and nature can exist in productive harmony, NEPA requires that federal agencies prepare an environmental impact

statement prior to undertaking major activities which might significantly affect the quality of the human environment. Within these impact statements, alternatives to the proposed action which may better safeguard environmental values are to be carefully assessed.

7.3.7 Fish and Wildlife Coordination Act; (U.S.C 661-66c)

Under the Fish and Wildlife Coordination Act, the U.S. Fish and Wildlife Service and the NMFS review and comment on fish and wildlife aspects of proposals for work and activities sanctioned, permitted, assisted or conducted by federal agencies which take place in or affect navigable waters. The review focuses on potential damage to fish and wildlife and their habitat and may, therefore, serve to provide some protection to fishery resources from federal activities, particularly in nearshore waters, since federal agencies must give consideration to recommendations of the two agencies.

7.3.8 Fish Restoration and Management Projects Act; (U.S.C 777-77k)

The Fish Restoration and Management Projects Act appropriates funds to state fish and game agencies for fish restoration and management projects. Additional funds for the protection of threatened fish communities located within state waters, including marine areas, could be made available under the Act.

7.3.9 Lacey Act Amendment of 1981 (P.L 97-79)

The Lacey Act Amendments of 1981 strengthens and improves enforcement of federal fish and game laws and provides federal assistance in enforcement of state laws. The Act prohibits import, export and interstate transport of illegally taken fish or wildlife. On November 27, 1987, the USFWS and NOAA published final rules that set forth regulations establishing requirements for marking containers of fish or wildlife that are imported, exported or transported in interstate commerce.

7.3.10 Commercial Fishing Industry Vessel Liability Act of 1987 (H.R.1841)

The Commercial Fishing Industry Vessel Compensation and Safety Act establishes guidelines for timely compensation for temporary injury incurred by seamen on fishing vessels.

7.3.11 Plastics Pollution Research and Control Act; (MARPOL Annex 5)

The Marine Plastics Pollution Research and Control Act of 1987 implements Annex V of the International Convention for the

Prevention of Pollution by Ships and prohibits all vessels, including commercial and recreational fishing vessels, from discharging plastics in U.S. waters and severely limits the discharge of other types of refuse at sea. This legislation also requires ports and terminals receiving these vessels to provide adequate facilities for in-port disposal of non-degradable refuse, as defined in the Act.

7.3.12 Clean Water Act; (33 U.S.C. 1251 et seq.)/Water Quality Act of 1987

The Clean Water Act (CWA) requires that a National Pollutant Discharge Elimination System (NPDES) permit be obtained before any pollutant is discharged from a point source into U.S. waters, including waters of the contiguous zone and adjoining ocean. The disposal of drilling effluents and other wastes from drilling platforms is among the activities for which a NPDES permit from EPA is required. Issuance of this permit is based primarily on the effluent guidelines found in 40 C.F.R. 435. However, additional conditions can be imposed on permit issuance on a case-by case basis in order to protect valuable resources in the discharge area (US DOC 1986).

The Water Quality Act of 1987 reauthorized and amended the Clean Water Act. Ocean dumping of sewage sludge into the New York Bight Apex is to be banned by December 15, 1987 (or earlier if a date is named by EPA) (OTA-O-334). Also, the Act: establishes that no additional dumpers may utilize the offshore Deepwater Municipal Dumpsite; requires the EPA to identify and establish numerical limits for each toxic pollutant in sewage sludge and establish management practices to achieve the set limits; authorizes the National Estuary Program, a sixty million dollar program designed to address estuarine pollution. As part of the program, the EPA will use 10% of the total funding for management conferences and provide five million dollars annually to NOAA for directed estuarine research in eleven prioritized waterbodies; prohibits the relaxing of discharge permit requirements once the permits are up for renewal; authorizes four hundred million dollars to states for grants to help reduce nonpoint source pollution; and authorizes twelve million dollars for the continuation of the Federal/State Chesapeake Bay Program and forty million dollar grants to states.

Reauthorization of the Clean Water Act by the Water Quality Act of 1987 addresses one of the greatest threats to the red drum population on the Atlantic coast, that is pollution and degradation of the estuarine, nearshore and offshore systems that provide habitat for eggs, larval, juvenile, subadult and adult stages of the red drum population

7.3.13 The National Aquaculture Improvement Act of 1985; (P.L. 99-198); (An amendment to the National Aquaculture Act of

The intent of the National Aquaculture Act, was to stimulate

development of the domestic aquaculture industry while creating jobs, replenishing depleted fisheries and reducing the trade deficit in fishery products. Research and development continues on red drum mariculture. With the support of such legislation these efforts will result in governmental agencies and private individuals pursuing the mariculture production of red drum for stock enhancement efforts and to supply an ever growing demand for seafood products.

7.3.14 The Coastal Barrier Resources Act of 1982

The Coastal Barrier Resources Act established a system of 186 undeveloped barrier units comprising 452,839 acres along 667 miles of Atlantic and Gulf of Mexico shoreline. The Department of the Interior (DOI) is required by law to study and recommend additions, deletions or modifications to the system and to consider other alternatives to foster conservation of coastal resources. The Barrier Island legislation was enacted to create economic disincentives in the development of coastal barrier islands by prohibiting the expenditure of federal funds on flood insurance, road and channel construction and utility construction. The DOI, pursuant to the Act, has studied the Act's implementation and developed an advisory report to be presented to Congress relative to deletions, additions and modifications to the system. Recommendations in the report include: 1) The addition of 1,243,678 acres of undeveloped, unprotected coastal barriers consisting mostly of wetlands and 140,000 acres of coastal uplands along the Gulf of Mexico and Atlantic coasts; 2) The addition of all aquatic habitats associated with both existing and recommended units of the system; 3) The inclusion of undeveloped, unprotected coastal barriers of the Florida Keys, Puerto Rico and the Virgin Islands; 4) The inclusion of secondary barriers found in large well defined bays such as the Chesapeake Bay or in lagoons on the mainland side of coastal barriers; and 5) The exclusion of Coast Guard and military lands until such time as they become available for development. The preservation of coastal barriers and associated wetlands benefits the red drum resource through protection of essential habitat.

7.3.15 The Marine Mammals Protection Act Amendments of 1988

The Marine Mammal Protection Act of 1982 (MMPA) prohibited the taking of marine mammals incidental to commercial fishing unless authorized by a general incidental take permit or a small take exemption. The MMPA also established a ban on the importation of marine mammal products. The MFCMA amended the Act to extend its requirements throughout the EEZ. The NMFS has responsibility for implementing the MMPA and issuing permits relative to the taking of marine mammals. On November 23, 1988, PL 100-711 was signed into law reauthorizing and amending the MMPA. The amendments replace existing provisions for granting incidental take authority by commercial fishermen with an interim exemption system valid until October 1, 1993. This will supply information to NOAA Fisheries so a long-term program to manage

the incidental take of marine mammals in commercial fisheries can be developed. Amendments direct the Secretary to publish a list of fisheries and number of vessels in these fisheries which fall into the following categories: (I) A frequent incidental taking of marine mammals; (II) An occasional incidental taking of marine mammals; or (III) A remote likelihood of, or no known incidental taking of marine mammals. If a commercial fishing vessel is classed Category I or II, owners of the vessel are required, by law, to register with the Secretary to obtain an exemption and submit periodic reports to NMFS. Vessels in Category I must also take on-board a natural resource observer if requested by the Secretary. Owners in Category III are not required to register with the Secretary for an exemption but must report any lethal incidental takings. The exemption system is available only to U.S. Vessels or foreign vessels with valid fishing permits issued under Section 204(b) of the MFCMA.

7.4 International Treaties and Agreements

Foreign fishing is prohibited within the EEZ for anadromous species or continental shelf fishery resources beyond the EEZ to the limit of United States jurisdiction under the Convention of the Continental Shelf unless authorized by an international agreement which existed prior to passage of the MFCMA and is still in force and effect or authorized by a Governing International Fishery Agreement (GIFA) which has been issued subsequent to the Magnuson Act. There are no pre-Magnuson Act agreements affecting Atlantic coast red drum. GIFAs resulting from the Magnuson Act are generally bilateral agreements in which participants agree to abide by the fishing laws and regulations of the other nation when fishing in the other nation's waters. A GIFA is required before a nation can apply for fishing rights pertaining to a particular fishery. There are currently nine nations that have entered into GIFAs with the United States. If any country with a GIFA wishes to obtain fishing rights for a specific fishery, an application must be submitted to the Secretary of State. No permits can be issued unless a surplus (amount which will not be harvested by U.S. vessels and which also is less than optimum yield) of that fishery exists. No applications for fishing permits have been made for fishing rights applying to Atlantic coast red drum.

8.0 DESCRIPTION OF FISHING ACTIVITIES

8.1 Domestic Commercial and Recreational Fishing Activities

8.1.1 Participating User Groups

8.1.1.1 Commercial Fishing Activities

No directed commercial fishery currently exists for Atlantic coast red drum in either state waters or the EEZ. Small quantities of red drum are landed as a bycatch of other fisheries, particularly those targeting weakfish, spotted seatrout, flounder and mullet. Commercial harvest of red drum along the Atlantic coast reached levels of 628,425 in 1950, 440,445 lb in 1980, 422,416 lb 1984 and 367,331 lb in 1986 (Figure 7) and occurred almost exclusively in state waters. In 1988, 23% of commercial harvest occurred in coastal waters (beach to outward boundary of the EEZ). With the imposition of recent state legislation on red drum, Atlantic coast commercial landings in 1988 totaled 227,580 lb, less than previous years. Landings of red drum caught in the EEZ is a bycatch of other fisheries and has been less than 2,000 lb since 1985 (Table 11). On January 1, 1989, the state of Florida imposed regulations that prevented sale of native caught fish. Similar legislation was enacted in South Carolina in 1987 declaring red drum a gamefish and establishing a no sale provision except for mariculture grown fish. In addition, North Carolina imposed a 300,000 lb cap on the commercial fishery. Therefore, coastwide landings in 1990 may be less than previous years unless effort levels increase substantially in other Atlantic coast states or a directed fishery develops in the EEZ. The Atlantic coast state which presently contributes the largest portion of commercial landings is North Carolina, mainly as a bycatch in other fisheries. Commercial landings in the North Carolina have varied over time with the highest recorded landings in 1954 of 284,445 lb and the lowest recorded in 1969 of 3,922 lb (Table 4). Landings have decreased more recently due largely to restrictive state laws.

Historic commercial landings and nominal value information can be subdivided into five major gear categories: gill nets, pound nets, seines, hand gear and trawls (Figures 8-12).

8.1.1.1.1 Mid-Atlantic States

Commercial landings of red drum were recorded in the 1930s from the State of New Jersey, the most northerly location in which this fishery has been prosecuted. Landings reached approximately 64,000 lb mainly as a bycatch from a deep water, ocean pound net fishery prosecuted in water depths up to 60-70 ft. This fishery was eliminated with the destruction of the gear during a hurricane. Virginia has reported small landings of red drum in nine of the last eleven years; landings have not exceeded 3,000 lb (Figure 13). Virginia's commercial red drum landings in 1988 amounted to 4,028 lb or 1.8% of the Atlantic coast landings.

In 1988 New Jersey, Delaware and Maryland did not identify any red drum in their commercial landings. In addition no commercial landings of red drum have been recorded in states north of New Jersey.

Table 4. Commercial red drum landings (lb) for Atlantic coast states (Source: NMFS Annual Reports and SEFC Reports).

Year	New Jersey	Delaware	Maryland	Virginia	North Carolina	South Carolina	Georgia	Florida	Atlantic Coast
50	0	0	2,205	183,015	200,655	33,075	19,845	189,630	628,425
51	*	0	4,410	74,970	183,015	114,660	19,845	132,300	529,200
52	0	2,205	0	46,305	183,015	68,355	13,230	114,660	427,770
53	0	0	*	19,845	222,705	55,125	13,230	127,890	438,795
54	0	0	4,410	39,690	284,445	11,025	13,230	138,915	491,715
55	0	0	0	37,485	266,805	66,150	6,609	97,020	474,069
56	0	0	0	19,845	134,505	57,330	2,205	105,840	319,725
57	0	0	0	24,255	30,870	*	0	108,045	163,170
58	0	0	2,205	35,280	138,915	*	0	101,430	277,830
59	0	0	*	33,075	17,640	0	0	130,095	180,810
60	0	0	*	28,665	4,410	0	*	130,095	163,170
61	0	0	0	11,025	79,380	*	*	114,660	205,065
62	0	0	0	12,900	61,740	0	0	149,300	223,940
63	0	0	0	2,700	70,560	0	0	134,200	207,460
64	0	0	0	4,600	101,430	11,025	0	119,000	236,055
65	0	0	1,200	94,900	71,381	0	0	146,300	313,781
66	0	0	200	3100	35,131	200	2,600	153,000	193,636
67	0	0	0	1100	12,757	900	5,800	147,100	160,957
68	0	0	0	100	12,428	0	5,567	167,000	185,095
69	0	0	400	700	3,922	700	2,695	119,000	126,717
70	0	0	0	100	7,719	400	2,265	146,800	156,884
71	0	0	0	700	17,208	2,205	1,260	85,200	106,573
72	0	0	0	5,900	42,919	1,148	3,393	128,400	181,760
73	0	0	0	6,200	70,264	620	3,747	166,500	247,331
74	0	0	0	15,700	142,437	2,169	2,957	137,300	300,565
75	0	*	0	19,600	214,236	12,371	9,931	83,300	339,438
76	0	0	0	18,600	168,259	2,557	7,241	106,000	302,657
77	0	*	0	300	19,637	779	4,889	103,300	129,092
78	0	*	0	2,100	21,774	4,325	328	104,696	133,223
79	0	0	100	1,900	126,517	1,900	935	93,654	224,873
80	0	0	0	400	243,223	4,107	1,493	191,222	440,445
81	0	0	0	200	93,420	808	261	258,374	353,063
82	0	0	0	1,700	52,561	2,228	251	139,170	195,910
83	0	0	100	41,700	219,871	2,274	1,126	105,164	370,235
84	0	0	0	2,600	283,020	3,950	1,961	130,885	422,416
85	0	0	0	1,100	152,676	3,512	6,522	88,908	249,758
86	0	0	1,000	5,400	249,076	12,429	2,939	96,487	367,331
87	0	0	0	2,727	249,659	13,863	4,865	63,944	334,736
88	0	0	0	4,028	220,271	*	3,281	0	227,580

* confidential data

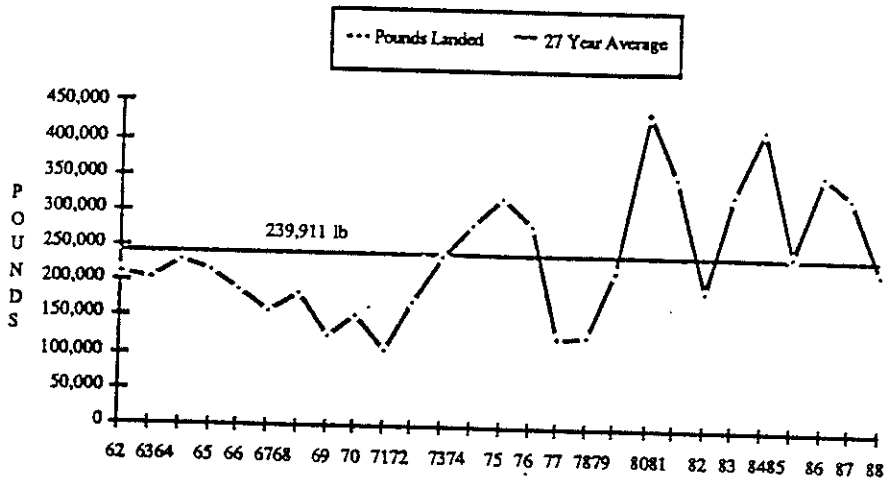


Figure 7. Total commercial landings of red drum in the Atlantic (Source: NMFS Annual Reports).

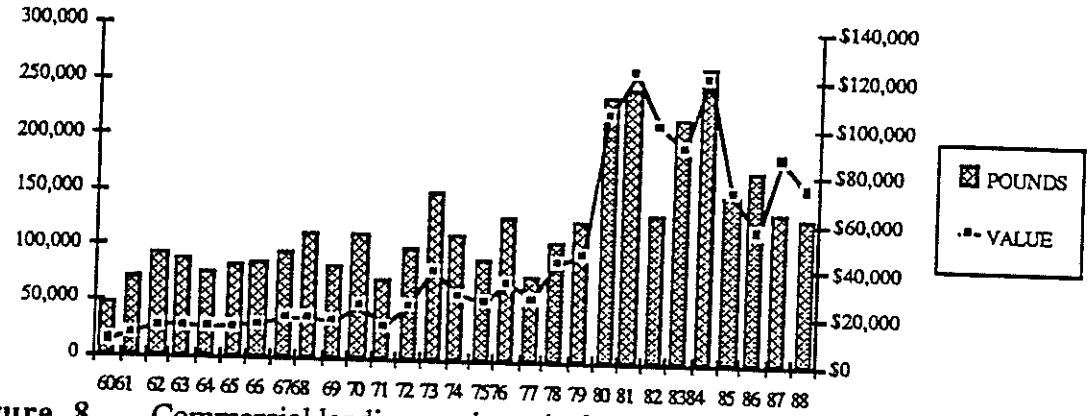


Figure 8. Commercial landings and nominal ex-vessel value of Atlantic coast red drum caught by run-around, anchor and other gill nets(Source: NMFS SEFC).

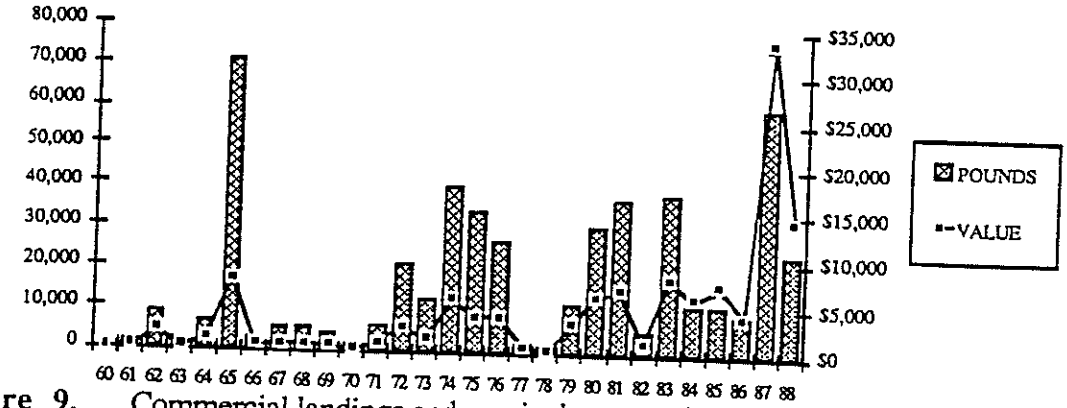


Figure 9. Commercial landings and nominal ex-vessel total revenue of Atlantic coast red drum caught by pound, trammel and stop nets (Source: NMFS SEFC).

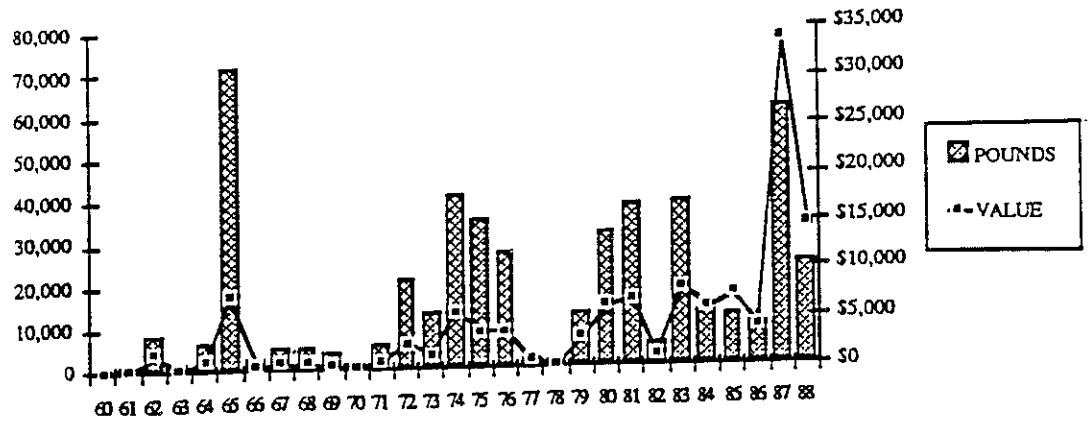


Figure 10. Commercial landings and nominal ex-vessel total revenue of Atlantic coast red drum caught by long haul, beach and common seines(Source: NMFS SEFC).

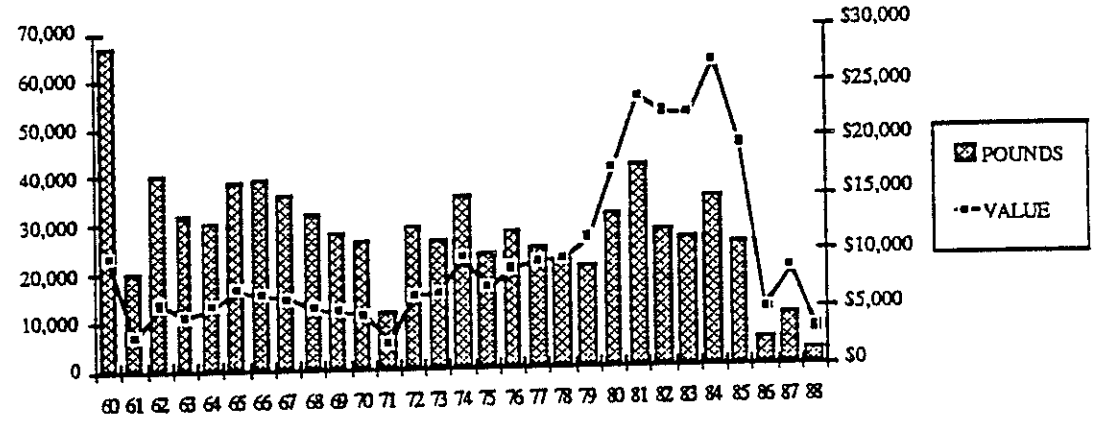


Figure 11. Commercial landings and nominal ex-vessel total revenue of Atlantic coast red drum caught by hand lines, trolling, spears(gigs) and cast nets(Source: NMFS SEFC)

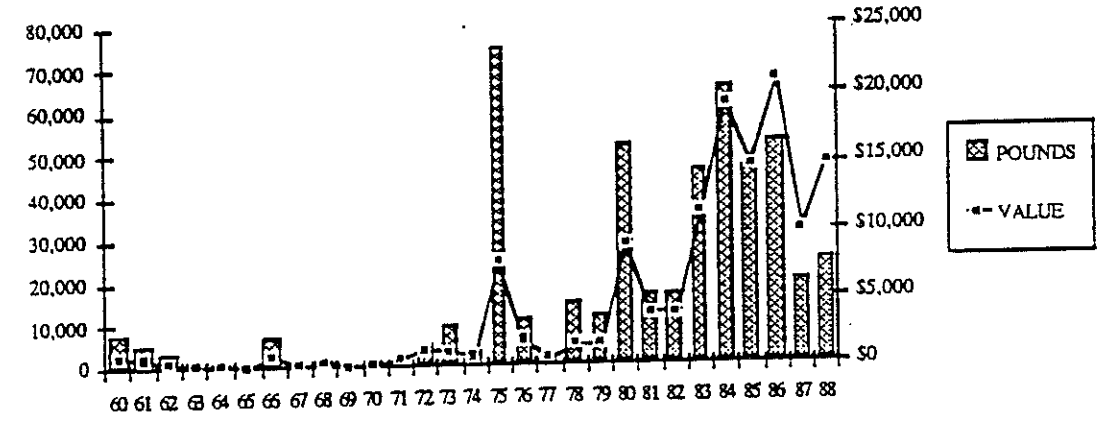


Figure 12. Commercial landings and nominal ex-vessel total revenue of Atlantic coast red drum caught by finfish, shrimp and crab trawls (Source: NMFS SEFC).

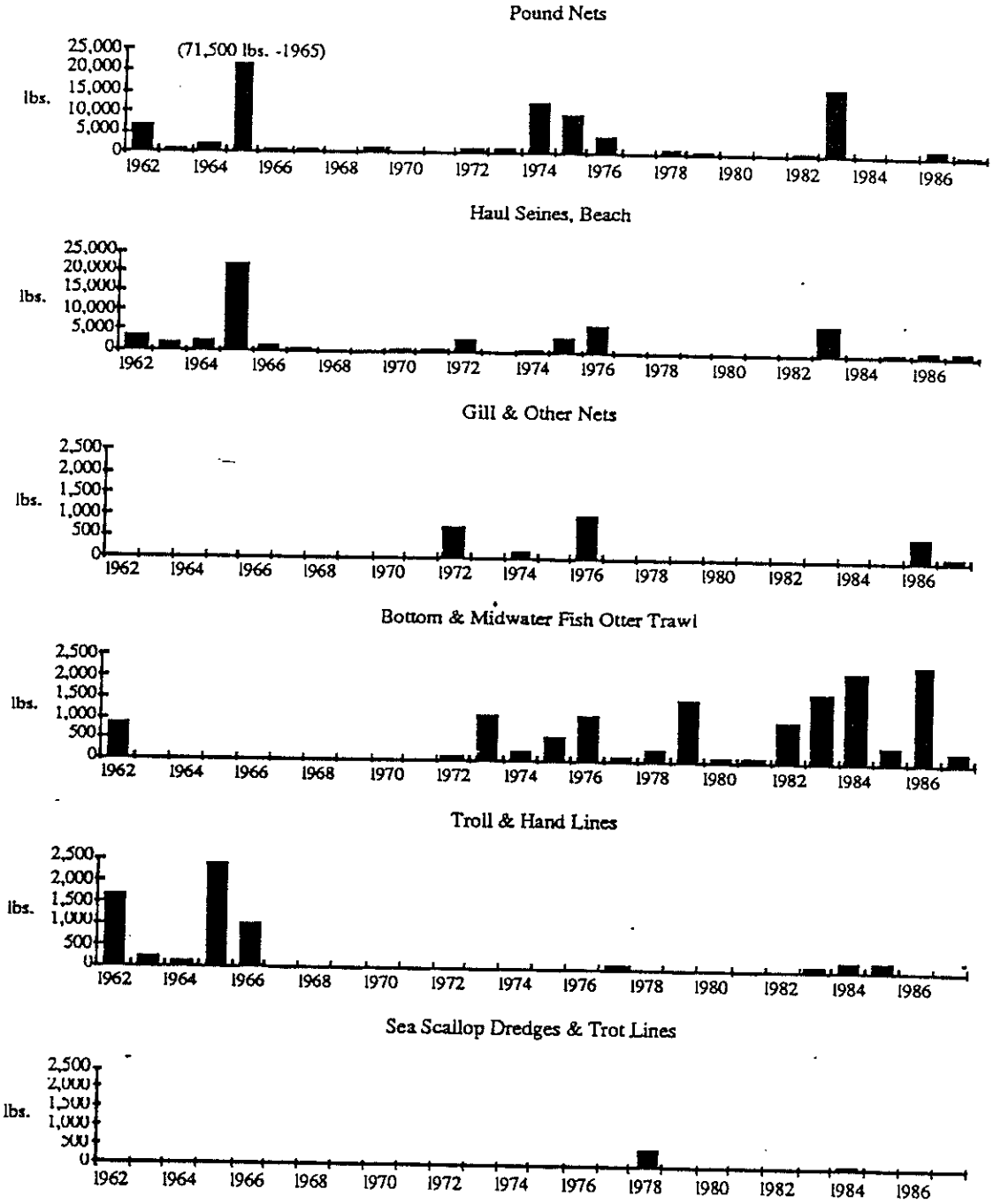


Figure 13. Commercial red drum landings by gear for the Mid-Atlantic region (Source: NMFS 1988).

8.1.1.1.2 North Carolina

No directed red drum fishery exists in North Carolina today and historically red drum have not been a significant component of North Carolina's commercial landings. However, prior to North Carolina imposing a possession limit on red drum greater than 32 in, Outer Banks fishermen occasionally targeted large red drum with long haul seines in Pamlico Sound.

Between 1960 and 1974, reported annual commercial landings were less than 150,000 lb. Since 1982, landings have exceeded 150,000 lb with landings in 1984, 1986 and 1987 of between 245,000 lb and 280,000 lb (Figure 14).

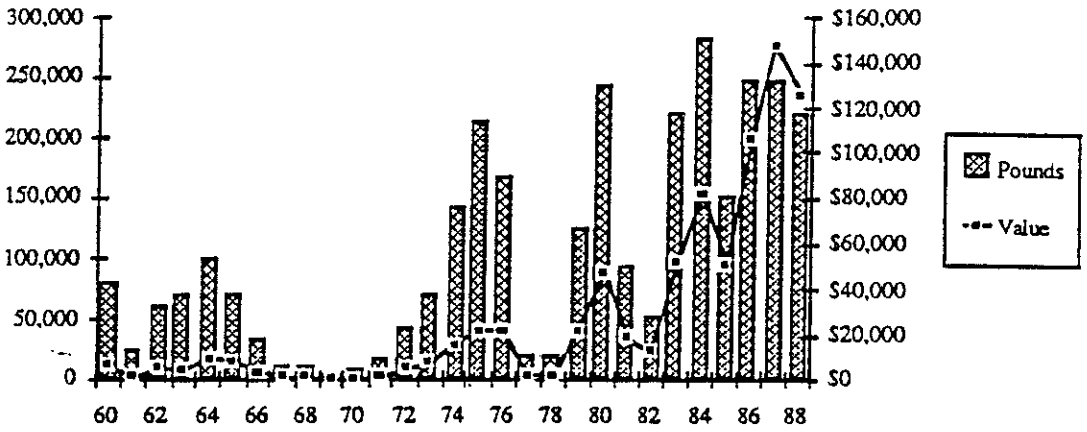


Figure 14. Commercial landings and ex-vessel total value of red drum in North Carolina (Source: NMFS SEFC).

The majority of landings have historically originated from Pamlico and Core sounds. During the 1970s no single commercial gear dominated landings, though long haul seines and common haul seines were generally most productive; fish trawls, pound nets and gill nets dominated annual landings less frequently. Gill nets became the dominant gear during the 1980s, accounting for 31-61% of the commercial landings annually. Seasonally, gill nets in North Carolina estuarine and nearshore waters target weakfish, spotted seatrout, flounder and mullet along barrier islands and mainland shorelines. Red drum are caught incidentally in these nets but often make an important contribution to the overall catch. The mesh sizes of these nets fished (3-5 in stretched mesh) capture red drum in the 14-24 in TL size range. Pound nets in the rivers and the shallow part of the sound which target flounders and fish for crab pot bait also catch substantial numbers of red drum (10-18 in) valued at $0.30-0.40/lb.

Spawning aggregations of large red drum occur at Oregon Inlet, Hatteras Inlet, Ocracoke Inlet, Drum Inlet, the Neuse River and off Bold Head Island and Cape Hatteras. Two to four year old fish are distributed on the outer shoals and bars around the inlets with no well known concentrations in the sounds. It would be difficult, under existing state regulations, for the fishery in state waters for fish over three years old to expand. Present concern is over the large percentage of those Age I+ fish (14-18 in) being harvested. Tagging efforts indicate that these fish are extremely susceptible to capture in the upper estuaries and the fishing mortality for these fish is high.

North Carolina tagging studies have found commercial fishing gear dominated red drum recaptures (Figure 15), though in certain areas, recreational gears predominate. Of the 1,819 Age I red

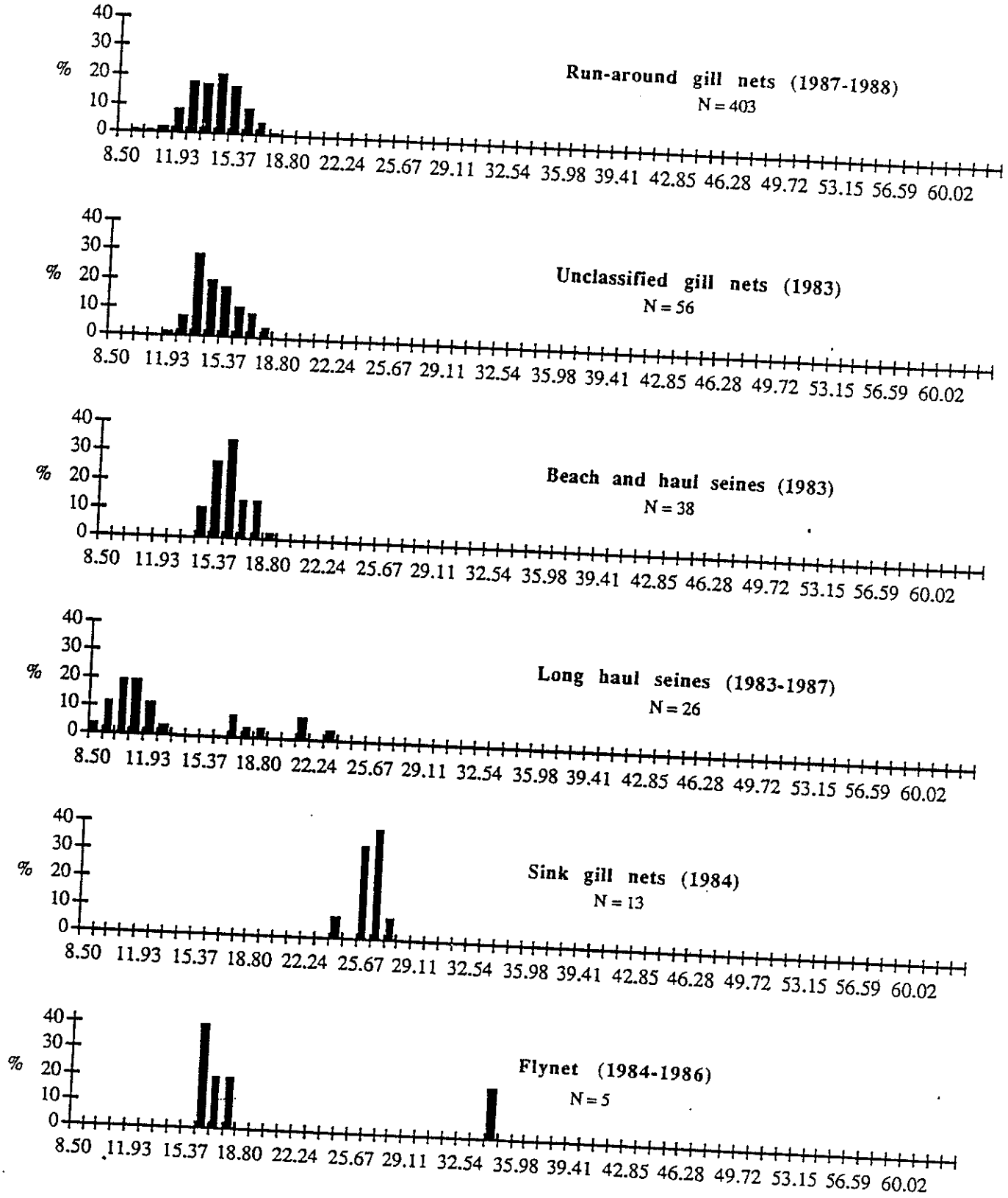


Figure 15. Length frequency of tagged red drum recaptured by commercial fisheries in North Carolina (by gear) for 1983-1988 (Source: Ross and Stevens 1989).

drum tagged in the Pamlico River in 1986 through 1988, 754 (41%) were recaptured, including 24% in commercial gear leased by the N.C. Department of Marine Fisheries (DMF), 56% by commercial gears (primarily gill nets) and 18.4% by recreational fishermen (hook and line). In southern North Carolina estuaries (New and North Rivers), 288 one year old fish were tagged and 74 (26%) recaptured. Of the recaptured fish, 70% were caught by commercial gears (primarily gill nets). Conversely, one year old red drum tagged along the Outer Banks were recaptured more frequently by recreational fishermen. Of the 464 fish tagged over Hatteras grass flats, 15% were recaptured; 59% by hook and line and 41% by commercial gears. Sport fishermen have tagged 1,601 red drum since 1984, 70% of which were >32 in TL and more than 90% of which were along the Outer Banks. Of these, 56 (3.5%) have been recaptured; 80% by hook and line and 20% by commercial gears. It appears that young red drum in upper portions of North Carolina estuaries are subjected to greater commercial harvest, while red drum catches along the barrier islands are dominated by sports fishermen. A cap of 250,000 lb has recently been placed on the commercial fishery in North Carolina.

8.1.1.1.3 South Carolina

South Carolina designated red drum a gamefish in 1987. Thus, they cannot be sold unless they are either transported into the State with proper documentation showing legal capture, or the fish is a product of a bonafide mariculture operation. Red drum landings never exceeded 14,000 lb with a nominal value of $12,000 in the last 30 years (Figure 16).

8.1.1.1.4 Georgia

A small commercial gill net fishery existed in Georgia prior to the 1950s, but presently there is not a directed commercial fishery for red drum. Red drum enter the market through recreational fishermen who sell their catch (Figure 17), often directly to restaurants which is not illegal as long as they were not harvested with net gear. Thus, many red drum do not enter official commercial statistics.

8.1.1.1.5 Florida

Commercial landings on the east coast of Florida fluctuated between 85,000 lb to 250,000 lb annually between 1962 and 1987 (Figure 18). In the past, the majority of the catch was taken by either a bycatch of the mullet gill net fishery or by a directed fishery utilizing trammel nets. Commercial landings ceased when regulations prohibiting their sale became effective in 1988. The existence of and potential for harvest of red drum in the EEZ off the east coast of Florida has been noted by commercial and recreational fishermen. In Council deliberations it was noted that one purse seiner was prosecuted for catching approximately 50,000 lb of red drum outside of 2 miles off the east coast of Florida.

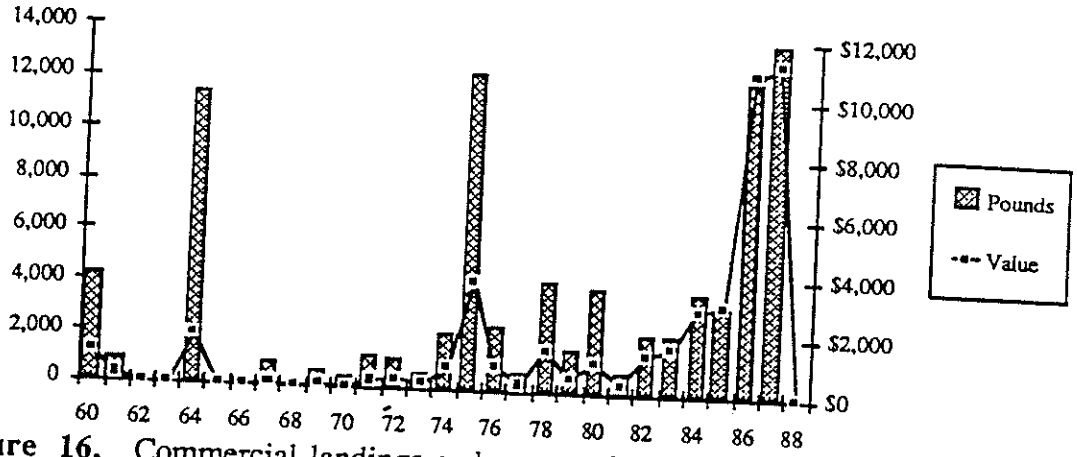


Figure 16. Commercial landings and ex-vessel total value of red drum in South Carolina (Source: NMFS SEFC).

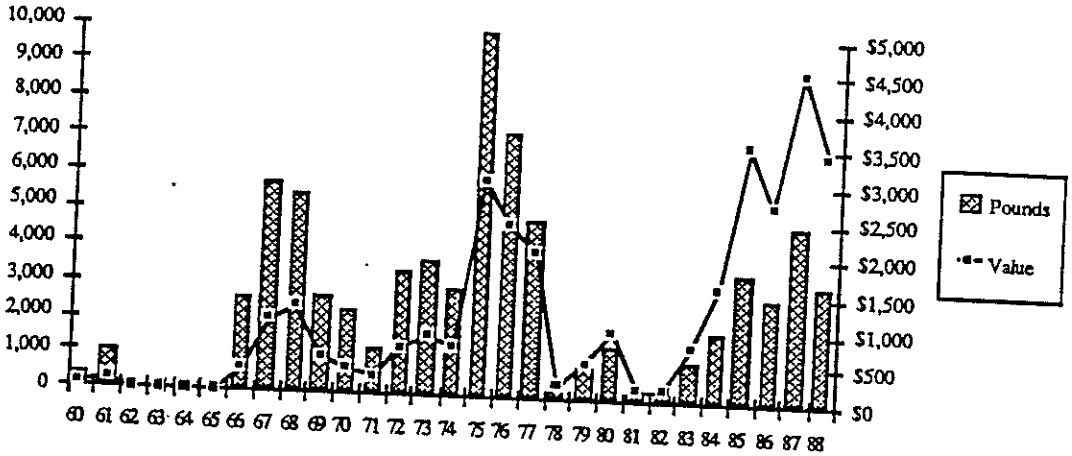


Figure 17. Commercial landings and ex-vessel total revenue of red drum in Georgia (Source: NMFS SEFC).

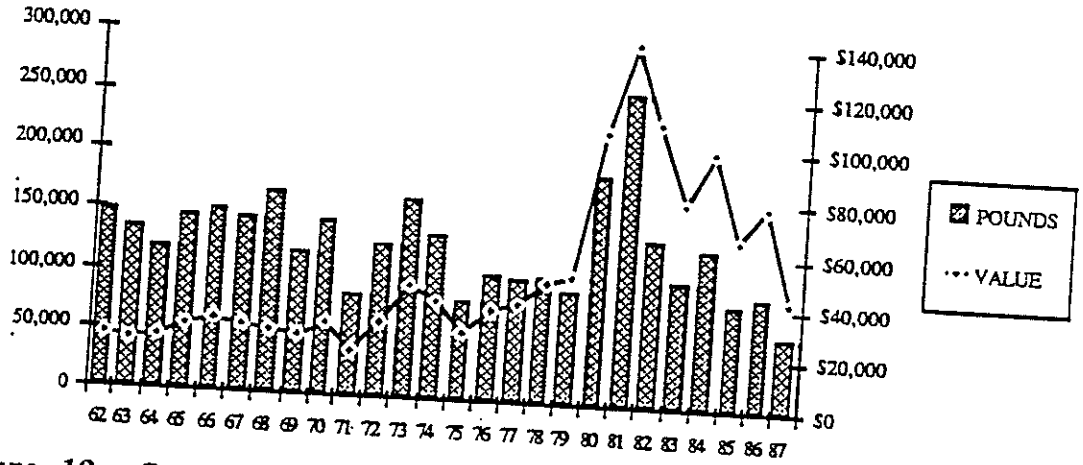


Figure 18. Commercial landings and ex-vessel total revenue of red drum in Florida (Source: NMFS SEFC).

8.1.1.1.6 Turtle Excluder Devices

Red drum are occasionally caught by trawlers along the Atlantic coast. In 1975, approximately 70,000 lb of red drum were landed as a bycatch of trawling operations along the Atlantic coast. This represents a small percentage of the total shrimp and finfish weight and value but a significant portion of the red drum catch occurring that year. Turtle Excluder Devices (TEDs) are required to be used seasonally by all shrimp trawlers operating along the Atlantic coast in an effort to save dwindling numbers of endangered and threatened sea turtles. Bycatch of finfish will be reduced in shrimp trawls using TEDs with a possible beneficiary being larger, spawning red drum which are occasionally caught by these trawlers. In a study conducted by the South Carolina Wildlife and Marine Resources Department (SCWMRD) while testing TEDs, 26 red drum were caught in the control net with an average TL of 38.2 in (971 mm; range=29.8-41.5 in or 757-1,055 mm) and an average weight of 9.9 kg (21.7 lb; range=10.0-39.1 lb). Only one red drum weighing 28.7 lb with a total length of 43.1 in (1,095 mm) was taken in the net towed with the Georgia TED. The study was intended to collect information on the species composition and magnitude of the finfish bycatch, the effectiveness of TEDs in reducing mortality of fishes during trawling and the impact of these devices on the harvest of shrimp. This study showed the Georgia TED to be effective in excluding large, mature red drum. It must be noted that due to differences in TEDs with their design goal as turtle exclusion, some are better at finfish release than others.

Recent Federal action requires the use of TEDs seasonally, May 1-August 31 except the Canaveral area (Florida) where they are required year round. In addition, Florida and South Carolina have adopted, through emergency regulation, state regulations requiring the use of TEDs in State waters. Florida regulations when in effect may require the use of TEDs throughout the year and South Carolina regulations will track the Federal regulations.

8.1.1.2 Recreational Fishing Activities

8.1.1.2.1 Recreational Exploitation

Recreational fishing for red drum along the Atlantic coast has taken many forms over the years and historically extended farther north than at present. Red drum was a prized sport fish as far North as Barnaget Light, New Jersey where surf fishermen commonly landed large adult 25-45 lb fish. This fishery no longer exists; only an occasional large red drum is caught.

The present recreational fishery in the Mid-Atlantic region extends mainly from Assateaugue Island, Maryland southward along Virginia's barrier islands to Cape Charles and into the Chesapeake Bay. Two distinct fisheries are prosecuted in the Chesapeake- a puppy drum fishery and a large-fish trophy fishery. The State of Virginia awards citations for red drum larger than 40 lb caught by recreational fishermen in the Virginia Sport Fishing Tournament. In 1988, red drum ranked fifteenth in total number of citations awarded for all species. Approximately 70% of the 124 red drum entered for citation in 1988 were released alive.

The recreational fishery for trophy red drum which exists along the South Atlantic has been primarily a surf fishery along the outer beaches of barrier islands. The largest (94 lb 2 oz) red drum ever recorded caught by recreational fishermen was caught in the surf on the Atlantic coast. Small red drum are caught in estuaries from Chesapeake Bay to Florida. The salt-water angling surveys indicated that 88% of red drum caught in the Mid-Atlantic region in 1965 were caught in sounds, rivers and bays, whereas in 1970 only 47% were caught in estuarine waters. In the South Atlantic more red drum (59%) were caught in the ocean in 1965, but in 1970, 79% were caught in sounds, rivers and bays than in the ocean in all survey years. Red drum catch data by month and year on the eastern shore of Virginia were reported for 1955 to 1965. Catch rates were never high but relative highs occurred during 1957 and 1962 at 0.14 fish per man-hour. More fish were landed during May and September, but catch rates were highest for April, June and September. A low of 0.01 fish per man-hour occurred in 1959. A 1963 sport fishery survey in the Cape Canaveral area of Florida found that catch per unit effort was highest in October and April.

Seasonality

Between False Cape, Virginia and South Carolina most red drum are caught from mid-March or early April to early December. The best fishing for adult red drum runs from late March to early June and for juvenile red drum from late September to November. The fishing season in Chesapeake Bay is from late April or May to November. The best fishing for adults is from mid-May to mid-June and from August to October for juveniles. The red drum fishing season from False Cape, Virginia to Delaware Bay extends from

April or May to November and the best fishing is from May-June and September-October. Along the North Carolina coast surf fishing is best from March to June and October to November. Peak seasons along the barrier beaches and inlets are from mid-March through early June and mid-September through November. In Pamlico Sound large red drum are also available from mid-May through early October, especially around river mouths and high shoals. Small red drum are caught along barrier island beaches from June through December with September through December being the peak seasons. They are also caught during this period in estuarine waters, particularly around grass flats and shorelines. The fishing season for red drum is year round from Georgia to southeastern Florida. From Altamaha Sound to Fort Pierce Inlet, best fishing for small fish is August to December inshore, and for large fish, March to May and September to December in beach and shoal areas. Best fishing for small red drum from St. Lucie Inlet to southern Florida is from April to August and from August to November for large ones. Adult red drum generally remain in coastal waters during spring and fall months and during late summer move offshore, presumably to spawn. Generally, adult drum move offshore during the coldest months.

Fishing Gear

Red drum are caught by bottom fishing, jigging and casting from shore, as well as, bottom fishing, casting, live-lining and trolling from boats. Baits include soft or shedder crabs, shrimp, clams, squid, cut or whole mullet, spot, herring or menhaden, as well as artificial lures such as spoons, jigs, weighted bucktails, feathers, plugs and streamer flies. Red drum have been harvested by gill netting and gigging for home consumption in North and South Carolina. In South Carolina, 94% of the gill net fishermen who fished in 1978, fished recreationally. This recreational gill net fishery no longer exists since the State of South Carolina declared red drum a gamefish and harvest is restricted to hook and line and during designated months, gigs.

The NMFS salt-water angling surveys (1960-1970) indicated that the number of red drum per angler declined in all regions from 1965 to 1970. The average reported weight of fish decreased in both the Mid and South Atlantic regions from 1960 to 1970, but increased from 1960 to 1965 and decreased slightly from 1965 to 1970.

NMFS initiated the Marine Recreational Fisheries Statistics Survey (MRFSS) in 1979 to obtain estimates of participation, catch and effort by recreational fishermen in U.S. marine waters to establish a reliable data base for estimating the impact of recreational fishing on marine resources. The MRFSS, now in its eleventh year, is the data base the Regional Fishery Management Councils utilize in estimating recreational catch of a particular species. Data collection involves the acquisition of two sets of information resulting from a telephone survey of households and an intercept survey of fishermen at fishing sites. Combining

these independent sources of data produces the estimations of total effort, participation and total catch. In recent years the survey has been expanded and number of intercepts increased through participation by state fishery management agencies in most South Atlantic states. This increased support by the states has increased the precision of the catch and effort estimates.

The recreational fishery has expanded significantly over the last nine years the survey has been conducted. Recreational anglers along the Atlantic coast caught approximately 1.3 million red drum weighing 3.8 million lb in 1988 representing the highest recorded level to date (Figure 19).

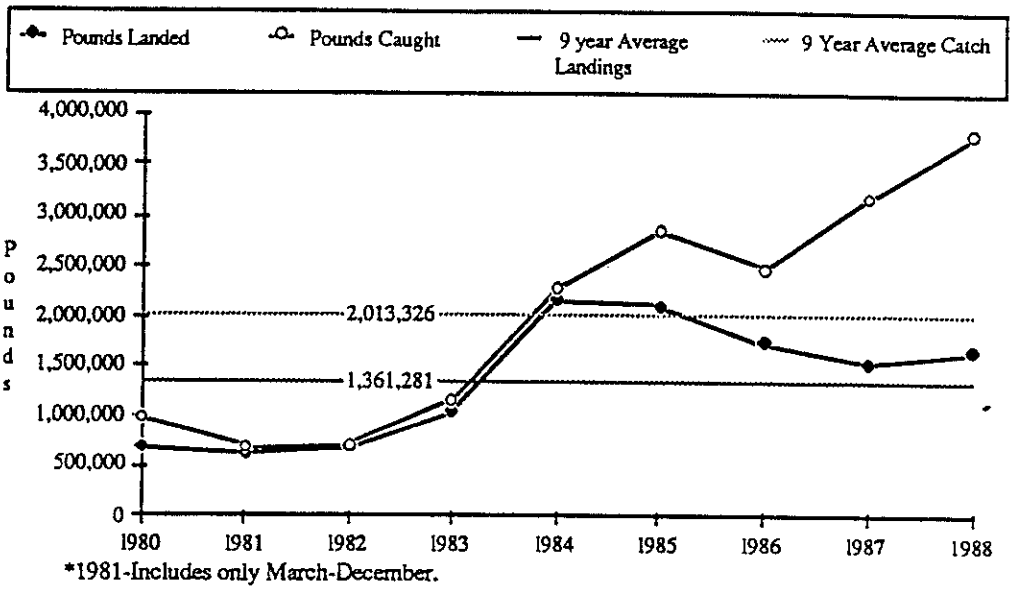


Figure 19. Total recreational red drum catch and landings for Atlantic coast (Source: MRFSS).

Recreational landings in numbers of red drum (Table 5) have generally declined since 1985, in part due to the imposition of minimum and maximum size limits by Atlantic coast State agencies as recommended in the ASMFC FMP. Table 5 shows that the coastwide mean weight of landed fish by mode varied over the years, with fish caught by boat to be larger in recent years. In 1988 approximately 54.4% of red drum caught were released alive (Table 5).

Table 5. Estimated total number and pounds of red drum caught, landed and percent released alive by recreational fishermen in the Atlantic (Source: Vaughan and Helser 1989).

Year	Mean Weight** (lb)		% Released Alive	Number Caught	Number Landed	Pounds Caught***	Pounds Landed
	Boat	Shore					
1980	1.930	3.613	35.27	416,795	269,801	969,943	679,199
1981*	4.668	1.311	7.13	200,425	186,140	685,103	627,139
1982	1.640	2.186	4.36	406,344	388,609	713,983	678,266
1983	1.565	1.927	10.31	708,001	635,012	1,168,582	1,051,480
1984	1.637	3.433	5.65	1,132,634	1,068,608	2,287,066	2,164,134
1985	1.694	2.173	28.27	1,547,105	1,109,719	2,850,736	2,101,659
1986	4.300	2.268	29.78	610,349	428,598	2,470,151	1,741,403
1987	2.158	1.757	50.86	1,501,684	737,997	3,174,298	1,537,463
1988	3.168	1.850	54.43	1,300,450	592,638	3,800,072	1,670,190

* Includes only March-December
** Of landed fish (A1+B1 fish), Boat = private/rental & charter, Shore = beach/bank & man made
*** = (lb landed + (mean weight of landed fish by mode x number of fish released by mode))

Estimated mean weight of Atlantic red drum landed by recreational fishermen, has ranged from 1.57 lb in 1983 to 4.67 lb in 1981 for fish caught from a boat and from 1.31 lb in 1981 to 3.61 lb in 1980 for fish caught from the shore (Table 6). Mid-Atlantic shore fishermen land smaller fish than boat fishermen.

Table 6. Mean weight (lb) of red drum landed by recreational anglers by state, mode and year (Source: Vaughan and Helser 1989).

State	Mode	1980	1981	1982	1983	1984	1985	1986	1987	1988
Maryland	Boat	0	9.913	0	1.914	0	0	62.77	0	0
	Shore	0	0	0	0	0	0	0	0	0
Virginia	Boat	0	7.004	0	1.095	1.762	0	5.432	40.090	0
	Shore	0	0	0	1.652	0	0	3.608	0.441	2.099
North	Boat	1.322	0.881	4.168	0.080	0.770	2.866	1.102	2.432	3.378
Carolina	Shore	3.731	2.748	2.327	2.360	7.941	2.984	2.129	2.871	2.580
South	Boat	2.309	1.431	1.976	1.701	1.501	2.884	2.552	1.807	3.362
Carolina	Shore	2.620	5.038	1.082	3.584	1.121	2.701	1.711	1.257	1.432
Georgia	Boat	1.147	1.488	1.181	1.232	1.145	1.008	1.684	1.775	2.514
	Shore	0.784	0	0.017	0.636	0.504	0.643	1.461	0.726	1.137
Florida	Boat	1.896	2.521	1.439	1.896	1.911	1.508	3.346	4.379	0
E. Coast	Shore	4.150	0.954	4.704	1.658	1.183	1.433	1.668	0	0.643
	Total Boat	1.930	4.668	1.640	1.565	1.637	1.694	4.300	2.158	3.168
	Total Shore	3.613	1.311	2.186	1.927	3.433	2.173	2.268	1.757	1.850

The Atlantic coast recreational red drum fishery can be summarized from the MRFSS in two modes: the shore mode, which includes shore based anglers fishing from the beach, bank or man made structure; and the boat mode, which includes anglers fishing from personal or rented vessels, party or charterboats. Anglers fishing for red drum from charterboats contributed a very small portion of red drum catch for all years, with the highest level, 5% of total catch, occurring in 1984. Recreational anglers fishing in the South Atlantic region caught 99.4% by number, landed 99.6% by number and 99.5% by weight of all red drum caught along the Atlantic coast in 1988 (Tables 7, 8 and 9).

Table 7. Total landings of red drum (lb) caught by Atlantic coast recreational anglers by state and year, MRFSS 1980-1988 (Source: Vaughan and Helser 1989).

State	1980	1981	1982	1983	1984	1985	1986	1987	1988
Maryland	0	8,079	0	6,231	0	0	609,710	0	0
Virginia	0	436,258	0	44,626	4,421	0	179,002	37,573	6,570
North Carolina	201,965	28,775	50,370	97,529	614,738	50,263	8,475	157,039	334,172
South Carolina	198,680	49,057	245,004	165,871	211,895	667,237	309,626	772,576	921,624
Georgia	30,021	10,059	23,643	58,938	233,458	242,122	101,737	204,073	228,086
Florida E. coast	248,534	94,910	359,249	678,285	1,050,129	450,190	348,074	190,349	6,892
Boat	338,922	532,727	514,253	743,655	1,371,440	1,096,295	1,627,909	1,295,965	1,379,081
Shore	340,278	94,412	164,012	307,824	792,694	1,005,363	113,494	241,498	291,109
Total Atlantic	679,200	627,139	678,265	1,051,479	2,164,134	2,101,658	1,741,403	1,537,463	1,670,190

Table 8. Total numbers of red drum caught* by Atlantic coast recreational anglers by State, mode and year, MRFSS 1980-1988 (Source: Vaughan and Helser 1989).

State	Mode	1980	1981	1982	1983	1984	1985	1986	1987	1988	Total (80-88)
Maryland	Boat	0	815	0	3,255	0	0	9,704	0	0	13,774
	Shore	0	0	0	0	0	0	0	0	0	0
Virginia	Boat	0	62,283	0	10,832	2,509	1,351	34,017	915	2,685	114,592
	Shore	0	0	0	14,202	0	0	13,185	1,948	4,660	33,995
North	Boat	3,456	2,154	3,502	65,818	15,134	13,799	1,675	30,758	77,501	213,797
Carolina	Shore	52,907	12,379	15,369	39,142	81,327	7,669	10,019	51,727	66,913	337,452
South	Boat	186,245	27,754	109,593	77,018	136,953	169,402	179,996	449,107	496,801	1,832,869
Carolina	Shore	21,212	1,992	28,553	14,247	5,425	286,679	16,198	85,388	101,699	561,393
Georgia	Boat	27,767	6,759	22,759	42,720	206,287	246,424	126,486	357,293	282,977	1,319,472
	Shore	965	0	11,331	11,455	14,181	30,074	7,859	14,280	7,844	97,989
Florida	Boat	100,958	26,043	183,329	340,633	533,250	637,818	182,455	498,229	197,770	2,700,485
E. Coast	Shore	23,285	60,246	31,908	88,679	137,568	153,889	28,755	12,039	61,600	597,969
	Total Boat	318,426	125,808	319,183	540,276	894,133	1,068,794	534,333	1,336,302	1,057,734	6,194,989
	Total Shore	98,369	74,617	87,161	167,725	238,501	478,311	76,016	165,382	242,716	1,628,798
	Total	416,795	200,425	406,344	708,001	1,132,634	1,547,105	610,349	1,501,684	1,300,450	7,823,787

* includes fish landed, discarded and released alive
Boat = private/rental & charter, Shore = beach/bank & man made

Table 9. Number of red drum landed by Atlantic coast recreational anglers by State, mode and year, MRFSS 1980-1988 (Source: Vaughan and Helser 1989).

State	Mode	1980	1981	1982	1983	1984	1985	1986	1987	1988	Total (80-88)
Maryland	Boat	0	815	0	3,255	0	0	9,704	0	0	13,774
	Shore	0	0	0	0	0	0	0	0	0	0
Virginia	Boat	0	62,283	0	10,832	0	0	25,034	915	0	99,064
	Shore	0	0	0	14,202	2,509	0	13,185	1,948	3,127	34,971
North	Boat	3,456	2,154	3,502	64,358	15,134	13,799	1,675	22,750	64,854	191,682
Carolina	Shore	52,907	9,782	15,370	39,142	78,124	7,669	10,019	45,222	63,377	321,612
South	Boat	66,195	27,272	108,966	67,936	136,953	160,576	157,958	382,708	269,745	1,378,309
Carolina	Shore	17,506	1,992	27,400	14,042	5,425	278,518	12,098	85,388	77,992	520,361
Georgia	Boat	25,850	6,759	19,867	42,013	203,510	238,547	833,334	129,811	100,653	850,341
	Shore	486	0	11,331	11,258	14,182	28,852	3,331	4,873	2,178	76,491
Florida	Boat	80,116	14,837	181,255	286,834	482,086	234,148	100,854	64,382	0	1,444,512
E. coast	Shore	23,285	60,246	20,918	81,140	130,685	147,610	11,406	0	10,712	486,002
	Total Boat	175,617	114,120	313,590	475,228	837,683	647,070	378,559	600,566	435,252	3,977,682
	Total Shore	94,184	72,020	75,019	159,784	230,925	462,649	50,039	137,431	157,386	1,439,437
	Total	269,801	186,140	388,609	635,012	1,068,608	1,109,719	428,598	737,997	592,638	5,417,119

Boat = private/rental & charter, Shore = beach/bank & man made

Recreational anglers currently release a greater proportion of red drum than in the early 1980s due mainly to the imposition of minimum size regulations by Atlantic coast states (Table 10).

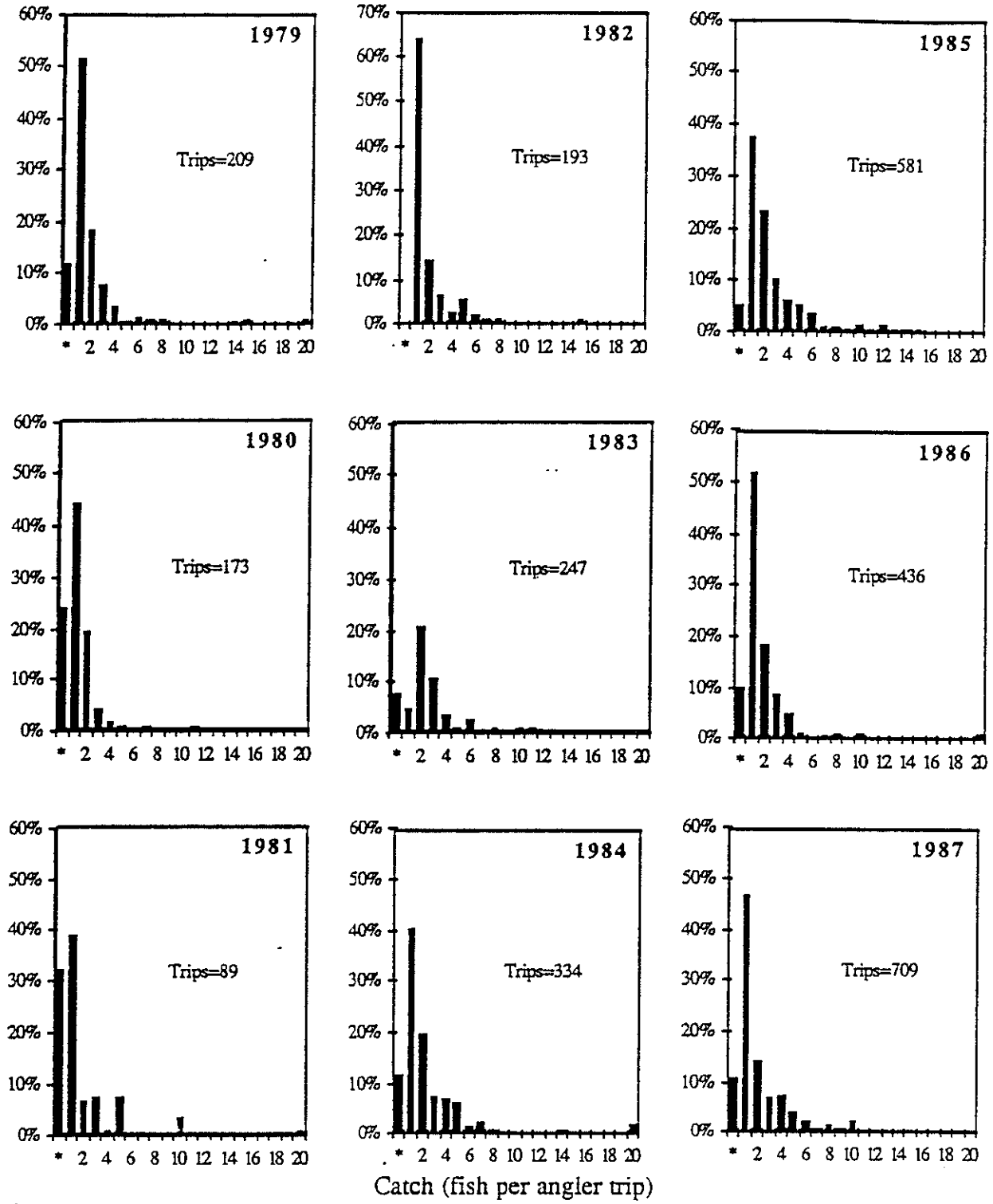
Table 10. Number of red drum caught* and released alive by Atlantic coast recreational anglers by State, mode and year, MRFSS 1980-1988 (Source: Vaughan and Helser 1989).

State	Mode	1980	1981	1982	1983	1984	1985	1986	1987	1988	Total (80-88)
Maryland	Boat	0	0	0	0	0	0	0	0	0	0
	Shore	0	0	0	0	0	0	0	0	0	0
Virginia	Boat	0	0	0	0	0	0	8,983	0	2,685	11,668
	Shore	0	0	0	0	0	1,351	0	0	1,533	2,884
North	Boat	0	0	0	1,460	0	0	0	8,008	12,646	22,114
Carolina	Shore	0	2,597	0	0	3,204	0	0	6,505	3,537	15,843
South	Boat	120,050	482	627	9,083	0	8,825	22,038	66,399	227,054	454,558
Carolina	Shore	3,706	0	1,153	205	0	8,160	4,100	0	23,707	41,031
Georgia	Boat	1,917	0	2,892	706	2,778	7,877	43,153	227,484	182,326	469,133
	Shore	479	0	0	197	0	1,222	4,528	9,407	5,666	21,499
Florida	Boat	20,843	11,206	2,074	53,799	51,164	403,670	81,601	433,848	197,770	1,255,975
E. Coast	Shore	0	0	10,990	7,539	6,883	6,279	17,349	12,039	50,888	111,967
	Total Boat	142,810	11,688	5,593	65,048	53,942	420,372	155,775	735,739	622,481	2,213,448
	Total Shore	4,185	2,597	12,143	7,941	10,087	17,012	25,977	27,951	85,331	193,224
	Total	146,995	14,285	17,736	72,989	64,029	437,384	181,752	763,690	707,812	2,406,672

* includes fish landed, discarded and released alive
Boat = private/rental & charter, Shore = beach/bank & man made

Historically, recreational catch of red drum from the EEZ has been minor. Recreational catch of red drum from EEZ waters in 1987, as identified in the MRFSS totaled less than 6,000 fish in the South Atlantic (0.4% of total number of fish caught) and less than 3,000 fish from the Mid-Atlantic region (0.2% of total number of fish caught).

Catch frequency, as derived from the MRFSS 1979-1987, shows that 99% caught less than 10 red drum per angler per trip. In 1987, approximately 90% of Atlantic coast recreational fishermen caught less than five red drum per angler per trip (Figure 20). Of landed red drum, 76-95% were less than 20 in TL (Figure 21).



*<.5 red drum per angler trip
Trips=Angler Trips
20=20 red drum or greater per angler trip

Figure 20. Catch frequency distribution for Atlantic coast red drum, MRFSS 1979-1987 (Source: MRFSS, Essig pers.comm. 1989).

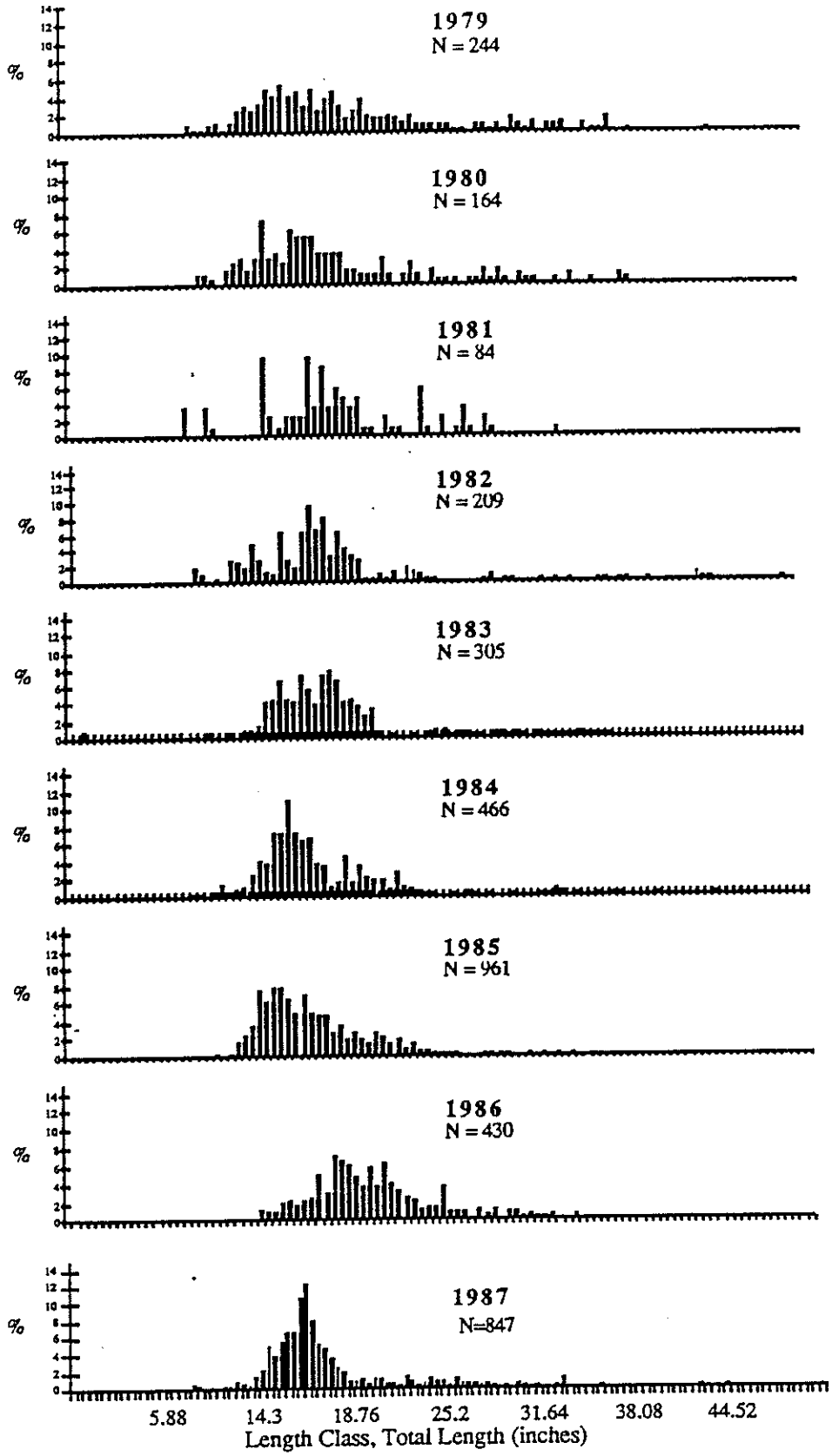


Figure 21. Length frequency of recreational catch in the South Atlantic (Source: MRFSS, Essig pers. comm. 1988).

8.1.1.2.2 Trends in Human Population and Recreational Boat Registration in the South Atlantic Region

Coastal populations in the South Atlantic continues to rise rapidly. Subsequently, recreational boating and fishing effort also continues to increase. Red drum, with their extended residence in estuarine systems and schooling behavior, are probably one of the most vulnerable species to such an increase in numbers of coastal recreational fishermen.

Recreational boat registrations in South Atlantic States increased 70% between 1976 and 1986. If one can gauge increased boating activity with the potential increase in fishing power of the recreational sector, then there has been a large increase in the last decade in the South Atlantic Region. As numbers of recreational vessels increase, so will the need for increased boat landings and marinas to afford access to the ocean, rivers, harbors, bays and estuaries. All these factors will result in increased pressure on the Atlantic coast red drum resource, specifically the easily accessible juvenile fish.

8.1.2 Vessel Safety Considerations

P.L. 99-659 amended the Magnuson Act to require that a FMP consider access to the fishery for vessels otherwise prevented from harvesting because of weather or other ocean conditions affecting vessel safety. The FMP may provide for temporary adjustments after consultation with the Coast Guard and persons utilizing the fishery. No vessel will be forced to participate in the fishery under adverse weather or ocean conditions as a result of the imposition of management regulations set forth in this FMP. Therefore, no management adjustments for fishery access will be provided. It is recommended that, where applicable, all vessels participating in this fishery follow the Federal safety requirements for vessels as presented in the Source Document for the Red Drum FMP.

Fishery Access and Weather Related Safety

There are no fishery conditions, management measures or regulations contained in this FMP that would result in the loss of harvesting opportunity because of crew and vessel safety effects of adverse weather or ocean conditions.

No Impact Determination

Vessel safety has not been identified as a relevant or significant issue in the red drum fishery or in the management measures set forth.

Adjustments

There are no procedures for making management adjustments in this plan because no harvest will be allowed in the EEZ for the foreseeable future. Adjustments may be reconsidered when harvest is allowed.

Procedures

There are no procedures to monitor, evaluate and report on the effect of management measures on vessel or crew safety under adverse weather or ocean conditions.

Other Safety Issues

There are no significant or relevant safety issues raised by fishery users, other public or the Coast Guard; therefore, there are no social or economic implications.

8.1.3 Assessment and Specification of Domestic Annual Harvesting Capacity

Present commercial landings totaled 227,580 lb in 1988 primarily as incidental catch. This is well below the highest level of harvest recorded by the commercial fishery which was 628,245 lb in 1950. If existing capacity was used in a directed fishery, U.S. vessels would have the capacity to harvest well in excess of recent landings.

8.1.4 Assessment and Specification of Domestic Annual Processing Capacity

Domestic processing capacity at present exceeds the commercial sector's ability to harvest Atlantic coast red drum.

8.1.5 Assessment and Specifications of the Extent to Which U.S. Fishermen will Harvest Optimum Yield

Optimum yield for the Atlantic coast red drum fishery as adopted by the SAFMC is the amount of harvest that can be taken by U.S. fishermen while maintaining the spawning stock biomass per recruit level at or above 30% of the level that would result in the absence of fishing. Approximately 628,425 lb of red drum were landed by Atlantic coast commercial fishermen in 1950, which represents the highest level of commercial fishing to date. Commercial landings totaled 227,580 lb in 1988. Recreational catch as approximated through the MRFSS has increased substantially between 1980 and 1988 and is at the highest level to date. Therefore, U.S. fishermen have more than sufficient capacity to harvest OY.

8.2 Foreign Fishing Activity

There is no current foreign fishing activity or foreign catch of Atlantic coast red drum. To date there have been no permit applications by foreign countries to fish for red drum within the U.S. EEZ and none are anticipated. There are no red drum in the EEZ in excess of the quantity needed to support the domestic Atlantic coast red drum fishery; therefore, Total Allowable Level of Foreign Fishing (TALFF) is zero.

8.3 Red Drum Mariculture

Atlantic coast states have historically supplied a very limited quantity of red drum to local and regional markets. For this reason, no more than a few consumers on the Atlantic are probably aware of the fine eating qualities red drum has to offer. Fisheries managers recognize, however, that red drum is one of the most prized species in the eyes of recreational fishermen. For this reason, many states have imposed regulations to protect the stock as well as limit the development or expansion of commercial fisheries for red drum in territorial waters.

In an attempt to serve consumer demand for this species, research is presently being conducted on the possible development of mariculture production of red drum. In South Carolina, culture trials began as early as 1947 and utilized fish that had been trapped in coastal impoundments. Recent progress in grow-out technology have resulted the encouragement of private sector investment for red drum mariculture. Mariculture technology, in addition to potential commercial applications, is presently being utilized to produce red drum for the evaluation of the effectiveness of stocking of red drum in coastal waters. SCWMRD in an ongoing program is presently stocking estuarine systems with juvenile red drum in an attempt to enhance local availability of these fish for recreational fishermen.

The decline in the Gulf of Mexico red drum stock and subsequent closure of the commercial fishery curtailed the supply of red drum for blackened redfish in the Gulf. Since then, the craze for blackened redfish in the Gulf of Mexico seems to have diminished. There is also evidence that black drum may be replacing red drum on restaurant menus. Landings of black drum in the Gulf increased from roughly 1.6 million pounds worth $557,000 in 1982 to 8 million pounds worth $2.67 million in 1987.

A number of factors contribute to the hypothesis that red drum mariculture is feasible in South Atlantic states: 1) The market price of red drum in some areas exceeds such highly successful aquaculture species as catfish; 2) Red drum is a highly desirable, white firm-fleshed fish with proven marketability; 3) Red drum are extremely hardy fish able to withstand a wide range of salinities; 4) Red drum exhibit rapid growth with the highest value marketable product available in

18-20 months; and 5) Production methodology for the species has been developed and fine tuned. Recently, record harvests (19,000 lb per acre) of marketable red drum were produced at the Waddell Mariculture Center in South Carolina. If one would assume 100% success, mariculture operations could supply a quantity equivalent to the 1985 total U.S. commercial harvest of wild red drum (~13 million lb), from production of approximately 2,737 quarter acre ponds or 638 total acres of mariculture ponds.

8.4 Marine Sanctuaries

The Florida Institute of Government has funded research to determine the utility of marine sanctuaries in enhancing wild populations of such species as red drum. Untouched by human activity, sanctuary areas such as the restricted portions of the Indian River Lagoon system within the Kennedy Space Center would serve to provide recharge areas. The benefits derived from designated sanctuaries would result from spillover as the population reached carrying capacity for the sanctuary and migration into adjacent non-sanctuary area occurred.

9.0 DESCRIPTION OF THE ECONOMIC CHARACTERISTICS OF THE FISHERY

9.1 Domestic Harvesting Sector

9.1.1 Commercial Fishing

Quantities and total exvessel value (1982 dollars) of red drum reported caught in EEZ waters from 1979 to 1988 is shown in Table 11. There is no directed EEZ commercial fishery at this time. These small quantities and values were caught as bycatch of the winter trawl fishery off North Carolina. At present, red drum in the EEZ appear to be of little consequence to commercial fishing.

Table 11. EEZ commercial red drum bycatch harvested in the Atlantic (Source: NMFS SEFC).

Year	Pounds	Ex-vessel value (1982 Dollars)
1979	679	$108
1980	19,992	$3,621
1981	3,985	$992
1982	3,913	$887
1983	4,920	$1,244
1984	11,778	$2,882
1985	1,832	$488
1986	1,883	$707
1987	1,149	$428
1988	991	$248

In states where commercially landed red drum from local waters is available to consumers, there is evidence that smaller size red drum are preferred over larger red drum. Exvessel red drum prices for red drum landings (1979-1988) vary with different size compositions of the catch (Figure 22). Prices in Figure 22 have been converted to 1982 dollars for comparative purposes. Price per pound for red drum from EEZ waters remained relatively low throughout the period. EEZ drum are adult fish, usually greater than 32 inches in length. Price per pound for total state waters landings was consistently higher than EEZ prices. State waters commercial landings are comprised of one and two year old fish with a small number of larger fish from trawl bycatch mixed in. State waters red drum, therefore, consist of smaller red drum on average than from EEZ waters and fetched higher prices than EEZ drum. Lastly, Georgia commercial red drum harvest is nearly completely from estuarine waters and has the highest composition of one and two year old fish. These smaller red drum commanded significantly higher prices than drum from either State waters or from the EEZ .

Price trends for different size red drum probably reflect the consumer's preference for smaller red drum. Differences in prices at exvessel level will reflect price differences at the retail level when markets are relatively unconstrained by dominant firms or other barriers that might alter the forces of demand and supply across different market levels. If consumer preferences are accurately reflected by exvessel red drum price differences, then consumer and producer benefit from commercial use of the state waters red drum resource may involve more benefit to consumers and producers than potential commercial use of the same or greater quantity of EEZ red drum. This would only necessarily be true, however, if production economies for state waters fish and EEZ fish were roughly the same.

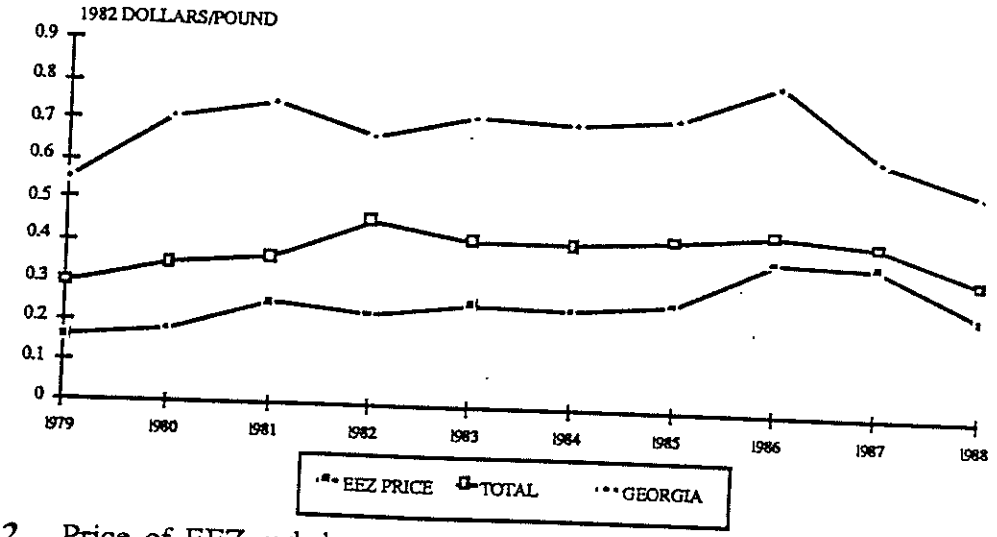


Figure 22. Price of EEZ red drum compared to inshore Atlantic prices (Source: NMFS SEFC).

Red drum is of greater consequence to commercial fishing in state waters. Nominal ex-vessel value for Atlantic coast red drum reached $217,126 in 1987. Run-around, anchor and other gillnets are responsible for the majority of total nominal value of red drum landings for all years since 1960. The next most valuable component of commercial landings has alternated between hand gear and more recently seines and pound nets (Figure 23). Nominal price per pound for Atlantic coast red drum has increased in the last 20 years, going from a range of 9-18 ¢/lb in 1969 to 82-93 ¢/lb in 1986 (Figure 24). The highest value in nominal price per pound is acquired from hand gear approaching 90 ¢/lb in 1988 averaged for all areas (Figure 25). In 1988 the value of red drum caught in seines, gillnets, trawls, and pound nets ranged between 55 and 60 ¢/lb (Figure 26).

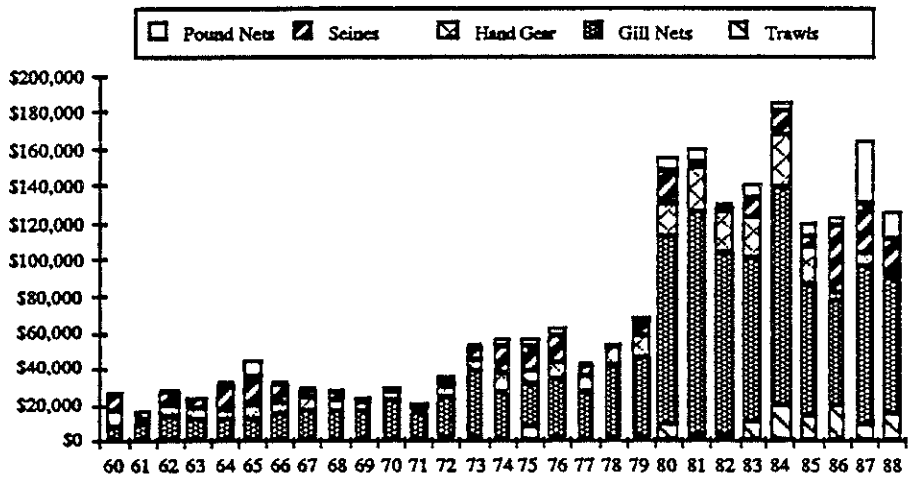


Figure 23. Nominal ex-vessel value of Atlantic coast red drum commercial landings by gear type for 1960-1988 (Source: NMFS SEFC).

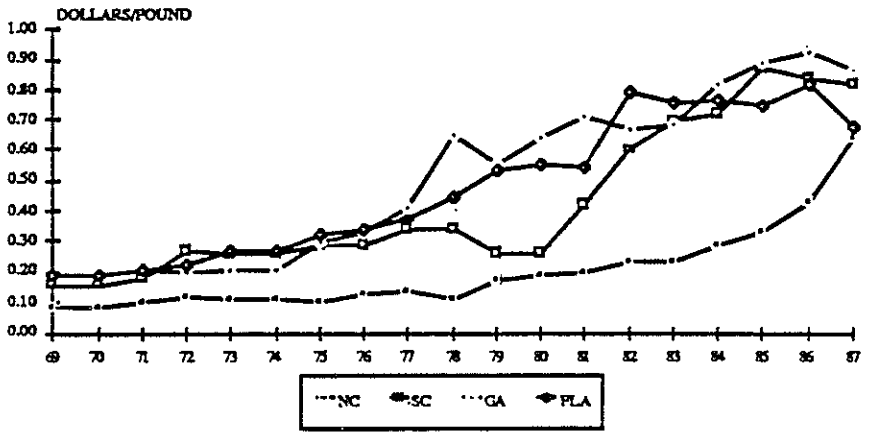


Figure 24. Ex-vessel nominal price per pound by South Atlantic State, 1969-1987 (Source: NMFS SEFC).

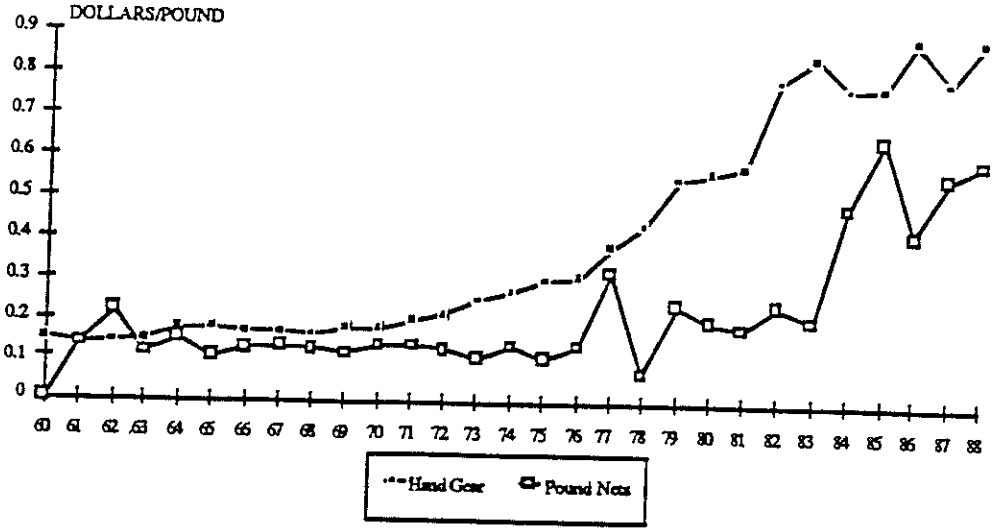


Figure 25. Nominal ex-vessel price per pound for commercial landings of Atlantic coast red drum caught by hand gear and pound nets, 1960-1988 (Source: NMFS SEFC).

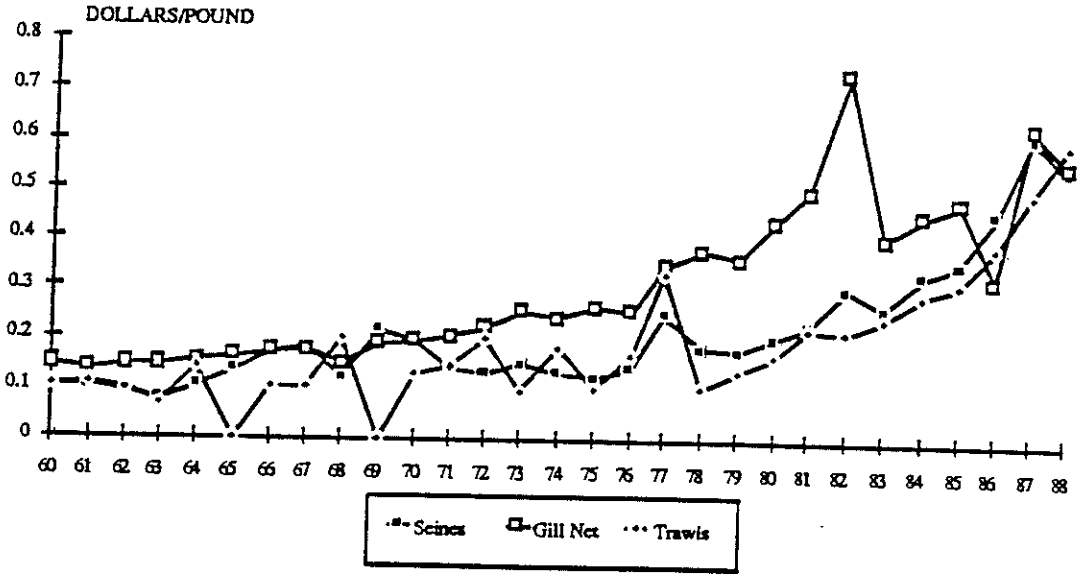


Figure 26. Nominal ex-vessel price per pound for commercial landings of Atlantic coast red drum caught by seines, gillnets and trawls, 1960-1988 (Source: NMFS SEFC).

9.1.2 Recreational Fishing

The appropriate index to describe the economic value recreational fishermen derive from the red drum resource is consumer surplus (for a succinct explanation of consumer surplus as an appropriate measure of value vs. expenditures see Edwards 1989a). For non-market goods such as recreational fishing, consumer surplus or benefit is often measured by willingness to pay or be compensated for changes in the quality or quantity of the non-market good.

An in-depth study of consumer surplus or benefit in the Gulf of Mexico derived from changes in the quality of recreational red drum fishing was conducted that focused on quantifying benefits to be realized from measured increases in recreational catch (Green 1989). This study did not explicitly quantify total benefits at present levels of red drum abundance. Although specific to the Gulf of Mexico, some results from Green's study can be used to approximate present levels of benefits to red drum anglers on the Atlantic coast if appropriate assumptions and adjustments are made.

Green's most conservative estimates of increases in consumer surplus from the Gulf recreational fishery can be obtained from his multi-site travel cost model which uses a multi-nominal logit estimation technique. That specification also demonstrates the best overall statistical fit. The bottom-line result from that model, using 1986 MRFSS data pooled for all Gulf states, is that a ten percent increase in catch per trip increases per trip benefits to the average angler by $4.04. Several simple manipulations using the above result can be made to develop an estimate of total recreational value from red drum angling in the South Atlantic. Before that can be done, however, some assumptions and qualifications have to be set.

The first criterion for assessing how appropriate Green's estimates are to the South Atlantic context is whether the base level quality of red drum angling in the Gulf and in the South Atlantic are reasonably similar. Green reports angling success as fish per trip broken down by fishing mode. Average Gulf success rates by mode are 0.65, 0.66 and 1.90 fish per trip for shore/pier, charterboat, and private boat respectively (Green 1989, p. 41). Section 5.3 of this plan reports success rates as fish per trip for 1980-1987 but these CPUE indices are not broken down by fishing mode. Fish per trip indices for recreational catch in the South Atlantic as described in section 5.3 vary from 0.5 to 1.2 fish/trip over the eight year period across all angling modes. From this comparison of available data, it appears that the success rate for red drum angling in the Gulf is fairly similar to that of the South Atlantic.

In the Gulf study, rather detailed information from the 1981 Socio-Economic Survey (SES) are tabulated and presented to provide a profile of the typical red drum angler in the Gulf. It

would be useful to compare the typical red drum angler in the Gulf to his Atlantic counterpart but that detailed comparison cannot be undertaken due to data limitations at this time. We do know, however, that the percentage of anglers using specified fishing mode categories is fairly similar between the two areas. In addition, the distance from shore where anglers primarily fish is very similar for the two areas. Expenditures per trip are also roughly equal. The use of artificial lures appears to be more prevalent in the Gulf. From available data, the recreational fishery on the Atlantic coast is not inherently different from that of the Gulf of Mexico. Future analysis of 1981 SES data in the South Atlantic will provide information as to whether anglers in the South Atlantic differ from Gulf anglers in terms of age, income, education, years of fishing experience, etc.

Accepting the possibility that red drum anglers in the South Atlantic are not significantly different from those in the Gulf, some approximate estimates of total benefit to recreational anglers in the South Atlantic can be made. The process of using Green's estimate of benefits to anglers from a ten percent increase in catch to an estimate of total benefit from a red drum trip is reasonably simple. Total value per average angler per trip could be calculated by solving Green's multi-nomial logit pooled site travel cost model at mean values for explanatory variables. Unfortunately, not all of those mean values are provided in the report. We can, however, assume that at values relatively close to equilibrium, the magnitude of the increase in benefits from a percent increase in catch per trip can be used to describe the baseline total value per trip with relatively good accuracy. Specifically, if a ten percent increase in catch per trip means a $4.04 increase in benefits, then total value per trip at equilibrium is roughly ten times the ten percent increase in value or roughly $40.40. This means that at present levels of catch, roughly $40.00 per angler consumer surplus or benefit is realized per trip. The per trip value to the South Atlantic can be used to calculate total benefit in the South Atlantic in the following manner:

20,924,000 x (total est. rec. trips/yr)		0.0968 (% prim or sec*)	x	$40.40 (est.consumer surplus./ trip)	=	$84,262,724 (est. annual benefit to anglers)

*MRFSS 1987 data for primary and secondary red drum trips

The calculation above multiplies the estimated total number of annual recreational trips in the South Atlantic in 1987 by the percent of intercept trips that identified red drum as the primary or secondary target of the trip. That percent is multiplied by the estimated total consumer surplus benefit to an average angler per trip. The magnitude of benefits is quite large. However, the per trip benefit estimate was calculated from Green's pooled travel cost model. Travel cost models usually give fairly conservative estimates compared to willingness to pay or be compensated estimation techniques. In fact, the $4.04 estimate

of increased benefits is the lowest estimate for a ten percent increase in catch for all the estimation techniques used in Green's work.

The calculation above can be performed using only the percentage of intercept trips identifying red drum as the primary target:

20,924,000 x	0.0319	x	$40.40	= $26,966,014
(total est. rec. trips/yr)	(% prim*)		(est.consumer surplus./ trip)	(est. annual benefi to anglers)

*MRFSS 1987 data for primary red drum trips.

One limiting aspect of the MRFSS format as it presently exists is that there is no exact way to calculate the number of trips that actually target a given species. A considerable number of trips that report red drum as a secondary target may involve significant catches of red drum. Arguments can be made for using only primary or primary and secondary target. Yet given the nature of red drum and sea trout fishing in most parts of the South Atlantic using primary and secondary target trips together may be justified. The actual number of trips that can reasonably be considered red drum trips and the associated estimated annual total benefit probably lies somewhere between the high and low estimates.

Although not appropriate to estimating net national benefit tradeoffs, expenditures by recreational fishermen targeting red drum are a measure of the importance of red drum to anglers and to local economies. Estimates of expenditures by recreational fishermen targeting red drum on a coastwide basis can be derived through MRFSS information (Table 12). Mean expenditures for 1979 per trip and by mode for fishing in the South Atlantic were estimated to be: $46.70 for party/charter, $16.10 for private rental, $7.70 for beach/bank and $7.60 for man-made. The column for 1987 expenditures is based on 1979 expenditures put in 1987 dollars because more recent expenditure estimates are not available at this time.

In 1979, approximately 4% of trip interviews identified red drum as the primary or secondary target species or in the catch. As was done before, this percentage is applied to the total number of recreational trips in the South Atlantic to estimate total red drum trips in 1979. This number of red drum trips is broken down by percentage in each fishing mode for that year and average expenditure per trip per mode is used to estimate annual expenditure per mode and is summed to provide total red drum expenditure in that year.

The same calculation is made for 1987 recreational fishing expenditure attributable to red drum anglers (see the righthand portion of Table 12). The number of trips per mode is calculated in the same way using the 1987 total number of trips, 1987

percentages by mode and 1987 expenditures per trip (1979 expenditure in 1987 dollars). As with consumer benefit estimates, expenditure estimates would be considerably lower if only the percentage of trips that target red drum primarily is used. Both benefit and expenditure indices point out the great importance of the red drum resource to recreational anglers in the South Atlantic and local economies along this coast.

Table 12. Estimated 1979 & 1987 Expenditures by fishermen targeting, as primary or secondary species, or catching red drum in the South Atlantic Region (Source: MRFSS).

	1979	1987
Total Fishing Trips in The South Atlantic Region	15,947,000	20,924,000
Percent Fishermen Interviewed Identifying Red Drum as Primary or Secondary Target Species or Present in Catch	4.065%	9.968%
Nominal Red Drum Trips	648,207	2,085,711
Red Drum Catch : Shore Mode*	(85%) 550,976 Trips	(81%) 1,695,683 Trips
Red Drum Catch : Private/ Rental Mode	(15%) 97,231 Trips	(19%) 390,028 Trips
Average Expenditures: Shore Mode	$7.65	$11.0**
Average Expenditures: Private/Rental Mode	$16.1	$23.1**
Average Expenditures:(Shore) x Number of Trips in Mode	$4,214,966	$18,649,121
Average Expenditures:(Private/ Rental) x Number of Trips in Mode	$1,565,419	$9,027,588
Estimated Recreational Expenditures =	$5,780,385	$27,676,709

* shore mode includes beach and bank and man made modes.
** based on 1979 estimate put into 1987 dollars.

9.2 International Trade

Red drum have been imported for at least the past 20 years. Since there is no official classification for red drum in the U.S. Customs import/export data system, there are no official statistics on international trade. Subsequently, information pertaining to imports are limited to market news reports (Table 13). The market news information for red drum is limited to imports mainly from Mexico.

Table 13. U.S. Imports of Red Drum (Source: Market News Reports).

Year	Pounds	Year	Pounds
1970	841,300	1980	357,900
1971	599,600	1981	144,500
1972	623,400	1982	284,900
1973	739,900	1983	219,400
1974	479,000	1984	167,400
1975	403,300	1985	251,500
1976	393,000	1986	625,200
1977	560,600	1987	137,000
1978	519,300	1988	132,400
1979	361,700	1989	131,000*

* through September 1989.

10.0 SOCIAL AND CULTURAL FRAMEWORK OF THE FISHERY

10.1 Recreational Fishery

Historic and current recreational catch of red drum from the EEZ is minor in comparison to coastwide totals. Recreational catch of red drum from EEZ waters in 1987, as identified in the MRFSS totaled less than 6,000 fish in the South Atlantic (0.4% of total number of fish caught) and less than 3,000 fish from the Mid-Atlantic region (0.2% of total number of fish caught). The present day recreational red drum or channel bass fishery in the Mid-Atlantic region extends mainly from Assateaugue Island, Maryland southward along Virginia's barrier islands to Cape Charles and into the Chesapeake Bay.

Red drum is one of the most popular species with saltwater recreational anglers in the Atlantic. Juvenile and subadult red drum are caught in the extensive network of creeks, rivers and sounds. Larger adults are sought by surf fisherman along the beaches and inlets of states with barrier islands. Attitudes of recreational fisherman vary from the angler who will retain large quantities of sub-legal red drum to the surf fisherman who pursues trophy red drum, most often releasing what they catch.

Although the current recreational fishery now is limited to the area from Florida to Maryland, an important historical fishery once existed in New Jersey. Red drum, or channel bass was once a favorite fish caught by sport fishermen in New Jersey. Red drum have been not occurred in New Jersey waters since the 1920s. Fish taken by recreational fishermen were caught along southern New Jersey beaches with Barnegat Light, Little Beach, Corson's Inlet and Townsend's Inlet being prime hot spots (Feinberg pers. comm. 1989). These "surfmen" pitched tent camps, which remained for months in the dune fields, accommodating many fishermen in their fishing and socializing. Channel bass were revered by fishermen as apparently the ultimate challenge in the surf. The charter fishing industry and facilities associated with inlets such as Corson's Inlet, advertised specifically for bass fishing and described the area as the "Anglers Paradise and Home of the Fighting Channel Bass." In some advertising, channel bass were placed ahead of striped bass, weakfish and bluefish.

One organization in New Jersey, the Asbury Park Fishing Club, maintained catch records and had an award category for channel bass. Records during 1919 and 1922 identified the first caught and largest channel bass caught by Club members during the year. Channel bass had to exceed 25 lb to receive Club recognition. Fish over 40 lb were taken every year. One of the largest channel bass ever recorded, over 63 pounds gutted, was caught at Corson's Inlet, in July 1924.

10.2 Commercial Fishery

Commercial landings of red drum from the EEZ have been minor in comparison to the fisheries from which they have been identified as a bycatch. Commercial fishermen do not target red drum year round or even throughout a specific season. In North Carolina red drum are caught incidentally throughout estuarine waters and nearshore fisheries by nearly all fisheries. For this reason a characterization would be difficult and encompass a presentation on most fishermen in North Carolina. Gill net fishermen targeting mullet, spotted seatrout, weakfish, flounders, striped bass or anything in recent years have caught most of the commercially reported red drum landed in North Carolina. They rarely target red drum although they are considered a valuable bycatch. Gill netters fishing inshore waters often fish singly or in pairs, and from small outboard motorboats, often flat bottomed, to traverse the shallow water grass flats where much of the fishing is concentrated. Catches are rarely large (1,000 lb per trip) and annual incomes from this pursuit are not very large.

In Georgia, there is no large-scale commercial fishery for red drum. Gill-netting in Georgia's waters is restricted to shad and Alantic sturgeon which rarely take red drum. Commercial landings of red drum have been approximately 2% of recreational landings for the past ten years, with the majority of sales being hook and line caught fish sold directly by opportunistic recreational fishermen. Minimum size limits and daily bag limits have reduced the quantities retained by recreational anglers and the amount available for sale.

With the designation of a no sale provision in Florida and gamefish status for red drum in South Carolina, there presently is no legal commercial fishery for red drum in these states.

11.0 MANAGEMENT PROGRAM

11.1 Definition of Fishery

The red drum fishery includes one species of drum (Sciaenops ocellatus) in the coastal waters and EEZ off the Atlantic coast. Red drum occur or have been captured from Massachusetts to Key West, Florida on the Atlantic coast and from extreme southwest Florida along the Gulf coast to Tuxpan, Mexico.

11.2 Management Unit

The management unit is defined as the population of red drum (Sciaenops ocellatus) occurring along the U.S. Atlantic coast from the east coast of Florida to the New Jersey/New York line. The fishery in the Gulf of Mexico targets the same species but is sufficiently isolated to be managed separately. The selection of this management unit is based on the biological distribution of

the species along the Atlantic coast and historical harvest patterns which have identified fisheries for red drum extending north through New Jersey.

11.3 Optimum Yield

11.3.1 Statement of Optimum Yield

Optimum yield for the Atlantic coast red drum fishery is the amount of harvest that can be taken by U.S. fishermen while maintaining the spawning stock biomass per recruit ratio (SSBR) at or above 30%.

The definition of OY was chosen because it is measurable and is based on maintaining a minimum level of SSBR, through adequate escapement to the spawning stock, needed to maintain spawning stock biomass levels believed sufficient to prevent recruitment overfishing.

Alternatives Considered and Rejected

Alternative 1. Optimum yield for the red drum resource will be obtained by not fishing the resource below the 20% SSBR level and preserving stability of the red drum resource along the Atlantic coast in order to generate the greatest possible economic and social benefits from its harvest and utilization over time by U.S. Fishermen.

Alternative 2. Optimum yield for the red drum resource is to achieve at least a 20% spawning stock biomass per recruit and preserve the stability of the red drum resource along the Atlantic coast in order to generate the greatest possible economic and social benefits from its harvest and utilization over time by U. S. fishermen.

The ASMFC and South Atlantic Council considered and rejected OY alternatives 1 and 2 based on the following: 1) OY was not clearly defined, 2) OY was not expressed as a level of harvest, and 3) the SSBR ratio adopted, needed to be expressed as being maintained at or above a percentage of the level that would result in the absence of fishing.

Alternative 3. Optimum yield for the Atlantic coast red drum fishery is the amount of harvest that can be taken by U.S. fishermen while maintaining the spawning stock biomass per recruit level at or above 20% of the level that would result at a fishing mortality rate of F=0.

This definition of OY was not accepted based on information supplied at the recent NMFS overfishing workshop. This information, based on the Gulf red drum, indicated that the 20% SSBR level would probably be too low to assure a minimum level of SSBR needed to maintain spawning stock biomass levels sufficient to prevent recruitment overfishing. Recruitment in the Gulf red

drum stock continues to decline despite a 28% SSBR in 1987.

Alternative 4. Optimum yield for the Atlantic coast red drum fishery is the amount of harvest that can be taken by U.S. fishermen while maintaining the spawning stock biomass per recruit level at or above 40% of the level that would result at a fishing mortality rate of F=0.

The ASMFC and South Atlantic Council considered and rejected this alternative based on the following: 1) The SAFMC Red Drum Plan Development Team recommended that the Council initially adopt a 30% SSBR ratio and recommend that states adopt a 30% escapement of juvenile red drum to the spawning stock; 2) The adoption of a 40% SSBR ratio without sufficient biological justification, would result in a recommendation that states adopt possibly unwarranted stringent regulations to meet a 40% escapement level; and 3) Modifications to the SSBR ratio needed to prevent overfishing may be made through plan amendment based on the analysis of the effectiveness of the selected SSBR ratio provided by the NMFS in stock assessments as requested by Council.

11.3.2 Definition of Overfishing

Overfishing is defined as a fishing mortality rate that will, if continued, reduce the spawning stock biomass per recruit (SSBR) below 30% of the level that would exist at equilibrium without fishing. The Atlantic coast red drum stock will be considered overfished when the SSBR is below 30% of the level that would have existed in the absence of fishing. The 1989 stock assessment report indicates that the red drum stock is overfished with a present SSBR between 2% and 3%.

Spawning stock biomass per recruit (SSBR) is used as the model for defining overfishing to minimize the probability of recruitment overfishing directly. The SSBR (reproductive potential) can be used to evaluate fishing mortality scenarios without knowing actual levels of recruitment or spawning stock. Maximum SSBR is obtained by when fishing mortality is zero. The ratio of fished to unfished SSBR or spawning potential ratio (SPR) is a measure of reproductive potential of a fish stock. Theoretically, there is a minimum value of that ratio ($SPR_{critical}$) below which the population will decline to extinction (Goodyear 1989b). Where sufficient data exists the critical value may be derived from the stock recruitment relationship or the observed behavior of recruitment at different levels of SPR. Where data is insufficient, critical levels can be drawn from information on the nature of the relationship or from experience with other stocks (Goodyear 1989b). The $SPR_{critical}$ for the Atlantic red drum stock has been set at 30% based on the rapid decrease for compensation required for maintenance between 20% and 40%, the observation that the Gulf red drum stock continued to show declining recruitment with a 28% SPR in 1987

and the observation that fish stocks in the Northeast have collapsed or continued to decline when at the lower end of the 20%-40% SPR range. The best indication of present stock status given the limitations of the data available for the Atlantic coast red drum stock is the equilibrium fished to unfished SSBR or SPR. If appropriate management measures meeting target escapement levels are implemented by states the equilibrium SSBR may be met in one year but, this level must be maintained over time to achieve the realized spawning potential and minimize the probability of recruitment overfishing.

This definition meets the NMFS guidelines, in that it is based on best available information and has sufficient scientific merit; will result in effective ASMFC and Council action to minimize the probability of the stock from closely approaching or reaching an overfished status; provides a basis for objective measurement of the status of the stock against the definition; and is operationally feasible.

Alternatives Considered and Rejected

Alternative 1: Overfishing is defined as a fishing mortality rate that prohibits attaining the spawning stock goal which is currently set at a 20% SSBR ratio of the level at F=0. The Atlantic coast red drum stock is overfished when it is below the level of 20% of the SSBR that would occur in the absence of fishing. When the Atlantic coast red drum stock is overfished, overfishing is defined as harvesting at a rate that is not consistent with a program that has been established to rebuild the stock to the 20% spawning stock biomass per recruit level. When the Atlantic coast red drum stock is not overfished, overfishing is defined as a harvesting rate that if continued would lead to a state of the stock that would not at least allow harvest of OY on a continuing basis.

This definition of overfishing was rejected based on information supplied at the recent NMFS overfishing workshop. This information, based on the Gulf red drum, indicated that the 20% SSBR level would probably be too low to assure a minimum level of SSBR needed to maintain spawning stock biomass levels sufficient to prevent recruitment overfishing. Recruitment in the Gulf red drum stock continues to decline despite a 28% SSBR in 1987.

Alternative 2: Overfishing is defined as a fishing mortality rate that prohibits attaining the spawning stock goal which is currently set at a 40% SSBR ratio of the level at F=0. The Atlantic coast red drum stock is overfished when it is below the level of 40% of the spawning stock biomass per recruit that would occur in the absence of fishing. When the stock is overfished, overfishing is defined as harvesting at a rate that is not consistent with a program that has been established to rebuild the stock to the 40% spawning stock biomass per recruit level. When the stock is not overfished, overfishing is defined as a

harvesting rate that if continued would lead to a state of the stock that would not at least allow harvest of OY on a continuing basis.

The ASMFC and Council considered and rejected this alternative based on the following: 1) The SAFMC Red Drum Plan Development Team recommended that the Council initially adopt a 30% SSBR ratio and recommend that states adopt a 30% escapement of juvenile red drum to the spawning stock; 2) The adoption of a 40% SSBR ratio without sufficient biological justification, would result in a recommendation that states adopt possibly unwarranted stringent regulations to meet a 40% escapement level; and 3) Modifications to the SSBR ratio needed to prevent overfishing may be made through plan amendment based on the analysis of the effectiveness of the selected SSBR ratio provided by the NMFS in stock assessments as requested by the Council.

11.3.3 Adjustments to Definitions of Optimum Yield and Overfishing

NMFS, in preparation of the initial stock assessment and subsequent stock assessments as requested by the Council, will provide the ASMFC and Council with an assessment of the effectiveness of the SSBR level selected. The ASMFC and Council will subsequently modify the definitions of optimum yield and overfishing if needed through plan amendments to each of their plans.

Alternatives Considered and Rejected

Alternative 1. NMFS, in the preparation of the annual stock assessment, will provide the Council with an assessment of the effectiveness of the SSBR level selected as the SSBR ratio. The Council will subsequently modify the definitions of optimum yield and overfishing, if needed, through a Modified Notice Action procedure to be developed.

The Council considered and rejected this option because the stock assessment may not be requested annually and the use of a notice action procedure to modify definitions of OY and overfishing would not speed the process since changes in allowable catch for the EEZ would have to be accomplished through plan amendment.

11.4 Problems in the Fishery

Problems in the Fishery are:

1) Intense fishing mortality on juvenile red drum, predominantly in state waters, has resulted in significantly decreased recruitment to the spawning stock. The 1989 stock assessment report indicates that the red drum stock is overfished with a present SSBR ratio between 2% and 3%. In

addition, the potential exists for development of a directed EEZ fishery which could result in rapid reduction of the spawning stock. High juvenile mortality, alone, or in combination with the development of a directed EEZ fishery, could eventually contribute to recruitment failure.

The potential exists for uncontrolled harvest of spawning size red drum in the EEZ with landing of fish in states with no red drum regulations or with regulations that permit this (egs. New Jersey and Delaware).

2) Lack of Federal regulations, in addition to inconsistency and incompatibility among state regulations, makes enforcement difficult and may result in inadequate protection of the red drum resource.

3) There is a need for additional biological, economic and sociological data to effectively monitor and assess the status of the resource and management efforts.

11.5 Management Objectives

Objectives to address the identified problems are:

1) Maintain a spawning stock biomass sufficient to prevent recruitment failure. This will be accomplished by working with the States to provide 30% escapement of juvenile red drum to the spawning stock and controlling fishing mortality to achieve at least a 30% SSBR level.

2) Juvenile red drum are estuarine dependent, occurring in nearshore and inside waters and are harvested by both recreational and commercial fisheries. Red drum have been aged to 55 years along the Atlantic coast, yet the majority of existing recreational and commercial fisheries target juveniles and mature fish less than four years old. Tag recapture studies conducted for Atlantic coast states substantiate the theory that juvenile red drum generally stay within the same estuarine system for their first years of life and are susceptible to intense fishing pressure and high fishing mortality.

Red drum are a long-lived species and extremely sensitive to fishing pressure. In addition to the present high inshore mortality, the potential removal of spawning stock through uncontrolled harvest in the EEZ could more rapidly reduce the spawning stock to a level too low to ensure adequate production of young fish to sustain the population (i.e., recruitment overfishing).

2) Provide a flexible management system to address incompatibility and inconsistency among state and federal regulations which minimizes regulatory delay while retaining substantial ASMFC, Council and public input into management decisions; and which can adapt to changes in resource abundance, new scientific information and changes in fishing patterns among user groups or by area.

In order to build on state efforts to manage red drum in territorial waters, the ASMFC and South Atlantic Council are coordinating efforts to manage the Atlantic coast red drum stock as a unit setting an initial SSBR ratio level below which the stock must not fall. In order to accomplish this, the Council will regulate fishing mortality in the EEZ and the ASMFC will ask the States to adopt a level of escapement that will ultimately achieve at least the 30% SSBR ratio.

The ASMFC and South Atlantic Council received a coastwide stock assessment prepared by NMFS which serves as the basis upon which the EEZ is closed and recommendations have been made to the States. The ASMFC and South Atlantic Council, through implementation of initial management measures and procedures in cooperation with the States, will be able to protect the resource throughout its range on the Atlantic coast by having the ability to adapt management measures through plan amendment to reflect changes in abundance, new scientific information or fishing patterns.

An ASMFC red drum plan review team evaluated the 1984 ASMFC interstate plan in the context of the SAFMC plan. The results of that review led to the development of this Amendment 1 to the ASMFC plan.

3) Promote cooperative collection of biological, economic and sociological data required to effectively monitor and assess the status of the red drum resource and evaluate management efforts.

The SAFMC Red Drum PDT, through the cooperative efforts of State, Federal and Council staff members who comprise the PDT, have compiled the best available information on Atlantic coast red drum into the Source Document for the Council FMP. PDT meetings have afforded individuals coordinating state and federal red drum research projects the opportunity to discuss and compare methodology and results of their research efforts. Updates to the source document will occur and be distributed as additional information becomes available and is incorporated. In developing the Source Document and requesting completion of a coastwide red drum stock assessment, the Council has compiled information concerning on-going research efforts and is promoting additional research needed for stock assessment and socioeconomic impact analyses. Additional economic information is needed to more accurately assess the value of the coastwide fishery and impacts

associated with implemented and proposed management measures. The ASMFC has endorsed this work and concurs with the Council research recommendations that are listed later in this FMP.

11.6 Management Measures Implemented by the SAFMC

11.6.1 Management Measure 1: Fishing Year

A fishing year of January 1-December 31 is established to complement ongoing state and federal efforts in the collection of commercial and recreational fishery statistics. Because there was not a dramatic variation in fishing seasons for red drum among Atlantic coast states, no specific alternatives to the selected fishing year were proposed.

11.6.2 Management Measure 2: A Procedure for Preparation and Review of Stock Assessments to Support Specification of Total Allowable Catch (TAC) and Allocations in the EEZ by Plan Amendment

1) Prior to October 1,NMFS in preparation of stock assessments as requested by the Council will: A) Update the stock assessment for Atlantic coast red drum; B) Reassess the MSY; C) Specify the best estimate of the standing stock and its age composition; D) Reexamine the spawning stock requirements and specify escapement levels needed to achieve these requirements; E) Specify the geographical variations in stock abundance, mortality, juvenile escapement and recruitment; F) Summarize current and historical information on the migratory movements of the stock; and G) Analyze available social and economic data for the fishery.

2) The Council will appoint a scientific stock assessment review group that will review the NMFS report(s), current harvest statistics, economic, social and other relevant data. This group will prepare a written assessment report to the Council specifying a range of Acceptable Biological Catch (ABC) for the EEZ. The report will set forth a risk analysis showing the probabilities of adversely impacting the spawning stock biomass (SSB) through fishing at each level of ABC and the economic and social impacts of those levels. Such a report shall include consideration of the fishing mortality rate(s), abundance relative to the spawning stock goal, trends in recruitment and whether overfishing is occurring for the stock as a whole or upon a portion of the stock for any geographical area. Specification of ABC shall separately identify the quantity of the population in excess of the spawning stock goal and in excess of the annual surplus production that may be harvested from the EEZ. Such report will, when requested by the Council, include information on bag limits, size limits, specific gear harvest limits and other restrictions required

to attain the escapement goal or prevent a user group from exceeding its allocation or quota under a TAC specified by the Council for the EEZ, along with the economic and social impacts of such restrictions.

The FMP will establish the basis for management of the red drum stock. Changes in stock abundance or the fishery should not occur too rapidly for additional modifications to the management regime to be accomplished through plan amendment.

Alternative Considered and Rejected

Alternative 1. Procedure for Specifying Total Allowable Catch in the EEZ and for Allocations by Notice Action.

The Council considered and rejected this option since adoption of the FMP will establish the basis for management of the red drum stock. Changes in stock abundance or the fishery should not occur too rapidly for additional modifications to the management regime to be accomplished through plan amendment.

11.6.3 Management Measure 3: The Harvest or Possession of Atlantic Red Drum in or from the EEZ is Prohibited

The EEZ will be closed to all harvest or possession of red drum in or from the EEZ until a TAC is specified by plan amendment that provides for harvest. This may occur only if the scientific stock assessment review group determines that the SSBR level is above 30%.

If harvest is allowed, commercial catch will be monitored by quota and recreational harvest will be regulated by bag limit with no reversion to zero. The Council, recognizing that many States have adopted stringent regulations on adult harvest in territorial waters, desires to prevent the development of a directed fishery on spawning stock in the EEZ and maximize the protection of spawning red drum offshore.

No directed fishery for red drum in the EEZ presently exists. The Atlantic coast stock is being exploited in state waters at the highest historic level recorded with over 3.8 million lb caught in state waters in 1988. Presently, there is very low escapement to the adult stock, and it is believed that recruitment is being maintained by the accumulated biomass of older adults which themselves recruited to the spawning stock when the inshore fishing mortality was much lower. Until fishing mortality on juveniles is reduced so that escapement to the adult stock is adequate, any fishing mortality on adults threatens future recruitment. Therefore, this measure is adopted to prevent a directed fishery on mature red drum. This measure does not preclude catch and release fishing for red drum in the EEZ.

The 1989 NMFS stock assessment report indicated the best estimate of SSBR was 2%-3% in relation to an unfished population. The Atlantic coast red drum stock is presently being overfished since the (1986-1988) coast-wide SSBR ratio is substantially below the 30% ratio as specified in Section 11.3.2.

Although present economic conditions on the Atlantic coast make the development of a directed EEZ fishery appear unlikely (see Section 12), a conservative approach is warranted. Conditions that might make uncontrolled harvest of EEZ red drum attractive could possibly unfold faster than management can respond. Clearly it is easier, and possibly more cost effective, to preempt the development of a directed EEZ fishery before it exists than to attempt to eliminate an existing fishery because this would involve economic impacts on boats that have geared up to fish.

Even with a low probability of a directed fishery for EEZ red drum arising, what is at stake is a recreational fishery in state waters that produces annual benefits estimated at between $26 and $84 million in the Atlantic (see Section 9.0). Taking a conservative approach may also help to protect the small but valuable inshore commercial red drum fishery in state waters. Because consumer preferences tend to favor smaller red drum, that sustainable inshore commercial fishery may be worth more to commercial fishermen and consumers than a potentially short-lived uncontrolled commercial fishery for large red drum in EEZ waters. For these reasons, the costs associated with being cautious are probably small when compared to the benefits realized from protecting the red drum resource from uncontrolled exploitation while measures to improve escapement from inshore waters to the adult stock are being implemented.

Alternatives Considered and Rejected by SAFMC

Commercial Harvest:

Alternative 1. No action.

If no action is taken by the SAFMC and MAFMC, the Atlantic coast red drum stock would not be protected from development of an offshore fishery, which in combination with high inshore mortality, could lead to recruitment failure. This is what occurred in the Gulf of Mexico. For these reasons the Council rejected this alternative.

The GMFMC, in cooperation with the GSMFC completed a profile for the Gulf red drum fishery in 1983. Despite the profile identifying a significant problem with recruitment from estuaries in Texas and Florida, the Council determined there was no need to prepare an FMP until such time as the industries marketing effort was successful and additional exploitation of the resource occurred. In 1986 the GMFMCs' SSC concluded that the high rate of

inshore fishing under equilibrium yield conditions had or would reduce the spawning stock biomass below 20% of the virgin spawning stock biomass, thus exceeding the 20%-40% of virgin SSB guideline where recruitment overfishing would be expected to occur. Additional information supplied to the Council indicated that the high inshore mortality and recruitment overfishing were Gulf-wide. EEZ harvest of red drum escalated between 1985 and 1986 due perhaps to changes in harvesting technology and market demand. Concerned that this unregulated fishery in the EEZ could lead to recruitment overfishing of the Gulf red drum stock, Congressman John Breaux (at that time, Chairman of the Subcommittee on Fisheries and Wildlife Conservation and Environment now Senator Breaux) requested the GMFMC recommend regulatory action. While the Gulf Council deliberated on whether to develop an FMP, Mr. Breaux introduced H.R. 4690 which required an emergency Secretarial Rule until such time as the Council prepared a FMP. NMFS subsequently implemented an emergency rule regulating the fishery and developed the Secretarial FMP.

Alternative 2. Adopt a minimum size limit of 14 in TL with comparable mesh size regulations in directed fisheries, a possession limit of two fish greater than 32 in TL and prohibition of purse seines in the fishery. These measures, if adopted in the EEZ, would track the suggested management measures contained in the Atlantic States Marine Fisheries Commission 1984 Red Drum Fishery Management Plan.

Alternative 3. The EEZ shall be closed to directed commercial harvest (trips catching more than 5% red drum by weight) of red drum until the spawning stock level (20% SSBR) is attained and until such time as a TAC is specified that provides for harvest. An incidental bycatch quota for non-directed commercial fisheries is established at (Council to specify) pounds; the catch must be landed in conformance with state laws.

Alternative 4. Establishment of an annual commercial red drum quota in the EEZ of (Council to specify) pounds. All catches must be landed in conformance with state laws.

Alternative 5. The EEZ shall be closed to all harvest of red drum until the spawning stock level (20% SSBR) is attained and until such time as a TAC is specified by plan amendment that provides for harvest. Retention or possession of red drum from the EEZ is prohibited.

Recreational Harvest:

Alternative 1. No action.

Alternative 2. Adopt a minimum size limit of 14 in TL and a possession limit of two fish greater than 32 in TL. Catch must be landed in conformance with existing state laws.

The Council considered and rejected commercial harvest alternatives 1-5 and recreational harvest alternatives 1-2 based on the stock assessment report indication that the present SSBR ratio was between 2% and 3% and that the spawning stock levels may have been reduced to critical levels as occurred in the Gulf of Mexico. The Councils' proposed management measures are intended to preclude the development of a directed fishery on spawning size red drum in the EEZ and preserving remaining spawning stock biomass while encouraging States to adopt regulations which assure levels of escapement necessary to protect the long term spawning potential of the stock. The Council, concluded, based on information presented at a NMFS overfishing workshop which showed that the Gulf red drum stock continued to show a decline in recruitment at a 28% SSBR level, that a level higher than 20% SSBR would be appropriate.

11.6.4 Other Management Measures Considered and Rejected

Alternative 1. Prohibit the transfer or attempt to transfer red drum at sea.

Section 620.7 General Provisions for Domestic Fisheries subsection (b) prohibits the "transfer or attempt to transfer, directly or indirectly any U.S. harvested fish to any foreign fishing vessel, while such vessel is in the EEZ ..." except when the vessel is permitted under section 204 of the MFCMA. This measure would prevent the possibility of harvest of red drum in the EEZ by a fishing vessel and transfer of catch to a transport vessel bound for northern ports. The Council considered and rejected this option at this time based on the fact that harvest in the EEZ will be prohibited until at least the 30% SSBR is attained. This option may be readdressed in a future amendment if necessary.

Alternative 2. Require the landing of red drum with head and tail intact.

This measure would aid state and Federal agents in enforcing regulations. In addition, statistics collected for the MRFSS and from commercial fisheries may increase accuracy. The Council considered and rejected this option since harvest in the EEZ will be prohibited until at least the 30% SSBR is attained. This option may be readdressed in a future amendment if necessary.

11.7 ASMFC Recommendations to States

The ASMFC recommends that its member states from Florida through New Jersey take any actions necessary to support the management measures prepared by the South Atlantic and Mid-Atlantic Fishery Management Councils for the EEZ fisheries (see sections 11.6.1, 11.6.2, and 11.6.3). In addition, the ASMFC recommends that states undertake a management program for Territorial Sea fisheries that will complement the existing program for the EEZ. (The Councils also outlined some management alternatives for states in their FMP which are included in Appendix 1 of this document).

11.7.1 ASMFC Management Program

The ASMFC management program includes a management goal and objectives that are identical to that specified by the Councils (see sections 11.3 and 11.5). The original 1984 ASMFC fishery management plan for red drum recommended a minimum size limit of 14" TL, with a comparable mesh size regulation in directed fisheries (defined as containing at least 60% red drum by weight), a daily possession limit of two fish exceeding 32" in TL and a prohibition of purse seining for red drum. These management measures do not meet the new management goal and objectives for the fishery and do not reflect new state and Council management actions in the fishery. Thus, a new management strategy and measures have been adopted by the ASMFC in this plan Amendment 1.

11.7.1.1 ASMFC Management Strategy

The ASMFC recommends that the states adopt a level of escapement needed to achieve a spawning stock biomass per recruit (SSBR) level of 30%. Spawning stock biomass per recruit is a measure of reproductive potential and the target level is 30% of the level that would exist without any fishing. Escapement is a means of achieving the target SSBR and refers to the survival of subadult red drum from age 0.5 to 6 years of age. Fishing mortality on sub-adults (ages 0.5 to age 6) in the inshore state waters of the Territorial Sea has been shown to have a direct effect on levels of escapement.

The recommended management strategy is to implement specific management measures in a series of steps in order to reduce overall fishing mortality, increase subadult escapement, and reach the target SSBR level. Management measures that will attain an SSBR level above 10% should be implemented as a first step. The ASMFC Advisory Committee will appoint a plan review team which will evaluate the annual report of the SAFMC Red Drum Stock Assessment Review Group (See Appendix 2 for 1991 Stock Assessment Review Group Report). Beginning in 1992, the Advisory Committee will make recommendations to the ASMFC about the measures included in the first step of management, and if necessary, further adjustments in management measures will be recommended to the states by the ASMFC.

11.7.1.2 - ASMFC Management Measures

There are numerous combinations of size limits and daily possession limits to attain levels of SSBR that are above 10% (Tables 14 and 15).

Table 14. Level of % SSBR resulting from combined management options that include a 1 fish limit for fish over a 27" maximum size.

27" Maximum Size Limit (1 fish possession)

Minimum Size Limits (in)	Daily Possession Limits (includes 1 ≥ 27")				
	2	3	4	5	6
12	12%	9	8	7	6
14	13	10	9	8	7
16	15	12	10	9	8
18	17	14	13	12	10
20	20	17	15	13	12

Table 15 Level of % SSBR resulting from combined management options that prohibit possession of fish over a 27" maximum size.

27" Maximum (no possession)

Minimum Size Limits (in)	Daily Possession Limits				
	2	3	4	5	6
12	22%	19	17	15	17
14	24	21	18	17	19
16	26	23	21	19	21
18	29	26	24	22	24
20	33	29	27	26	28

Given the variations in state red drum fisheries along the Atlantic coast, the ASMFC recommends either of two scenarios for the first step of management:

	Minimum Size	Maximum Size	Possession Limit
1.	18 inches TL	27 inches TL	5 fish, including one fish exceeding 27 inches TL
2.	14 inches TL	27 inches TL	5 fish, with no fish exceeding 27 inches TL

(TL = Total Length)

On a coastwide basis, it is estimated that management scenario 1 (see above) corresponds to an SSBR level equal to 12%, and management scenario 2 corresponds to an SSBR level equal to 17%. While both management scenarios reduce mortality of subadults, the second option results in a higher estimated SSBR level because it also prohibits harvest of all fish greater than 27 inches. Appendix 1 includes additional tables of management alternatives including those combinations that would lead to the ultimate management goal of attaining a 30% SSBR level.

11.7.2 Research Recommendations

The ASMFC endorses the following research recommendations that were previously developed by the South and Mid-Atlantic Councils, especially those essential to stock assessment data and reliable results, and encourages state and federal agencies to commit the necessary resources to obtain such data.

11.7.2.1 Immediate Research Needs for Stock Assessment

The following list is from the stock assessment for Atlantic coast red drum (NMFS 1989):

1) Direct the improvement in catch, effort and length frequency statistics from the recreational and commercial fisheries.

2) Direct additional effort in intercepting recreational fishermen through the MRFSS who fish nighttime hours.

3) Increased tagging efforts on age 3-5 year old red drum, with directed effort to recapture subadult and adult red drum to determine if disappearance is due in part to offshore emigration.

4) Standardize sampling of the Atlantic coast subadult red drum population to develop a long-term index of recruitment.

5) Develop a more reliable maturity schedule for population level analyses.

6) Determine relationships between annual egg production and female length or weight for Atlantic coast red drum.

7) Develop a more reliable estimate of natural mortality through directed sampling of the adult population.

11.7.2.2 Other Research Needs

Items 1-10 in the following list are contained in the Source Document for the Atlantic coast red drum fishery management plan (SAFMC 1990). Item 11 was added by the SAFMC during an initial review of this document. The SAFMC has adopted a procedure to be included in the FMP for Atlantic coast red drum which requests NMFS to prepare an initial stock assessment and subsequent stock assessments as required by the Council. The following list of needs is presented to direct additional research and to build on recent and ongoing state research efforts pertaining to red drum:

1) Determine escapement levels of juvenile red drum to the spawning stock by state.

2) Determine natural and fishing mortality rates.

3) Determine stock structure.

4) Determine survival rate of released red drum.

5) Develop a fishery independent index of relative abundance.

6) Determine inshore/offshore, as well as coastwide, migration patterns through enhanced mark-recapture studies, aerial surveys and sonic tagging efforts.

7) Determine spawning areas.

8) Determine the economic value of the Atlantic coast recreational red drum fishery.

9) Assess and modify, as needed, MRFSS procedures to more accurately survey red drum recreational catch and effort.

10) Document and characterize schooling behavior for Atlantic coast red drum.

11) Encourage current efforts to continue collection of socioeconomic data in the MRFSS and to collect socioeconomic data in the commercial fishery, where available.

11.7.2.3 Habitat Research

The following habitat research needs are provided in the Source Document for the Atlantic coast Red Drum (SAFMC 1990) so that state, federal, and private research efforts can focus on those areas that will allow the SAFMC to develop measures that best manage red drum habitat:

1) Identify optimum red drum habitat and environmental conditions.

2) Quantify relationships between red drum production and habitat.

3) Identify the effects of water quality degradation on red drum production.

4) Identify areas of particular concern for red drum.

5) Determine habitat conditions that limit red drum production.

6) Determine methods for restoring red drum habitat and/or improving existing environmental conditions that adversely affect red drum production.

7) Encourage research in developing bio- or photo-degradable plastic products to reduce impact as refuse on the inshore, nearshore, offshore marine environments utilized by red drum at various stages of development.

8) Quantify impacts of acid rain on estuarine systems vital to red drum production.

9) Determine research that could be incorporated into a biological and socioeconomic impact assessment quantifying the effects of oil, gas and mineral exploration, development or transportation on red drum, their essential offshore, nearshore and estuarine habitat and the Atlantic coast red drum fishery.

10) Determine the impacts of dredging nearshore and offshore sand bars for beach renourishment on red drum spawning activity. In addition, the impacts of any type of dredging activity on all life history stages of red drum.

12.0 REGULATORY IMPACT REVIEW

This is an analysis of regulatory impacts resulting from measures in the Fishery Management Plan (FMP) for red drum enacted by the South and Mid-Atlantic Councils for EEZ fisheries. The analysis also includes a discussion of impacts on fisheries if all states immediately adopted measures that attained the ultimate management goal of an SSBR level of 30% as discussed in the Council plan (see Appendix 1). Although a Regulatory Impact Review is not required for adoption of an ASMFC plan, it is included in this document to provide additional information on possible future impacts in the fishery.

12.1 Impacts of the Proposed Total Allowable Catch (TAC) for the Fishery in the U.S. Exclusive Economic Zone (EEZ)

Analysis of impacts expected from the Councils' red drum plan has been revised according to recommendations from informal review by the National Marine Fisheries Service and comments from the public after completion of the public hearing period. Only management measures which are thought to have potential impact on user groups are discussed in this analysis.

12.1.1 Biological Impacts

The proposed management measures contained in this FMP have no adverse impacts on the physical environment and have been developed to prevent recruitment overfishing and promote conservation. Actions taken to prohibit harvest in the EEZ are based on best available scientific information included in the 1989 stock assessment report for Atlantic coast red drum which shows that the SSBR ratio is between 2% and 3% of the level that would occur in the absence of fishing. The FMP provides for regulation of a previously unregulated EEZ in order to preserve the spawning potential and reduce the potential for recruitment overfishing. The proposed actions will have no anticipated impact on threatened or endangered species or marine mammals.

12.1.2 Economic Impacts on Groups Harvesting Red Drum in the EEZ

In the process of developing a FMP for red drum in the Gulf of Mexico, many assertions were made as to the disparity in relative economic value between recreational and commercial interests in the Gulf. Much of what was said by people on both sides of the allocation issue was based on inappropriate measures of economic value. Assertions based on the relative magnitude of expenditures made by user groups rather than value (consumer and producer surpluses) are not appropriate in the Federal context where changes in net national benefit should be considered.

Recreational fisheries for red drum in both the Gulf and

South Atlantic have a very large associated economic value. As of yet, however, a comprehensive study has not been conducted to quantify the relative value tradeoffs associated with different allocations among user groups in the South Atlantic. The degree to which recreational value may exceed overall benefit from the commercial fishery is not of direct importance for this RIR because the critical issue for this fishery management plan is not allocation of common property resources between user groups. At issue is the potential impact of closing the EEZ to recreational and commercial harvest (i.e. preemption of the development of recreational and commercial fisheries in the EEZ) in order to reduce the threat of a rapid reduction in spawning stock. The discussion that follows looks at impacts on recreational and commercial user groups from the proposed actions. Impacts on each group are considered separately for illustrative clarity.

12.1.2.1 Impacts on Recreational Fishery

The most recent data available from the Marine Recreational Fishery Statistical Survey (MRFSS) place the recreational catch of red drum from EEZ waters in 1987 at approximately 6,000 fish in the South Atlantic (0.4% of total number of fish caught) and less than 3,000 fish from the Mid-Atlantic region (0.2% of total number of fish caught) These estimates are expansions from small numbers of intercept interviews wherein red drum catches were attributed to the EEZ. Standard errors related to the MRFSS expansion technique used for these estimates are not available, so the accuracy of these estimates cannot be evaluated statistically. All available evidence suggests, however, that recreational catch from the EEZ is rather insignificant at the present time.

Current recreational catches of red drum in the EEZ occur as incidental catches during trips that target other species (fishing around artificial reefs or other structures in Georgia or North Carolina). The incidental nature of these captures means that everything else held constant, a change in the number of red drum that can be retained will most likely not affect anglers' perceptions of trip satisfaction greatly. Therefore, relevant indices of consumer benefit such as number of trips taken or willingness to pay (or be compensated) would probably not change as a result of closing the EEZ.

Decreasing the number of red drum available for recreational use is, however, not without impacts. An empirical study of economic value of red drum to recreational users in the Gulf of Mexico points out that the loss of benefit from reducing the total amount of red drum available to recreational fishermen is greater than the additional benefit from a proportional increase in the amount of red drum available to recreational fishermen (Green 1989). Impacts are thought to be insignificant simply due to the fact that existing recreational catch is so small. For this reason, although we lack quantitative evidence it can be

assumed that the proposed regulation will have minimal impact on the recreational fishery.

The only significant impact the proposed EEZ closure may have on anglers can be viewed in an opportunity cost framework. The proposed closure impedes development of a potentially attractive recreational fishing opportunity, at least as long as the EEZ is closed. Although recreational fishermen do not presently target red drum in the EEZ, it is possible that advances in fish-finding technology, as well as, improved knowledge of red drum behavior offshore could make targeting red drum in the EEZ feasible for recreational anglers. This could have, in effect, expanded the fishery for large red drum beyond the few weeks/months when those fish can be found off beaches and groins along the coast. The sport aspect of the fishery for large red drum are well known and probably have a large consumer benefit associated with them to anglers familiar with that mode of fishing. Hence any expansion of that fishery (even hypothetical), in terms of extending its time period, involves potential positive impacts on recreational value. A key question that remains unanswered here is whether retaining red drum in the EEZ is a necessary condition for trip satisfaction because the proposed management measures do not preempt catch and release fishing. While that question could probably be addressed by examining how recreational value and other indices of trip satisfaction were affected in state waters when one or two fish bag limits were imposed on catches of large red drum (over 32 in TL except in Florida where no red drum can be retained over 27 in TL), to date this information is not available.

While the development of an EEZ recreational fishery for red drum seems improbable at this point, it must be remembered that the recreational swordfish fishery in the South Atlantic developed rather suddenly as knowledge of fish behavior improved and technological breakthroughs in fishing methods occurred. The same can be said of the growing recreational tarpon fishery off the Carolinas which seemed unlikely only a short time ago. In any case, the proposed closure stems the potential development of an EEZ recreational red drum fishery at least temporarily, and as such, it does impact recreational fishing opportunities.

12.1.2.2 Impacts on Commercial Fishery

There is no directed commercial harvest of red drum in the EEZ of the Atlantic at this time. Total pounds and ex-vessel revenue (adjusted to 1982 dollars) for red drum attributed to commercial bycatch harvest in the Atlantic EEZ 1979-1988 are limited (see Table 11). These small quantities and revenues were generated from fishing effort directed at other species in the winter trawl fishery off North Carolina.

The probability of a directed EEZ fishery developing in the

absence of regulatory action has been debated in numerous circles. Observers have pointed to increases in ex-vessel price for red drum over time as evidence that conditions may be right for development of an offshore fishery in the Atlantic. Figure 27 plots ex-vessel price for red drum caught in state waters of the Atlantic since 1966. This is an increase in nominal red drum price, however, and is not a reliable barometer of real price changes.

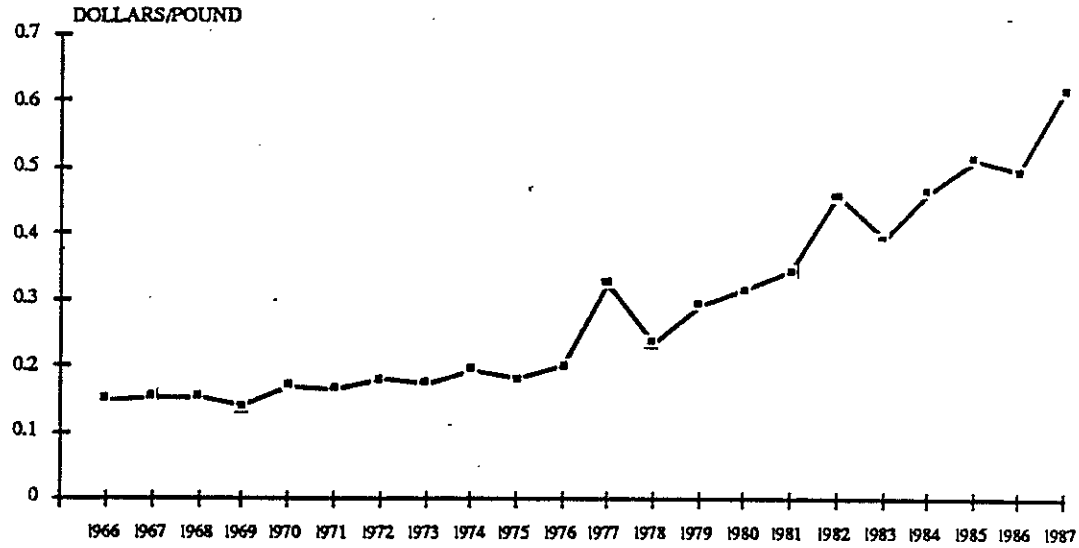


Figure 27. Nominal ex-vessel red drum price Atlantic commercial landings (Source: NMFS

To test whether price has increased at a rate that is greater than the rate of inflation, price changes are examined in constant dollars (Figure 28). The appropriate producer price index for unprocessed finfish is used in Figure 28 to look at price changes throughout the period indexed in 1982 dollars. Examining the movement of adjusted price, a slightly downward trend is evident. This indicates that price paid for red drum at the ex-vessel level has probably not become more attractive to commercial fishermen over time.

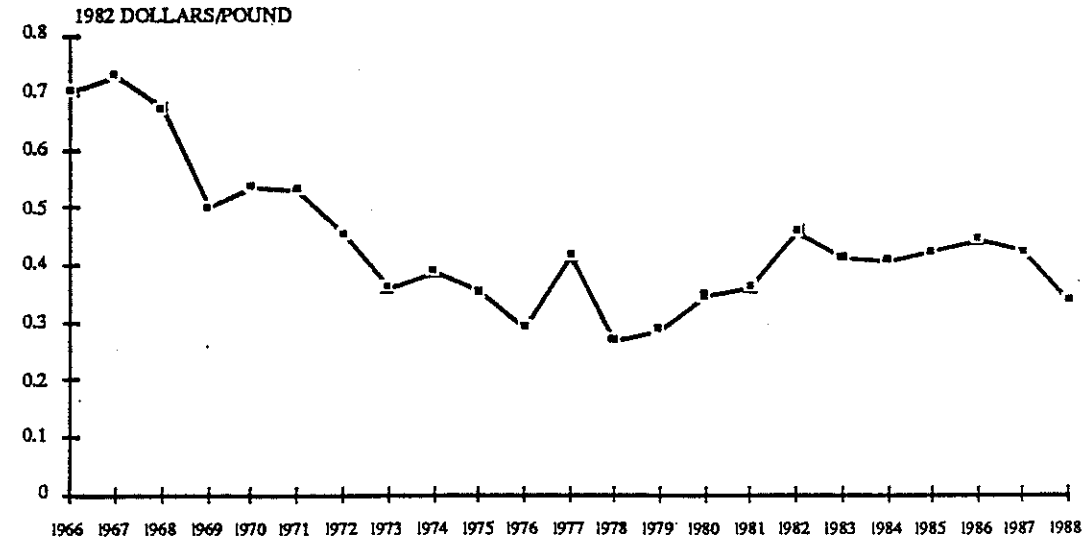


Figure 28. Atlantic red drum ex-vessel price adjusted for inflation (1982 dollars) (Source: NMFS SEFC).

The incentive to target red drum could evolve from factors other than price movements, however. For instance, changes in fishing technology independent of changes in ex-vessel price could make targeting red drum profitable for commercial fishermen. If the cost of catching red drum were to decrease considerably due to the introduction of a new gear, the ability to locate concentrations of fish, or improvements in the equipment to handle fish on board, then commercial fishermen might start directing effort at a previously unprofitable species. This is thought to be a key factor in explaining the development of an offshore commercial red drum fishery in the Gulf of Mexico. The scenario associated with the development of a commercial fishery is often thought to begin with an increase in consumer demand for a given species. Increased demand is expected to create a temporary shortage of the desired species which eventually filters down to fishermen as an incentive to increase production via more attractive ex-vessel price. If quantity supplied can be increased rapidly, however, then price increases may be short-lived. This is why a failure to observe an increase in annual average price does not necessarily indicate that demand for red drum has not increased.

If demand for red drum did increase on the Atlantic coast (because of changes in consumer tastes, disposable income, etc.) and price in the Atlantic did not increase, then one would expect to find that quantity supplied increased and this has tended to push market price down more than proportionally. Figure 29 traces total red drum commercial landings in the Atlantic since 1966. Note that landings have been well above average in most of the last ten years. This means that we cannot dismiss the possibility that demand for red drum has increased over time.

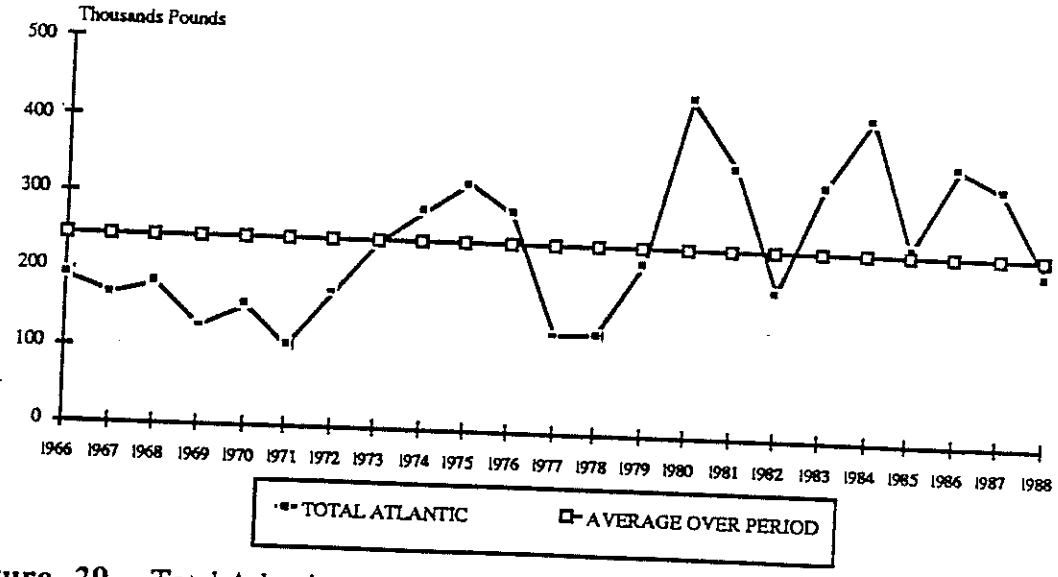


Figure 29. Total Atlantic states red drum commercial landings (Source: NMFS SEFC).

One way to look at demand for red drum without undertaking a detailed quantitative study is to look at how red drum prices have moved over time in relation to an index of fish prices in general. Price for red drum harvested in the Atlantic EEZ (adjusted for inflation) is plotted beside a composite average price for all marine fish for human consumption in the U.S. (also adjusted for inflation) in Figure 30. Notice that red drum price appears to move with the composite price. Prices for some other finfish species that were examined in this way increased at a much faster rate than the composite price. This seems to suggest that red drum prices kept pace with what has been described as the effect of a general demand increase for fish in the mid 1980s (Edwards 1989b) but showed no particular specialized or above-average price increase. To make a definitive statement on changes in demand for red drum, one would have to estimate a system of supply and demand equations. One would also have to study how local (Atlantic coast) supply and demand conditions are affected by overall U.S. demand and supply of red drum.

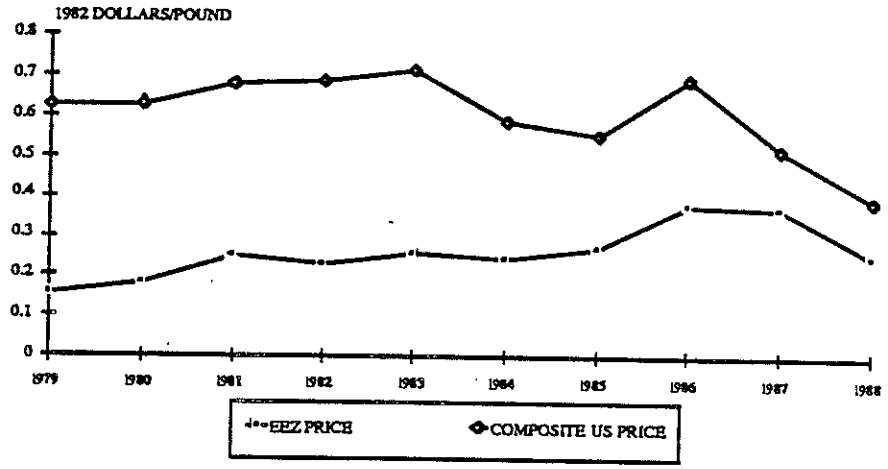


Figure 30. Price of EEZ red drum compared to composite fish prices in the U.S. (Source: NMFS SEFC and Fisheries of the U.S. 1988).

The decision of which species to target depends on demand conditions, production costs and constraints and alternative production opportunities. Figured into that decision for commercial fishermen are restrictions that Atlantic states have placed on landing red drum within their jurisdictions. These range from total bans on the sale of wild drum in some states to size and bycatch ratio regulations and commercial quotas in other states.

Because of measures that states have already undertaken in the Atlantic, the only legal way to target red drum commercially in the absence of a federal closure would be to catch them in the EEZ and land them in northern states which do not have low possession/bycatch provisions or total prohibitions on their sale. The shipping and handling costs involved with that are probably prohibitive because red drum are a relatively low priced fish. Hence the combined effect of existing state restrictions and shipping costs probably already tips the balance so far that targeting red drum might never be feasible even without regulation specifically for EEZ waters. On the other hand, demand or production costs/constraints could change over time. It is also possible that alternative production possibilities (i.e. abundance of other fish species) could become even less lucrative than they are presently, thus making red drum appear more attractive. It is, therefore, conceivable that commercial fishing could target red drum in the EEZ, but the possibility appears remote.

Since both historically and potentially, EEZ stocks of red drum in the Atlantic are not of direct importance to commercial fishing interests, setting TAC for the EEZ at zero should have little direct impact on commercial harvesters. The only impact that most commercial fishermen will likely feel is the small loss of revenue on trips where red drum are captured as a bycatch in the EEZ and must now be discarded. For fishing gears that have the potential to incidentally catch large numbers of red drum, the proposed closure appears to have more impact. Yet existing state regulations on landing red drum have already imposed virtually the same consequences.

A ramification of the EEZ red drum closure that merits attention, however, is that under the proposed plan all of the consumptive use of the red drum resource must now be extracted from state waters, that is until the SSBR target is met. This does not appear to be significantly different from the status quo but may have equity implications because of the way allocation between user groups is presently undertaken. One of the considerations for allocating common property resources between user groups at the Federal level is allocating units of the resource to their highest valued use. A brief discussion of how criteria for determining highest valued use are different at the state and Federal levels is outlined below.

Cost/benefit tradeoffs at the Federal level are supposed to be based on changes in economic value (i.e., producer and consumer surplus). At the state level, indices of economic impact (i.e. expenditures) are usually considered acceptable measures of cost/benefit tradeoffs because loss of expenditures represent real losses from the state perspective. From the Federal perspective, loss of expenditures in one state or region (such as taking a vacation in California rather than Massachusetts) will most likely show up as a gain in another state or region so expenditures are not supposed to be used in examining

cost/benefit tradeoffs.

As long as the EEZ is closed to red drum harvest, the only red drum available for allocation between user groups will be in state waters where expenditures can be used as an indicator of highest valued use. Expenditures on the commercial fishing side are constrained by the need to make profits over time. Yet even when the size and year class structure of the adult population of red drum in the EEZ is improved to the degree that harvest in the EEZ can be reconsidered, it is improbable that a large part of that resource would be allocated to commercial users even if economic value rather than expenditure criteria are used to make that allocation. The following information on price by size illustrates why this is likely.

Figure 31 shows prices in 1982 dollars for: 1) commercial red drum harvested from the EEZ of the Atlantic, 2) from state waters of the Atlantic, and 3) from waters of the State of Georgia specifically. Ex-vessel price is separated this way to look at the effect of red drum size on ex-vessel price. In general, EEZ caught red drum are adult fish and thus are large in size. Landings from state waters of the Atlantic are likely to be made up of one and two year old fish with a small but significant number of larger fish from trawl bycatch in state waters mixed in (note that red drum trawl bycatch data was not available for the size composition of catch information reported in the Species Profile). Georgia commercial red drum harvest is nearly completely from estuarine fishing and thus probably has the greatest composition of one and two year old fish.

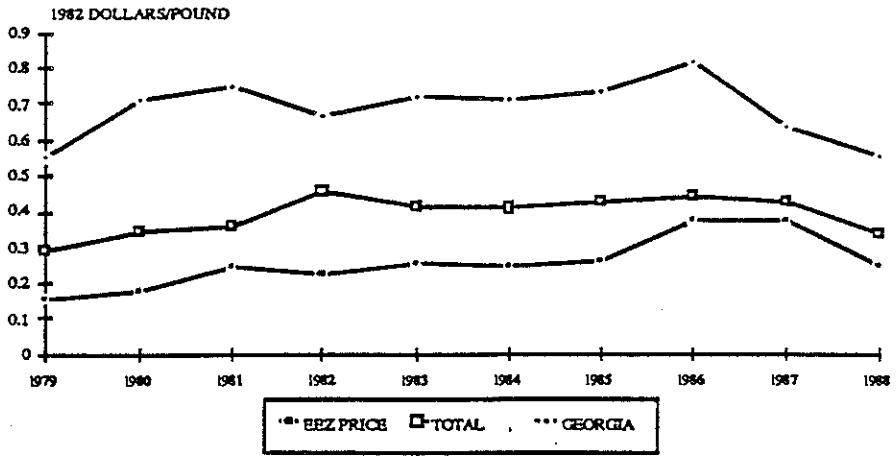


Figure 31. Price of EEZ red drum compared to inshore Atlantic prices (Source: NMFS SEFC).

From this information, one can presume that there are probably two demand curves for commercially caught red drum in the Atlantic- one for large drum and one for small drum. Demand for smaller red drum appears to generate higher ex-vessel prices on average. This means that EEZ red drum value is low compared to its value in state waters. Hence economic value or benefit indices will be correspondingly low. This indicates that unless demand conditions change significantly, commercial use of the EEZ red drum resource may not compete with other potential uses if and when the EEZ is reopened for harvest and the resource is allocated to its highest valued use.

Closing the EEZ to red drum harvest does limit the allocation arena to State waters but the net effect of this probably will not change the overall outcome of allocation between user groups. Behavioral characteristics of red drum alone tend to put most of the smaller, more valuable portion of the resource in State waters and this in itself seems to determine the outcome of allocation between user groups. The present proposed management measure leaves open the possibility of harvest when the SSBR target is met. Yet unless demand for red drum changes significantly and tends to promote relatively high values for adult fish, future allocation of the resource might not entail large allocations to commercial fishing.

12.1.2.3 Alternatives Considered and Rejected
No Action:

A decision not to close EEZ waters to red drum harvest could potentially allow a directed recreational or commercial fishery to develop. Although the probability of a directed fishery for red drum on the Atlantic coast developing appears remote at this point, factors that might make it feasible could unfold faster than a mechanism to stem that development could be put into place (see earlier discussion). Given that available biological evidence suggests that the spawning stock of red drum may already be in jeopardy, a directed fishery in the EEZ would surely aggravate the situation. For this reason, management has decided that any probability of directed harvest above a zero probability is too high given the current state of the red drum resource.

Because there is presently no directed harvest of red drum in the EEZ, the no action alternative does not avoid imposing any significant short run costs on user groups. For instance, total ex-vessel revenue from EEZ red drum has been less than $1,000 since 1985. Under the proposed closure, this small revenue would not be realized annually because EEZ red drum cannot be retained.

If the red drum resource is successfully rebuilt, valuable inshore recreational and commercial red drum fisheries will be more likely to be sustained. Under no action, potential long run benefits from sustainable red drum yields both from state waters and potentially the EEZ might be foregone. For these reasons, the no action alternative is not believed to maximize net benefits to

society.

Prohibit Transfer Or Attempt To Transfer Red Drum At Sea:

This measure would prohibit the transfer of red drum to vessels bound for ports in Northern states where the sale of red drum may not be controlled or prohibited. As such, the measure attempts to plug a potential enforcement loophole and might make enforcement more cost effective. Because harvest of red drum from the EEZ will be prohibited until the 30% SSBR is attained, the transfer at sea prohibition was not deemed necessary at this time.

Require Red Drum To Be Landed With Head And Tail Intact:

This measure may involve some benefits for enforcement as well as for biological and statistical data collection. It was rejected by the Council at this time because the harvest of red drum from the EEZ is prohibited until a 30% SSBR is attained.

12.2 Impacts on State Fisheries

In addition to the ASMFC recommendations to states for red drum fishery management, the Council plan lists possible recommendations to states (see Appendix 1). In developing the recommendations, the Council conducted an impact analysis that illustrates one approach to evaluating management impacts on red drum fisheries in the future.

The Council projected the potential impacts in the recreational fishery of one set of management combinations (Table 16). Various size and bag limits (no possession of fish > 27" TL) correspond to hypothetical percentage reductions in the recreational harvest. Although technically correct, these potential reductions in recreational catch must be viewed carefully because they somewhat overstate the magnitude of reductions in present day recreational catches. Potential catch reductions in Table 16 are the effects of bag and size limits projecting 1988 age-specific fishing mortalities forward compared to recreational catches prior to 1989. Potential reductions in total recreational catch will be somewhat smaller than depicted because, in some cases, States have already reduced bag limits lower than existed in 1988 (the most recent catch data used in this analysis). For specific details of when individual States adopted bag limits more restrictive than 1988 catch data reflect, see Section 7.2. For instance, fish per angler trip as reported in Figure 20, indicates that in 1987 there were few

trips that caught greater than six fish per trip. Those few trips with catch from six to ten fish account for roughly 30 percent of total catch in the catch frequency figure for 1987. Yet some of that catch from trips that catch more than six fish may already have been prevented by more restrictive bag limits undertaken by some states in 1989 and 1990.

Table 16. Hypothetical reduction in recreational landings from combined management options compared to landings based on 1988 age-specific fishing mortalities* (Source: Vaughan pers. comm. 1990).

* With 27" TL maximum size , bag limit

Minimum Length (in.)	Bag Limit 1	2	3	4	5	6	7	8	9	10
12	42%	34%	29%	25%	23%	21%	20%	19%	18%	17%
13	43%	35%	30%	26%	24%	22%	21%	20%	19%	18%
14	50%	44%	40%	37%	36%	34%	32%	32%	31%	30%
15	54%	48%	45%	43%	41%	40%	39%	39%	38%	37%
16	56%	51%	49%	47%	45%	44%	44%	43%	42%	42%
17	56%	52%	49%	47%	46%	45%	44%	43%	43%	42%
18	57%	53%	50%	48%	47%	46%	45%	45%	44%	44%
19	57%	54%	51%	49%	48%	47%	47%	46%	45%	45%
20	58%	50%	53%	51%	50%	49%	49%	48%	46%	47%

If escapement is to increase, some fairly large short run sacrifices in recreational catches in some states will have to be made. Given the high benefits that the red drum fishery provides anglers in the Atlantic (see Section 9.0), these catch reductions involve substantial short-run benefit losses to anglers. The tradeoff, however, is that increases in escapement (in conjunction with a temporary EEZ closure) will help insure the long term viability of the red drum fishery and long term stability or increase in recreational yields. Those long term sustainable gains will likely more than compensate short term losses particularly where losses will only accrue to the limited number of anglers that are catching large numbers of red drum on a trip. The average angler will probably not be directly affected by bag limits being considered (see bag limit analysis Section 8.1.1.2).

From a Federal perspective, recommendations to the states encourage escapement of juvenile red drum and hence recruitment to the adult population, which will help to determine how expeditiously the condition of the red drum resource will be improved and how soon harvest from the EEZ can be readdressed. If bag and size limits alone are used in combination to regulate the expanding recreational fishery in state waters, then increases in juvenile red drum escapement from relatively low bag limits could potentially be erased by increases in the overall number of recreational fishermen. Demographic projections predict coastal populations will increase in the future and recreational fishing appears to be gaining popularity. A measure to insure that states are approaching escapement targets is the annual stock assessment

and the provision to reevaluate the recommendations to the states upon examination of future stock assessments. The degree to which this approach is successful will have bearing on the duration of the EEZ closure and its associated present and potential impacts.

Another ramification of the recommendations to States is that if fairly restrictive bag and size limits are contemplated for the recreational red drum fishery in State waters, it is conceivable that the present allocation of red drum between recreational and commercial users (where applicable) may be reevaluated. As was mentioned before, because comparing expenditures is commonly used as a criterion for allocation between user groups, it is probable that the present commercial fishery may lose some or all of its present allocation. The outcome of reallocating the resource in state waters based on giving the next increment of the resource to its highest valued use (using consumer and producer surplus indices) is not known. It stands to reason, however, that there is a higher probability that commercial fishermen would have a smaller quantity of fish given an allocation based on expenditures.

12.3 Comparing Costs and Benefits

The long term benefit from the proposed management measures is that the adult portion of the Atlantic red drum stock will be rebuilt and stabilized at safe SSBR levels. This should lessen the possibility of recruitment failure. In the future, there could theoretically be surplus production in the EEZ that can be exploited by a controlled fishery if management efforts are successful. There being no directed harvest in EEZ waters at present means that data to assess the size of the spawning stock are not available. Because we do not know the size of the parent red drum stock in the Atlantic, it is difficult to project how large a fishery on the surplus production could be. Questions as to how much surplus production can be harvested, when, and by whom will be addressed in the future. Although intangible at present, the benefit from that harvestable surplus in Federal waters will be the sustainable yield that the adult population can generate to its user groups. A more specific estimate of long term benefit from a Federal perspective cannot be developed at this time.

Long term benefit would have to be discounted in order to compare it to present and future costs associated with managing the red drum parent stock. Costs at the Federal level have not been fully assessed at this time. It is estimated that there will be $137,750 spent annually to enforce the EEZ closure. The cost of Federal technical support for the assessment is estimated to be $10,000. Data collection is done exclusively at the state level and is not included in the Federal assessment cost. Future management costs will depend on futures levels of involvement on the part of both NMFS and the Councils and these cannot be predicted at this time. Management costs related to the Council process already incurred have not been estimated. Because the

size of the parent stock in federal waters is not known at this time and future sustainable yields cannot be quantified, a more rigorous comparison of costs and discounted benefits is not possible at this time. Another problem with quantifying benefits is that part of the inherent benefit from this FMP is the protection of the valuable inshore red drum fishery via efforts to protect the spawning stock. Hence, some portion of total benefit from the red drum resource is attributable in part to actions taken at the federal level but quantifying that portion is not possible at this time. This is why benefits and costs are generally not directly comparable for this plan.

12.4 Impacts on Small Businesses

Given the form in which data are made available to the SAFMC, it is nearly impossible to define the exact number of individual firms that will likely be impacted by the EEZ red drum closure. The following method was used to estimate how many vessels landed the 991 pounds of EEZ red drum reported landed in 1988 in data available from the Southeast Fisheries Center data: If a landing record is labeled confidential, then it was assumed that two vessels landed the specified poundage for the given month. If not labeled confidential, it was assumed that three vessels landed the reported poundage. Using this somewhat arbitrary accounting method, it is estimated that 11 vessels landed EEZ red drum as bycatch of EEZ fishing in 1988. It is possible, however, that the same vessels could have landed red drum bycatch from month to month. Thus the estimated number of vessels impacted would overstate the actual number.

It is felt that the proposed measures do not impose adverse effects on small entities. Because there is no directed red drum fishery in EEZ waters throughout its management unit, it is believed that significant impacts from the EEZ closure will not result. Total landings of red drum bycatch and price and value information are detailed in the RIR section of the Plan. In addition, the proposed measures do not impose any new paperwork requirements on groups that use the red drum resource.

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Appendix 1. Council Recommendations to States

(Source: Section 11.7 from The Atlantic Coast Red Drum Fishery Management Plan, SAFMC 1990)

11.7 Recommendations to States

11.7.1 Management Measures to Achieve Target Escapement Level

The SAFMC recommends that the States adopt a level of escapement needed to achieve the selected SSBR level of at least 30%. States are requested, through adoption of an amended ASMFC Red Drum FMP, to achieve 30% escapement of juvenile fish to the adult stock by reducing the rate of fishing mortality through such actions as gear restrictions, closed seasons, quotas, size limits and bag limits. Secondly, combinations of minimum and maximum size limits would reduce the length of time the fish are exposed to the fishery. States are requested to annually report to the Council the level of escapement of juvenile fish to the adult stock from their State waters and what actions they have taken to achieve the needed level of escapement.

The ASMFC will be revising their red drum FMP based on the target escapement level recommended to the States in the Federal FMP and comments supplied by a review group composed of State, Federal and Council representatives involved in red drum research and management. This review will assess the present management recommendations in the ASMFC FMP in relation to the need to achieve the target escapement level utilizing updated information contained in the stock assessment, Council FMP and Source Document for the FMP.

The Council concluded that landings for the EEZ should initially be set at zero to minimize mortality on adult spawning stock in addition to requesting States to adopt regulations that would allow for escapement of juveniles to the spawning stock high enough to maintain, at a minimum, a 30% SSBR ratio of the level of no fishing. The best available information conveyed to the Council by NMFS stock assessment scientists is that a 30% escapement level is needed to achieve a 30% SSBR ratio in the adult population. States should achieve a 30% escapement of juveniles (fish < Age 6). Examples of management measures that would achieve the 30% target escapement level coastwide include a maximum size limit of 27 in TL with; a 1 fish bag and 12 in minimum size, a 2 fish bag and 14 in minimum size, a 3 fish bag and 15 in minimum size, a 4 fish bag and 17 in minimum size, a 5 fish bag and 18 in minimum size, 6 fish bag and 19 in minimum size, a 7 fish bag and 20 in minimum size and an 8 fish bag and 20 in minimum size (Table 14).

Table 14. Coastwide escapement levels resulting from combined management options for Atlantic red drum incorporating a 27 in TL maximum size with various combinations of minimum size and bag limits. Management measures that achieve at least a 30% escapement level coastwide are in bold (Source: Vaughan pers. comm. 1990).

Minimum Length (in.)	Bag Limit 1	2	3	4	5	6	7	8	9	10
12	**33%**	25%	21%	18%	16%	14%	14%	13%	12%	12%
13	**34%**	26%	21%	19%	17%	15%	15%	14%	13%	12%
14	**38%**	**31%**	27%	24%	22%	21%	20%	19%	18%	18%
15	**40%**	**34%**	**30%**	27%	25%	24%	23%	22%	21%	21%
16	**42%**	**34%**	**32%**	29%	28%	26%	25%	24%	24%	23%
17	**42%**	**36%**	**32%**	**30%**	28%	27%	26%	25%	24%	23%
18	**43%**	**37%**	**34%**	**31%**	**30%**	28%	27%	26%	26%	25%
19	**44%**	**39%**	**35%**	**33%**	**31%**	**30%**	29%	28%	27%	27%
20	**45%**	**40%**	**37%**	**35%**	**33%**	**32%**	**31%**	**30%**	29%	29%

* based on 1988 age-specific fishing mortalities)

There is no combination of bag limit (≤ 10) and minimum size (≤ 20 in TL) combined with a 32 in TL maximum size that will achieve a 30% escapement level coastwide (Table 15). Any combination of management measures that achieves a 30% escapement level would be acceptable.

Table 15. Coastwide escapement levels resulting from combined management options for Atlantic red drum incorporating a 32 in TL maximum size and various combinations of minimum size and bag limits (Source: Vaughan pers. comm. 1990).

Minimum Length (in.)	Bag Limit 1	2	3	4	5	6	7	8	9	10
12	14%	11%	10%	8%	8%	7%	7%	6%	6%	6%
13	14%	12%	10%	9%	8%	75%	7%	7%	6%	6%
14	16%	14%	12%	11%	11%	10%	10%	9%	9%	9%
15	17%	15%	14%	13%	12%	12%	11%	11%	11%	10%
16	18%	16%	15%	14%	13%	13%	12%	12%	12%	12%
17	18%	16%	15%	14%	13%	13%	13%	12%	12%	12%
18	19%	17%	16%	15%	14%	14%	13%	13%	13%	13%
19	19%	17%	16%	15%	15%	14%	14%	14%	13%	13%
20	20%	18%	17%	16%	16%	15%	15%	15%	15%	14%

* based on 1988 age-specific fishing mortalities

Vaughan and Helser (1989) noted in the coastwide stock assessment the following regarding the issue of the interpretation of a portion of what is being identified as mortality as possibly being emigration from the estuary.

"Whether red drum in the Atlantic emigrate from the estuarine habitat at the onset of maturity to join the spawning stock offshore as in the Gulf or whether fish of mature age simply become less vulnerable to the fishery is not clear. Nor is it clear at which age red drum begin to move

offshore if they do emigrate or what the rates of emigration might be. Because of these uncertainties, it is difficult to ascertain if declining numbers of red drum is truly due to deaths or if emigration is also contributing."

Therefore, a component of estuarine mortality may really be escapement to the offshore stock (emigration) which is not distinguishable in tagging programs or age frequency analysis from mortality.

Impacts of coastwide bag and size limits are presented in Tables 16-18 and Appendix 1. Tables 19 and 20 present the percentages of trips impacted when a coastwide bag limit is applied to the recreational catch. In 1987 over 90% of angler trips caught less than 5 red drum and 97% of angler trips caught less than 10 red drum.

Table 16. Percent of catch exceeding bag limits, if limits were applied to recreational catch 1979-1988 (Source: MRFSS,Vaughan and Helser 1989).

Bag Limit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
% of catch exceeding bag limit (1979-1988)	72	58	48	41	35	31	27	24	21	19	17	16	14	13	12
% of catch exceeding bag limit (1988)	73	60	51	44	39	35	32	29	26	24	22	20	19	17	16

Table 17. Percent of catch less than minimum size limits, if limits were applied to recreational catch 1979-1988 (Source: MRFSS, Vaughan and Helser 1989).

Fishing Year	Minimum Size Limit (in TL)				
	12	14	16	18	20
	% < minimum size limit				
1979	31	51	65	77	83
1980	29	54	68	77	83
1981	19	40	61	68	76
1982	27	55	79	85	90
1983	21	48	78	87	89
1984	30	66	78	89	94
1985	38	66	81	91	95
1986	10	25	52	74	83
1987	6	35	75	83	88
1988	4	15	56	77	83

Table 18. Percent of catch exceeding maximum size limits, if limits were applied to recreational catch 1979-1988 (Source: MRFSS, Vaughan and Helser 1989).

	Maximum Size Limit (in TL)				
	25	26	28	30	32
	% > maximum size				
1979	8	7	4	1	6
1980	7	5	3	2	1
1981	11	11	6	3	1
1982	6	6	5	4	3
1983	5	4	2	>.5	>.5
1984	4	4	2	2	1
1985	2	4	>.5	>.5	>.5
1986	7	5	4	4	4
1987	4	2	1	1	1
1988	6	5	4	2	1

Table 19. Impact of coastwide bag limits if applied to recreational catch 1979-1987 (Source: MRFSS, Ron Essig pers. comm.1989).

1979-1987 bag limit	1	2	3	4	5	6	7	8	9	10	11	12	13	14
% angler trips having catches> bag limit	43.3	25.1	17.0	11.6	8.0	6.0	5.0	4.0	3.6	1.4	1.0	0.7	0.5	0.3
% angler trips with catches ≤ bag limit	56.7	74.9	83.1	88.4	92.0	94.0	95.0	96.0	96.4	98.6	99.0	99.3	99.5	99.7

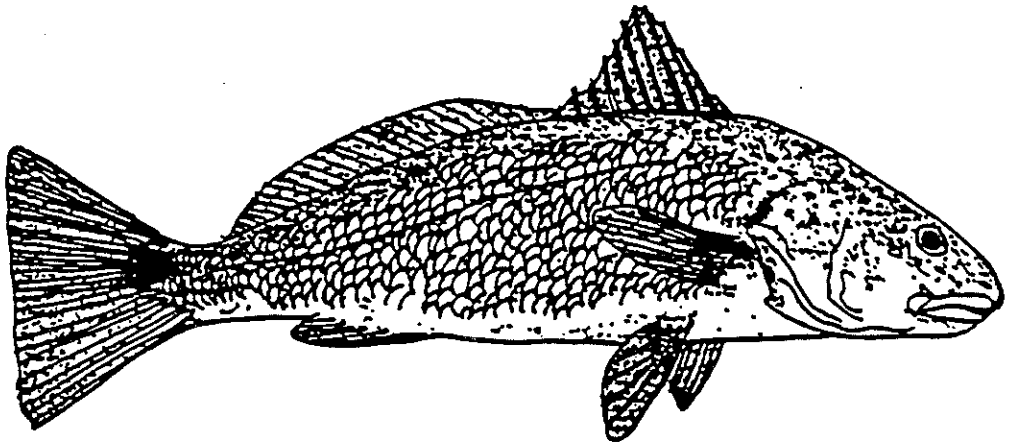
Table 20. Impact of coastwide bag limits if applied to recreational catch in 1987 (Source: MRFSS, Ron Essig pers. comm. 1989).

1987 bag limit	1	2	3	4	5	6	7	8	9	10	11	12	13	14
% angler trips having catches> bag-limit	42.5	28.3	21.4	14.0	9.7	7.5	7.0	5.2	5.2	2.8	2.5	2.3	2.3	2.1
% angler trips with catches ≤ bag limit	57.6	71.7	78.6	86.0	90.3	92.5	93.0	94.8	94.8	97.2	97.5	97.7	97.7	98.0

Appendix 2. 1991 Report of the SAFMC Red Drum Stock Assessment Review Group

(Source: SAFMC Red Drum Stock Assessment Review Group, 1991)

1991 REPORT OF THE SAFMC
RED DRUM STOCK ASSESSMENT REVIEW GROUP



Prepared by the SAFMC Red Drum Stock Assessment Review Group

DECEMBER 1991

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I. Background

The red drum fishery management plan, approved October 12, 1990, specifies that NMFS provide an annual update on the status of Atlantic coast red drum. The report is to include an update of the stock assessment for Atlantic coast red drum; an update of the estimate of maximum sustainable yield; the best estimate of the standing stock and its age composition; spawning stock requirements and escapement levels needed to meet these requirements; geographical variations in stock abundance, mortality, juvenile escapement and recruitment; a summary of current and historical information on the migratory movements of the stock; and available social and economic data for the fishery.

The report is to be reviewed by a Council-appointed stock assessment review group. In order to assure continued cooperation and coordination with the Atlantic States Marine Fisheries Commission, the Council appointed members of the Commission's red drum technical monitoring committee to the Council review group with the addition of Dr. Moore from the Mid-Atlantic Council. This report is based on the review of the techniques and results of the 1991 assessment which took place at the Commission's technical monitoring committee meeting held on September 4, 1991 in Beaufort, North Carolina. The report also incorporates comments and additional analyses forwarded by group members subsequent to finalization of the stock assessment document. The group is detailed in the FMP (SAFMC 1990).

This report specifies the acceptable biological catch (ABC) for the fishery in the EEZ. It also addresses and reaffirms the Council's recommendations to states pertaining to escapement of juvenile red drum to the spawning stock and the percent maximum spawning potential target.

II. Data Used in the 1991 Stock Assessment

A. Recreational Catch Data

Recreational landings and length frequency data were obtained from the NMFS Marine Recreational Fishery Statistics Survey. Estimated recreational catch of red drum in the Atlantic ranged from 632,000 lb in 1981 to 2,179,000 lb in 1984, and declined to 511,800 lb in 1990. The estimated catch included Type A fish (fish landed whole) and Type B1 fish (fish used as bait, filleted or discarded dead). In addition the 1991 assessment included 10% of B2 fish (fish released alive) in catch estimates to account for estimated release mortality. Although recent estimates of hooking mortality indicate considerable variability, the group considered 10% to be a reasonable estimate of average hooking mortality. Recreational length frequency distributions of recreationally caught red drum were updated to include 1989-90 information.

B. Commercial Catch Data

Commercial landings were supplied by the National Marine Fisheries Service Southeast Fisheries Science Center for Florida through North Carolina and the Northeast Fisheries Science Center for states north of North Carolina. Commercial length frequency data were supplied by the North Carolina Division of Marine Fisheries. Historical landings presented in the assessment were summarized from the original management plan.

Recent commercial landings have fluctuated between 200,000 and 300,000 lb. More than 95% of recent years' landings have come from North Carolina as a bycatch of mixed species fisheries. Commercial catch at length by gear type (gillnet, pound net, trawl, haul seine and hook and line) was provided by North Carolina and used in the assessment.

III. Analytical Methods and Assumptions

A. Introduction

The 1991 assessment follows the same format as the initial assessment but includes 1986-1990 recreational and commercial catch data. Catch in weight was converted to catch in numbers at age using length frequency distributions and age-length keys. In addition, new weight-length and length-age relationships were developed and used in the population analysis. The 1991 assessment, as was the 1989 assessment, is limited to the sub-adult phase (age 0-5) because sufficient data on older fish are not available.

B. Age/Growth

The updated assessment continued to utilize a double von Bertalanffy (1938) growth model and incorporated an expanded data set of aged fish for 1986-1990 supplied by North Carolina Division of Marine Fisheries, South Carolina Wildlife and Marine Resources Department and Georgia Department of Natural Resources. The group considered use of a double von Bertalanffy growth curve to be appropriate because it accurately represents rapid growth at early ages and slower growth in later years

C. Maturity

Size/age at maturity was further refined this year with the addition of a greater number of samples from South Carolina and North Carolina. This information was incorporated into the spawning stock biomass per recruit estimates.

D. Mortality

Coastwide Total Mortality

Total mortality (Z) was estimated from catch curve analyses (Ricker 1975) using Marine Recreational Fishery Statistics Survey data (1980-90) for ages 1 through 3. The analysis assumes that recruitment to the fishery is complete by age 1, recreational fishery catches are representative of the population for ages 1 through 3 and recruitment is constant. Estimates of total mortality (Z) ranged from Z=1.04 in 1981 to Z=2.57 in 1986. Total mortality was also estimated from cohort analysis which does not assume constant recruitment but does assume constant fishing mortality at ages and year utilized in catch curves. Estimates ranged from Z=2.57 for the 1984 year class (ages 2-5) to Z=1.70 for the 1988 year class (ages 1-2). The review group noted that the estimates agreed well with estimates of Z for various states: North Carolina estimates, based on tagging ranged from 1.44 to 2.76, and 1.56 to 2.88 based on catch curves; estimates from Georgia ranged from 1.26 to 3.23 based on tagging and from 1.13 to 2.96 based on catch curve analysis of fishery independent data.

Natural Mortality, Fishing Mortality and Emigration

Estimates of mortality remain uncertain because red drum migrate out of the estuary at the onset of maturity and become less vulnerable to the fishery. Thus, declining numbers of red drum at age in the catch may be due to mortality or to losses from emigration. Because there is very little fishing on the adult stock, age structure of this component of the population is poorly known. Simulations, using various levels of emigration beginning at age 3, were run to evaluate the effect of emigration on estimates of spawning stock biomass per recruit. These simulations indicated that rates of emigration after age 3 had only a minimal effect on spawning stock biomass per recruit and that mortality prior to age 3 was the principal determinant of spawning stock biomass per recruit.

Estimated subadult natural mortality (M_1) was 0.51 and adult natural mortality (M_2) was 0.17, slightly higher than estimates presented in the 1989 assessment. Because of uncertainty in estimates of subadult natural mortality and concern that the value may be high, various estimates ranging between M_1=0.1 and M_1=0.5 were used in the 1991 assessment. Lower estimates of natural mortality result in lower estimates of spawning stock biomass per recruit for a given level of total mortality.

The assessment review group concurs with results of the coastwide assessment that indicate extremely high fishing mortality on subadult red drum. The Atlantic coast red drum stock is very heavily exploited with average fishing mortality (F) rates (1986-1990) ranging between F= 0.98 and 1.46 for ages 1 through 3. For all year classes, average F = 1.3. The fact that the Atlantic red drum age distribution is missing age classes was cited as additional evidence supporting assessment results. In contrast, an early data set (1968-72) of aged red drum indicate fish ages spanning more than 45 years, with most year classes represented. Recent aging work from North Carolina shows an age distribution with missing year classes and poor representation of most older ages (Ross 1991). This same distribution is evident in most other South Atlantic states. It has been hypothesized that red drum have such a long life to compensate for environmental factors that may result in poor recruitment. High, and possibly increasing, fishing mortality, combined with poor recruitment, would result in minimal escapement to the spawning stock. As noted in the

original fishery management plan, such a compression of age distribution could, in the long run, impact future recruitment.

E. Virtual Population Analysis

Two types of virtual population analyses (VPA) were applied to the catch in numbers-at-age matrix for ages 0 to 5 and years 1986 to 1990. One method parallels the cohort-based analysis utilized in the 1989 assessment which is described by Murphy (1965). The second method is based on a separability assumption described in Doubleday (1976).

The 1991 assessment incorporated two additional years of data, full VPA techniques, and incorporates refined and expanded information on catch at age for Atlantic red drum. The group felt the 1991 assessment was more technically sound than the 1990 assessment, although they noted that there are still a limited number of ages and years represented in the assessment which could lead to potential error in the estimate of a starting fishing mortality rate, which would be carried through to estimates at earlier years.

F. Recruitment

Recruitment trends were derived from VPA and showed that between 1986 and 1988 there were between 700,000 and 1,000,000 recruits per year. Recruitment was lower in 1989 with estimates ranging between 340,000 and 460,000 recruits.

G. Yield per Recruit

Yield per recruit (Y/R) analysis indicated that increases in yield would result from increasing age at entry to the fishery up to age three. If subadult mortality (M_1) equals 0.1, Y/R increases from 1.6 lb at age 0 to 7.5 lb at age 3. If M_1=0.5, Y/R increases from 0.9 lb at age 0 to 1.8 lb at age 3. Higher subadult natural mortality implied greater removals from the stock and lower Y/R.

H. Escapement

Escapement is defined in the assessment as the relative survival of red drum from age at entry (i.e., age first caught by fisherman) to the beginning of age 6. Escapement is estimated to be between 0.2% and 1.5% for subadult natural mortality rates (M_1) between 0.1 and 0.5. To investigate implications of emigration on escapement, simulations were run for a range of assumed emigration rates of 0 to 0.7 at age 3. To test the sensitivity of population estimates, emigration was simply subtracted from fishing mortality at age 3. The analysis of Separable VPAs showed increasing escapement with increasing emigration, from 0.8% (emigration rate =0.0) to 1.6% (emigration rate =0.7) when M_1=0.5 (adult mortality, M_2=0.17).

I. Spawning Stock Biomass Per Recruit (Maximum Spawning Potential)

Spawning stock biomass per recruit (SSBR) is used to define overfishing. Maximum SSBR is obtained when fishing mortality is zero. The ratio of fished to unfished SSBR [or percent maximum spawning potential (MSP), the term used in the 1991 assessment] is a measure of relative reproductive potential of an exploited fish stock. The 1991 stock assessment report (Vaughan 1991), which incorporates data through 1990, estimates that SSBR ratio based on female biomass, assuming a subadult natural mortality between 0.1 and 0.5, with age-at-entry into the fishery of 0, ranges between 0.3% and 1.9%. The egg production model results in SSBR ratios between 0.4% and 2.4%.

To address the issue of emigration and implications for SSBR, various levels of emigration were assumed beginning at age 3 and showed SSBR to increase but not dramatically. The analysis showed increasing SSBR ratio with increasing emigration, from 2.2% to 3.0% when M_1=0.5 (adult mortality- M_2=0.17).

IV. Status of Stock and Recommendations

A. ASMFC Red Drum Technical Committee Findings (ASMFC 1991)

1) The Atlantic Coast red drum stock is very heavily exploited with average fishing mortality rates (1986-1990) ranging between F= 0.98 and 1.46 for ages 1 through 3. For all year classes, average F = 1.3.

2) Red drum natural mortality rates (M) can be expected to vary by area, year and age of fish. Estimates of M for sub-adults (ages 0-5) and adults (ages >5) are 0.50 and 0.17 respectively.

3) Overfishing is defined as a fishing mortality rate that will, if continued, reduce the spawning stock biomass per recruit (SSBR) below 30% of the level that would exist at equilibrium without fishing. SSBR can be used to evaluate fishing mortality scenarios without knowing actual levels of spawning stock. At present for a SSBR=30%, F must be reduced to 0.40 (from average F=1.3).

4) The most recent estimates of F (1986-90) would lead to an SSBR level= 2%. If these mortality rates continue and such a low level of SSBR is reached, there is a high probability of recruitment failure.

B. Overfishing

Overfishing is defined in the plan as a fishing mortality rate that will, if continued, reduce the spawning stock biomass per recruit (SSBR) below 30% of the level that would exist at equilibrium without fishing. The Atlantic coast red drum stock will be considered overfished when the SSBR is below 30% of the level that would have existed in the absence of fishing. The 1991 stock assessment report indicates that the red drum stock is overfished with a present SSBR (MSP) between 1% and 2% (subadult natural mortality = 0.5 and adult natural mortality = 0.17).

C. Acceptable Biological Catch for the EEZ

The review group is also charged with formulating recommendations on allowable catch in the EEZ for 1992. Specification of allowable biological catch (ABC) shall separately identify the quantity of the population in excess of the spawning stock goal and in excess of the annual surplus production above target SSBR that may be harvested from the EEZ. In accordance with the plan, allowable catch for the EEZ will not be considered unless there is an excess biomass beyond the 30% spawning stock biomass goal. Accordingly, there is no biomass in excess of the target and no allowable catch is recommended for the EEZ in 1992.

D. Recommendations to States: Management Measures to Increase Escapement

The South Atlantic Fishery Management Council closed the EEZ to assure that a directed fishery on spawning size red drum would not occur considering the high fishing mortality on juvenile red drum in state waters and subsequent minimal escapement to the spawning stock. Fishing mortality and effort on juvenile red drum has increased to a point where only a small portion of an incoming year class survives to enter the spawning stock. Considering the objectives of the FMP, the review group believes that the SSBR goal (30%) cannot be met without increased escapement. Given the most recent coastwide stock assessment which corroborates individual state findings, the present estimate of SSBR is between 1 and 2%.

The review group reaffirmed the Council's recommendations contained in the plan which request states, through adoption of an amended ASMFC Red Drum FMP, to achieve 30% escapement of juvenile fish to the adult stock by reducing the rate of fishing mortality through such actions as gear restrictions, closed seasons, quotas, size limits and bag limits. Secondly, combinations of minimum and maximum size limits would reduce the length of time the fish are exposed to the fishery. States have been requested to annually report to the council the level of escapement of juvenile fish to the adult stock from their state waters and what actions they have taken to achieve the needed level of escapement. Recent state actions to reduce fishing mortality and increase escapement, include implementation or reduction of bag limits, and the increase in minimum and/or decrease of maximum size limits. Present state management measures pertaining to bag limits, minimum and maximum size limits, the ability to sell and seasons are presented in Figure 1. A detailed analysis of potential state management measures and their relationship to the spawning potential target is contained in the 1991 assessment document.

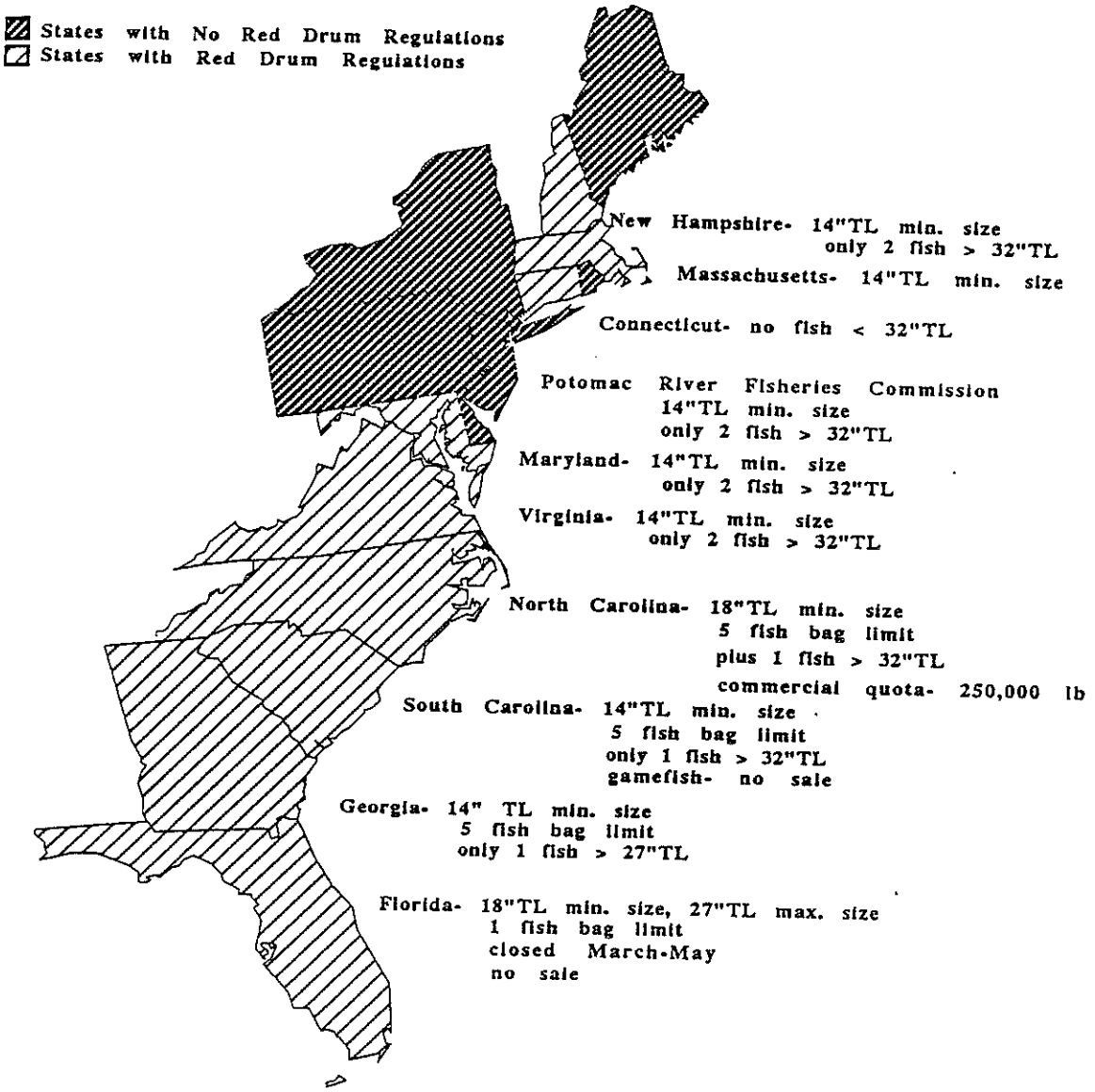

Figure 1. Current Atlantic coast state regulations for red drum.

In addition, a preliminary probability analysis was conducted by Dr. Vaughan which shows that in order to have a probability greater than 50% of achieving the 30% SSBR ratio in 20 years, fishing mortality must be reduced to 0.4. Detailed analysis was provided to the Atlantic States Marine Fisheries Commission to aid states in considering management measures to achieve the percent maximum spawning potential target and is available from ASMFC or NMFS SEFSC upon request.

V. Research Needs

The research needs detailed in Vaughan (1991) were endorsed by both the ASMFC Technical Monitoring Committee and the Council's Stock Assessment Review Group as being the most important needs for increasing our understanding of the Atlantic coast red drum stock which will

lead to enhanced stock assessments. Subsequently, state and federal agencies will have a better ability to determine and evaluate long term management strategies. These recommendations are to:

1. Continue tag-recapture studies to provide parallel information on fishing mortality rates, estimates of natural mortality and possibly estimates of emigration rates at age;
2. Improve catch statistics;
3. Improve coastwide coverage for age-length keys;
4. Determine fecundity as a function of Atlantic red drum length and weight;
5. Develop fishery independent index of spawning stock;
6. Develop long-term indices of recruitment;
7. Continue standardized sampling of subadults;
8. Increase numbers of intercepted length frequencies in the MRFSS.

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