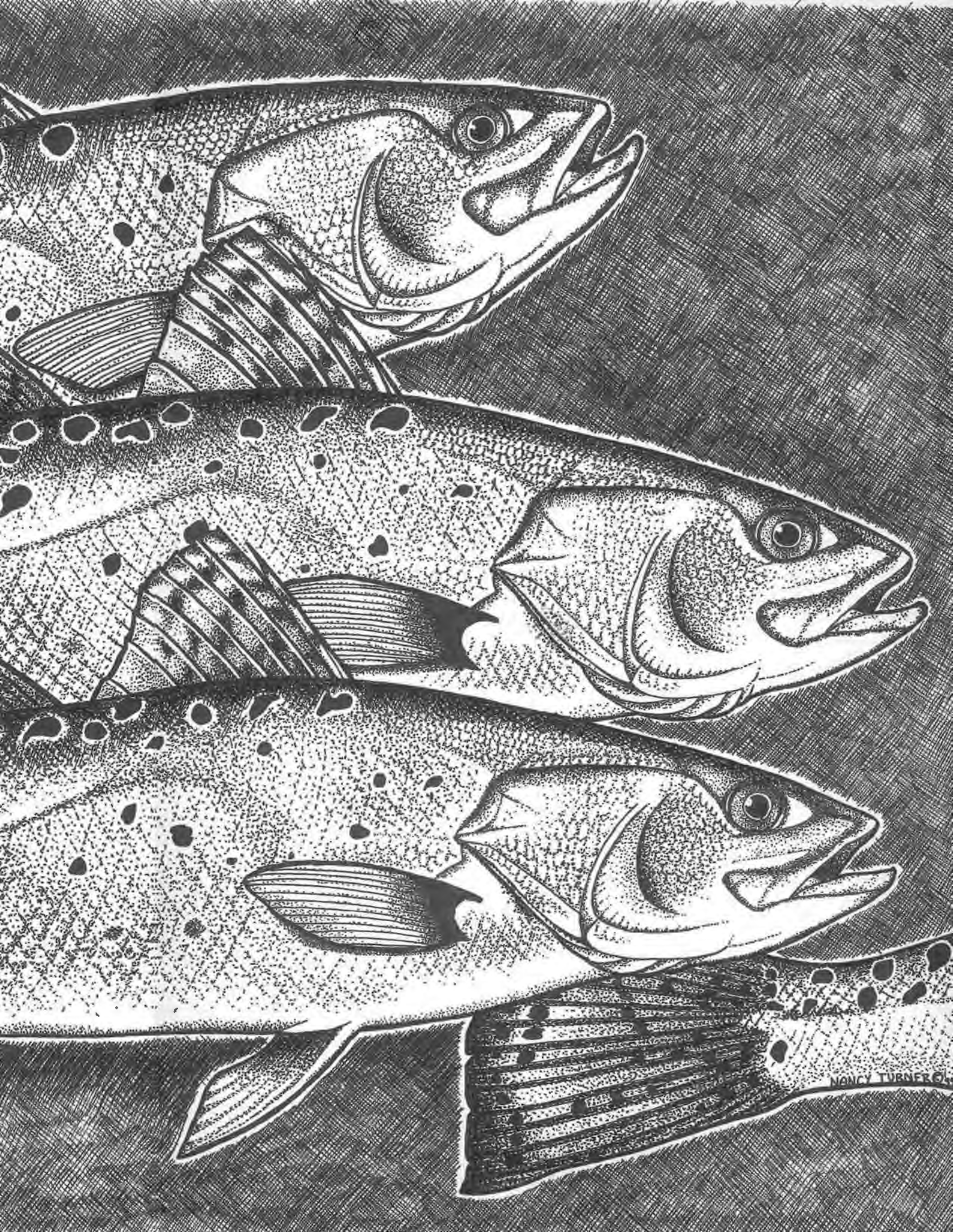
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THE SPOTTED SEATROUT FISHERY

OF THE GULF OF MEXICO, UNITED STATES:

A REGIONAL MANAGEMENT PLAN

by:

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The Gulf States Marine Fisheries Commission (GSMFC) would like to thank the Spotted Seatrout Technical Task Force (TTF) for their many hours of work and dedication in developing this spotted seatrout fishery management plan (FMP). Special thanks are extended to Dr. Richard Leard and Mr. Jim Duffy who served as IJF Program Coordinators in 1995-1996 and 1997, respectively, for their efforts and written contributions to this document. Thanks also go to Mr. Thomas Hults who served as the commercial representative on the TTF from 1996-1997. Additional thanks go to Nancy Brown-Peterson, Mike "Buck" Buchanan, Dr. Cindy Moncreiff, and Dr. Robin Overstreet who provided both their technical expertise as well as reviewed several sections of this plan.

This spotted seatrout FMP borrowed heavily from the Louisiana Department of Wildlife and Fisheries management plan, "A biological and fisheries profile for Louisiana spotted seatrout, *Cynoscion nebulosus"* (Bourgeois et al. 1996). In addition, Section 4 [Description of the Habitat of the Stock(s) Comprising the Management Unit] relies upon information drawn from the United States Department of Commerce's (USDOC) "Distribution and Abundance of Fishes and Invertebrates in Gulf of Mexico Estuaries Volume II: Species Life History Summaries" (Pattilo et al. 1997) and the Gulf of Mexico Fisheries Management Council's (GMFMC) "Generic Amendment for Addressing Essential Fish Habitat Requirements" (GMFMC 1998). We recognize that these documents are excellent reviews of the literature regarding spotted seatrout in the Gulf of Mexico and wish to acknowledge the time and effort the authors invested.

PREFACE

The GSMFC was established by the Gulf States Marine Fisheries Compact under Public Law 81-66 approved May 19, 1949. Its charge was to promote the better management and utilization of marine resources in the Gulf of Mexico.

The GSMFC is composed of three members from each of the five Gulf States. The head of the marine resource agency of each state is an *ex officio* member. The second is a member of the legislature. The third is a governor-appointed citizen with knowledge of or interest in marine fisheries. The offices of the chairman and vice chairman are rotated annually from state to state.

The GSMFC is empowered to recommend to the governor and legislature of the respective states action on programs helpful to the management of marine fisheries; however, the states do not relinquish any of their rights or responsibilities in regulating their own fisheries by being members of the GSMFC.

One of the most important functions of the GSMFC is to serve as a forum for the discussion of various problems and needs of marine management authorities, the commercial and recreational industries, researchers, and others. The GSMFC also plays a key role in the implementation of the Interjurisdictional Fisheries (IJF) Act. Paramount to this role are the GSMFC's activities to develop and maintain regional FMPs for important Gulf species.

The Spotted Seatrout FMP is a cooperative planning effort of the five Gulf States under the IJF Act. All members of the task force contributed by drafting individually-assigned sections. In addition, each contributed personal expertise to discussions that resulted in revisions and led to the final draft of the plan.

The GSMFC made all necessary arrangements for task force workshops. Under contract with the National Marine Fisheries Service (NMFS), the GSMFC funded travel for state agency representatives and consultants other than federal employees.

Throughout this document, metric equivalents are used where ever possible with the exception of the reporting of landings data and size limits which, by convention, are always reported in English units. A glossary of fisheries terms pertinent to this FMP is provided in Appendix 14.1. Recreational landings in this document are Type A and B1 and actually represent total harvest, as designated by the NMFS. Type A catch is fish that are brought back to the dock in a form that can be identified by trained interviewers and type B1 catch is fish that are used for bait, released dead, or filleted i.e., they are killed but identification is by individual anglers. Type B2 catch is fish that are released alive again, identification is by individual anglers and are excluded from the values in this FMP.

The state of Mississippi has indicated that the reported recreational landings for several near-shore, estuarine species in the MRFSS survey are under-represented due to a sampling anomaly which reports some fish caught in "state waters" as caught in the "exclusive economic zone." The problem was addressed and corrected for the 2000 MRFSS data; however, for the purposes of this

FMP, the recreational landings reported in Section 6 reflect the total Mississippi landings for spotted seatrout from "all waters combined" not just state waters. Recreational spotted seatrout landings for Alabama, Florida, and Louisiana are reported as "state water" fish only.

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Abbreviations and Symbols

ADCNR/MRD	Alabama Department of Conservation Natural Resources/Marine Resources Division
BRD	bycatch reduction device
°C	degrees Celsius
DO	dissolved oxygen
DMS	Data Management Subcommittee
EEZ	exclusive economic zone
EFH	essential fish habitat
FWC/FMRI	Florida Fish and Wildlife Conservation Commission/Florida Marine Research Institute
FMP	fishery management plan
ft	feet
g	gram
GSI	gonadal somatic index
GMFMC	Gulf of Mexico Fisheries Management Council
GMEI	Gulf of Mexico Estuarine Inventory
GSMFC	Gulf States Marine Fisheries Commission
hr(s)	hour(s)
ha	hectare
IJF	interjurisdictional fisheries
kg	kilogram
km	kilometer
lbs	pounds
LDWF	Louisiana Department of Wildlife and Fisheries
MFCMA	Magnuson Fishery Conservation and Management Act
m	meter
mm	millimeters
min(s)	minute(s)
MDMR	Mississippi Department of Marine Resources
MRFSS	Marine Recreational Fisheries Statistical Survey
mt	metric ton
n	number
NL	notocord length
NMFS	National Marine Fisheries Service
ppm	parts per million
‰	parts per thousand
PPI	producer price index
SAT	Stock Assessment Team
SD	standard deviation
SE	standard error
sec(s)	second(s)
SL	standard length
S-FFMC	State-Federal Fisheries Management Committee
SPR	spawning potential ratio

TCC	Technical Coordinating Committee
TED	turtle exclusion device
TL	total length
TPWD	Texas Parks and Wildlife Department
TTF	technical task force
TTS	Texas Territorial Sea
TW	total weight
USEPA	United States Environmental Protection Agency
USDOC	United States Department of Commerce
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
YOY	young-of-the-year
yr(s)	year(s)

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1.0 SUMMARY

Spotted seatrout are distributed along the Atlantic and Gulf Coasts of the United States from Cape Cod, Massachusetts, southward through Texas to Carmen Island in the lower Gulf of Campeche, Mexico. They are most numerous along the Gulf of Mexico from the west coast of Florida to Texas. Various researchers have attempted to ascertain the genetic diversity of spotted seatrout in the Gulf and the possible existence of genetically distinct subpopulations, even within estuaries. Early speculation was based on the slow movement of spotted seatrout among bay systems and morphological differences such as shape and growth characteristics of scales and otoliths. Recent analysis of mitochondrial DNA haplotypes by Gold and Richardson (1998) and Gold et al. (1999) confirms the presence of significant population substructuring among Gulf spotted seatrout.

Spotted seatrout are euryhaline and found in salinity ranges of 0.2‰-75‰. They are often found associated with seagrass beds in the warmer months and deeper holes within the estuaries during colder periods. There is little consensus on the preferred spawning habitat of spotted seatrout. Spotted seatrout do not migrate far from the estuaries where they are spawned, and it is rare that tagged specimens are captured more than 50 km from the tagging location.

Spotted seatrout spawning season varies throughout the Gulf but begins as early as March and ends after October with peaks of activity occurring from April-July. Spawning peaks usually occur in mid-summer (July and August) near the middle of the spawning season but have been observed to occur as early as April or May. Unimodal or bimodal peaks in spawning activity of spotted seatrout can appear and may vary temporally and geographically.

Habitat utilization by spotted seatrout varies by geographic location within the Gulf of Mexico based on the habitat types available in a particular area and life history stage. Substrate for larvae is variable. Larvae are found in bottom vegetation or demersal in deep channels with shell rubble. Juveniles and adults are often associated with seagrasses, particularly *Halodule* and *Thalassia,* but they are common over sand, sand-mud, or muddy areas, oil platforms, and shell reefs.

Spotted seatrout are important recreational and commercial components to the total Gulf of Mexico fin-fishery. They are taken almost exclusively within state jurisdictions due to close association with marsh and estuarine habitats. For biological, social, and economic reasons, spotted seatrout have been declared gamefish in Texas and Alabama. However, limited commercial harvest occurs in Louisiana, Mississippi, and Florida.

Stock assessments conducted by member states have estimated recent transitional spawning potential ratios (SPR) higher than 20% in the Gulf States except Mississippi. However, evaluating the status of the spotted seatrout stock Gulf-wide is problematic because different states have different conservation standards. For example, Louisiana has adopted a SPR value of 18% as their conservation standard and do not consider their population overfished because Louisiana's SPR in 1996 was 21.6%. However, Florida considers their spotted seatrout to be overfished (transitional SPR values of 22% in the Northwest region and 25% in the Southwest region) because their management objective is a transitional SPR value of 35%.

2.0 INTRODUCTION

On October 14, 1992, the State-Federal Fisheries Management Committee (S-FFMC) of the GSMFC agreed that spotted seatrout should be the next species (fishery) designated for Interjurisdictional Fisheries Management Plan (FMP) development. This decision was based on the fact that in state territorial waters of the Gulf of Mexico spotted seatrout have historically been the most sought recreational species and made up a significant component of the commercial harvest. Growing numbers of fishermen, decline in the quantity and quality of estuarine habitat, and fear of overfishing have prompted states to enact increasingly restrictive regulations on the harvest of spotted seatrout. Because of the popularity of this species, the lack of consolidated information regarding the fish and the fishery, and the level of concern for the well being of stocks, the S-FFMC concluded that a Gulf-wide FMP that includes the best available data was needed. The Spotted Seatrout Technical Task Force (TTF) was subsequently formed and held its first meeting on June 21-22, 1994.

2.1 IJF Program and Management Process

The Interjurisdictional Fisheries Act of 1986 (Title III, Public Law 99-659) was approved by Congress to: (1) promote and encourage state activities in support of the management of interjurisdictional fishery resources; and (2) promote and encourage management of interjurisdictional fishery resources throughout their range. Congress also authorized federal funding to support state research and management projects that were consistent with these purposes. Additional funds were authorized to support the development of interstate FMPs by the GSMFC and the other marine fishery commissions. The GSMFC patterns its plans after those of the Gulf of Mexico Fishery Management Council (GMFMC) under the Magnuson Fishery Conservation and Management Act of 1976 to ensure compatibility in format and approach to management among states, federal agencies, and the GMFMC.

After passage of the act, the GSMFC initiated the development of a FMP planning and approval process. This process has been modified as various plans have been developed, and its current form is outlined as follows:

DMS
↕
TTF → **TCC** → **S-FFMC** → **GSMFC**
↕ (TTF) ↕ (S-FFMC)
SAT **Outside Review***

DMS = Data Management Subcommittee
SAT = Stock Assessment Team
TTF = Technical Task Force
TCC = Technical Coordinating Committee
S-FFMC = State-Federal Fisheries Management Committee
GSMFC = Gulf States Marine Fisheries Commission
*Outside Review = standing committees, trade associations, general public

The TTF is composed of a core group of scientists from each Gulf state who are appointed by the respective state agency director serving on the S-FFMC. Also, a TTF member from the Law Enforcement Committee, the Commercial/Recreational Fisheries Advisory Panel, and TCC Habitat Subcommittee is appointed by their respective group. In addition, the TTF may include other experts in economics, socio-anthropology, population dynamics, or other specialty areas when needed. The TTF is responsible for development of the FMP and receives input in the form of data and other information from the DMS and the SAT.

Once the TTF completes the plan, it may be approved or modified by the TCC before being sent to the S-FFMC for review. The S-FFMC may also approve or modify the plan before releasing it for public review and comment. After public review and final approval by the S-FFMC, the plan is submitted to the GSMFC where it may be accepted or rejected. If rejected, the plan is returned to the S-FFMC for further review.

Once approved by the GSMFC, plans are submitted to the Gulf States for their consideration of adoption and implementation of management recommendations.

2.2 Spotted Seatrout Technical Task Force

Charles Adams	University of Florida (economic expert)
Harry Blanchet	Louisiana Department of Wildlife and Fisheries
Bob Ditton	Texas A&M University (sociology expert)
Joe Gill	Ainsworth-MacAllan, Ltd. (commercial representative)
Larry McEachron	Texas Parks and Wildlife Department
Robert Muller	Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute
Mark Van Hoose	Alabama Department of Conservation and Natural Resources
James Warren	University of Southern Mississippi, College of Marine Science, Gulf Coast Research Laboratory
Terry Waldrop	Gulfport, MS (recreational representative)
Jerald Waller	Alabama Department of Conservation and Natural Resources (law enforcement representative)
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Section 13.0 Staff
Section 14.0 Staff

2.5 FMP Management Objectives

The objectives of the Spotted Seatrout FMP are:

1. To summarize, reference, and discuss relevant scientific information and studies regarding the management of spotted seatrout in order to provide an understanding of past, present, and future efforts.

2. To describe the biological, social, and economic aspects of the spotted seatrout fishery.

3. To review state and federal management authorities and their jurisdictions, laws, regulations, and policies affecting spotted seatrout.

4. To ascertain optimum benefits of the spotted seatrout fishery of the U.S. Gulf of Mexico to the region while perpetuating these benefits into future generations.

5. To set clear and attainable management goals for the spotted seatrout fishery and to suggest management strategies and options needed to solve problems, meet the needs of the stock, and achieve these goals.

3.0 DESCRIPTION OF THE STOCKS

3.1 Geographic Distribution

Spotted seatrout are distributed along the Atlantic and Gulf Coasts of the United States from Cape Cod, Massachusetts, southward through Texas to Carmen Island in the lower Gulf of Campeche, Mexico (Welsh and Breder 1924, Mather 1952, Tabb 1966). They are uncommon in and north of Delaware Bay (Welsh and Breder 1924), increasingly abundant from the eastern seaboard of Virginia southward to Florida (Merriner 1980), and most numerous along the Gulf of Mexico from the west coast of Florida to Texas (Iversen and Moffett 1962, Tabb 1966, and Merriner 1980).

3.2 Biological Description

3.2.1 Classification and Morphology

3.2.1.1 Classification

The following classification of spotted seatrout is essentially that of Greenwood et al. (1966):

Phylum: Chordata
  Subphylum: Vertebrata
    Class: Osteichthyes
      Superorder: Acanthopterygii
        Order: Perciformes
          Suborder: Percoidei
            Family: Sciaenidae
              Genus: *Cynoscion*
                Species: *nebulosus*

The valid name for the spotted seatrout is *Cynoscion nebulosus* (Cuvier) 1830. The following synonymy is abbreviated from Jordan and Evermann (1898):

Labrus squeteague var. *maculatus*, Mitchill 1815
Otolithus nebulosus, Cuvier and Valenciennes 1830
Otolithus carolinensis, Cuvier and Valenciennes 1833
Otolithus drummondi, Richardson 1836
Cestreus carolinensis, Gronow 1854
Cynoscion carolinensis, Jordan and Gilbert 1878
Cynoscion maculatum, Jordan and Gilbert 1882
Cestreus nebulosus, Jordan and Eigenmann 1889

Spotted seatrout is the valid common name endorsed by the American Fisheries Society (Robins et al. 1991). Other common names include speckled trout, speck, speckles, spec, truite gris (Louisiana French), trucha de mar (Mexican Spanish), spotted weakfish, spotted squeateague, southern squeateague, salmon, salmon trout, simon trout, winter trout, seatrout, and black trout (Smith 1907, Welsh and Breder 1924, Hildebrand and Schroeder 1928, Hoese and Moore 1977).

3.2.1.2 Morphology

The life history stages of spotted seatrout have been described by various authors (Welsh and Breder 1924, Hildebrand and Schroeder 1928, Pearson 1929, Hildebrand and Cable 1934, Miles 1950, Miles 1951, Tabb 1966, Jannke 1971, Miller and Jorgenson 1973, Lippson and Moran 1974, Chao 1976, Daniels 1977, Fable et al. 1978, Johnson 1978, Powles and Stender 1978, Ditty 1989). Figure 3.1 represents a developmental series for juvenile spotted seatrout.

Spotted seatrout eggs have been described by Miles (1950, 1951); Tabb (1966); Fable et al. (1978); and Johnson (1978). Miles (1951) reported that spotted seatrout eggs vary from 0.70-0.98 mm in diameter and contain from one to four oil globules. Tabb (1966) and Fable et al. (1978) found that eggs were round and usually contained one oil globule but sometimes two or three. Fable et al. (1978) found that live eggs ranged from 0.73-0.82 mm in diameter with oil globules from 0.22-0.27 mm in diameter. Holt et al. (1988) reported the collection of spotted seatrout eggs ranging from 0.60-0.85 mm diameter containing one oil globule later in development. Eggs have been further described as clear with unsculptered chorion, narrow privitellene space occupying only 4% of the egg diameter, and homogeneous yolk (Miles 1951, Fable et al. 1978). Fable et al. (1978) presented an account and description of embryological development from fertilization to hatching which they reported to occur at 16-20 hours after fertilization at 25°C, 15 hours at 27°C, and 21 hours at 23°C. They used the three stages (early, middle, and late) described by Ahlstrom and Ball (1954) to characterize this development.

Various authors have described larval stages and development of spotted seatrout (Pearson 1929, Hildebrand and Cable 1934, Daniels 1977, Fable et al. 1978, Johnson 1978). At hatching, larvae were reported to range between 1.30-1.56 mm SL ($\bar{X}$ = 1.46 mm SL; Fable et al. 1978). The earliest, most complete description and drawings are those of Hildebrand and Cable (1934) for larvae 1.8 mm, 2.5 mm, 3.0-3.6 mm, 7.0 mm, and 10.0-12.0 mm long. Daniels (1977) described wild-caught spotted seatrout ranging between 1.8 and 11.3 mm SL from the northern Gulf of Mexico using morphological and osteological data, and Fable et al. (1978) provided additional descriptions of reared larvae to 4.5 mm SL.

Larvae about 1.8 mm have a deep head and trunk, but the caudal portion of the body is slender. The vent is anterior of midbody, and the depth behind the vent is only slightly greater than the eye diameter which results in an abrupt change in body contour. The mouth is somewhat large and very oblique, and the gape anteriorly falls backward under the eye. The vertical finfold is large and uninterrupted but without fin rays. Pectoral fin membranes are prominent, but ventrals are absent (Hildebrand and Cable 1934).

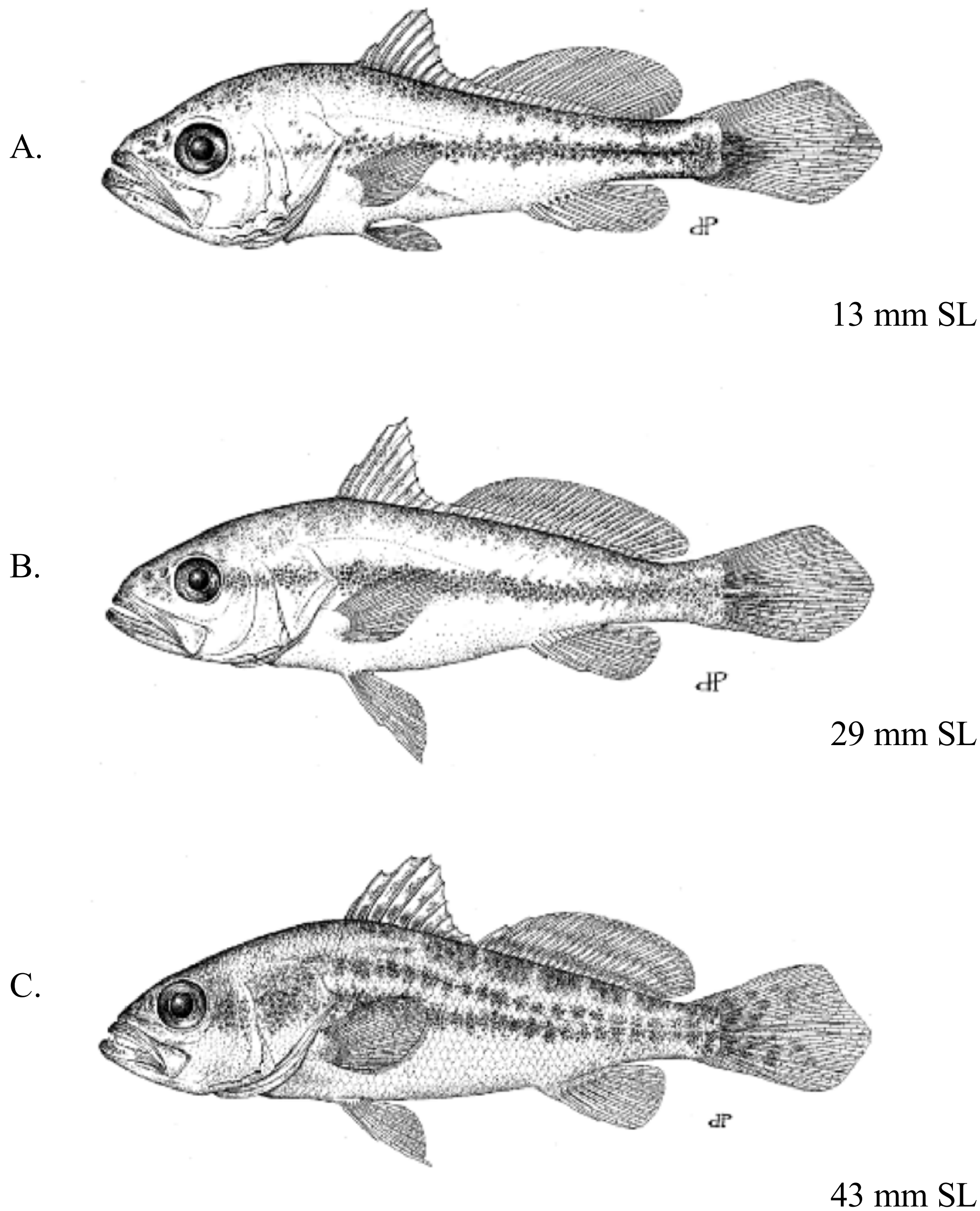

Figure 3.1. Developmental series for juvenile *Cynoscion nebulosus*. Printed with permission from Florida Department of Environmental Protection.

Fable et al. (1978) studied reared larvae and found many of the same morphological characteristics described previously by Hildebrand and Cable (1934). Pigmentation changed drastically from 16 hours to eight days and was variable. Four vertical pigment bands on larvae 16 hours post hatching became a wide, diffuse band just anterior of a point midway between the anus and the notochord tip by 40 hours post hatching and remained through 64 hours. Melanophores intensified over the dorsal and ventral margins and over the abdomen by six to eight days post hatching. Melanophores on the tail radiated dorsally and ventrally, and large melanophores were present just anterior of the anus, above and below the abdomen, and at the angle of the lower jaw (Fable et al. 1978).

From 9-11 days post hatching (average size 2.92 mm SL) teeth develop on the upper and lower jaws, and a small preopercular spine and branchiostegal rays are apparent. From 12-15 days post hatching, preopercular spines are prominent; caudal, dorsal, and anal fin rays are present; pectorals are still membranous; and notochord flexion occurs (Fable et al. 1978). Hildebrand and Cable (1934), however, did not observe dorsal and anal rays in specimens 3.0-3.6 mm. Principal body pigmentation during these periods appears as a dark stripe from snout to tail. Melanophores are also located along the lateral line (Fable et al. 1978) and along the ventral margin of the tail (Hildebrand and Cable 1934, Fable et al. 1978), but the characteristic dark melanophore anterior of the anus has dispersed. A single, dark melanophore appears on the caudal fin base.

A few descriptions of larval specimens between 5.0 and 12.0 mm occur in the literature. Spotted seatrout 7.0 and 7.8 mm were described by Pearson (1929) and Hildebrand and Cable (1934). Both studies noted an elongate, compressed body with a large pointed snout. Figures showed a large mouth; the presence of pectoral fin rays; well-developed soft dorsal, anal, and caudal fins; and rudimentary ventral and spinous dorsal fins. A dark band was present on either side of the eye, and the lips were dark. Melanophores appeared as a black stripe in the middle of the body between the soft dorsal and anal fins with a smaller group located on the ventral margin of the caudal peduncle (Pearson 1929, Hildebrand and Cable 1934).

Pearson (1929) and Hildebrand and Cable (1934) described larval specimens 10.0-12.0 mm, and 13.0 mm respectively. Both studies include descriptions of the larvae as having large mouth with protruding lower jaw, a low and pointed head with a rather long snout, developed but small and low ventral and spinous dorsal fins, and increased pigmentation along the midbody between the soft dorsal and anal fins. Hildebrand and Cable (1934) also observed small spines on the preopercular and interopercular margins but noted differences in fin placement from Pearson's (1929) description.

Juveniles from approximately 12-200 mm have been described by Welsh and Breder (1924), Pearson (1929), Hildebrand and Cable (1934), and Johnson (1978). At 16-20 mm, the body remains slender, and the large mouth is in the shape and position of adult fish. The caudal fin is described as "pointed" while the ventral and spinous dorsal fins have grown considerably reaching near-adult proportions. While scales are evident at 16 mm, fish become fully scaled at 20 mm, and the pigmentation of the midbody forms a dark somewhat undefined stripe extending from the snout to the caudal fin (Hildebrand and Cable 1934). From 25-30 mm, little change occurs in body proportions, but the lateral stripe is more prominent and defined, and it extends almost continuously through the middle of the caudal fin by about 35-40 mm (Welsh and Breder 1924, Pearson 1929, Hildebrand and Cable 1934). A similar, broken band extends along the head and on either side of the dorsal fins to the base of the caudal fin (Welsh and Breder 1924, Pearson 1929, Hildebrand and Cable 1934).

From about 40-60 mm, the body is deeper, the head is longer, the eye is larger, the maxillary is shorter, and the caudal fin is more pointed than in the adult (Welsh and Breder 1924). At about 60-80 mm (Hildebrand and Cable 1934) and 110-120 mm (Welsh and Breder 1924), both the lateral and dorsal bands have become numerous large spots or blotches on the upper half of the body. At about 110-120 mm, the larger, brownish spots become the smaller, black spots characteristic of adults and are scattered over the upper two-thirds of the body and on the dorsal and caudal fins.

Adult spotted seatrout were most extensively described by Jordan and Evermann (1898) and Hildebrand and Schroeder (1928). The following description was taken from Johnson (1978) with contributions from the authors above and others:

> Dorsal fin rays X (rarely IX or XI) - I, 24-28; anal fin rays II, 9-12 (typically 10-11); caudal fin rays 9+8, procurrent rays 6-9 + 5-7; ventral fin rays I, 5; lateral line scales 90-102, scales between anal fin origin and lateral line 11-12; vertebrae 13+12; gill rakers 6-9 on lower limb; branchiostegals 7; a pair of large canine-like teeth at tip of upper jaw; remaining teeth small conical, set in narrow bands with outer row slightly enlarged in upper jaw and inner row distinctly enlarged in jaw; no teeth on vomer, palatines, or tongue.
>
> Head 2.9-3.5, depth 3.4-4.5 in SL; snout 3.7-4.2, eye 4.4-5.3, interorbital 4.5-5.9, maxillary 2.2-2.3, pelvic fin 1.8-2.2 in head.
>
> Body elongate and somewhat compressed; back a little elevated; head long; snout pointed; mouth large, oblique; lower jaw projecting; maxillary reaching to or nearly to posterior margin of eye. Scales moderate, thin, all ctenoid, fins scaleless, except for 1-10 rows of small scales at dorsal and anal fin bases. Dorsal fin continuous or slightly separate, the spines weak, flexible; anal fin small, second spine very weak; caudal fin straight to somewhat emarginate. Preopercular margin smooth sometimes ciliated, never with strong serrations.
>
> Pigmentation: color dark gray above, with sky blue reflections, shading to a silvery below; upper parts of sides with numerous round black spots extending onto dorsal and caudal fins; fins pale to yellowish green.
>
> Readily distinguished from related species by the round black spots on upper parts of body and on dorsal and caudal fins, the small scales, and the scaleless median fins.

3.2.2 <u>Age and Growth</u>

Growth of spotted seatrout, expressed as an increase in length and/or weight, varies greatly by season, year, and area in the Gulf (Table 3.1). Habitat and environmental conditions including vegetation, salinity, temperature, food availability, competition, predation, and other factors are especially important for survival and growth (Miles 1950, Tabb 1958, Klima and Tabb 1959, Iversen and Tabb 1962, Tabb 1966, Fable et al. 1978, Lorio and Perret 1980, Taniguchi 1980, Arnoldi 1982, Peebles and Tolley 1988, McMichael and Peters 1989, Bumguardner and Maciorowski 1989). Iversen and Tabb (1962) suggested that independent groups of spotted seatrout may exist among Florida bays and that growth rates between these groups are density-dependent, i.e., faster growing fish should be in the least populated areas. Growth also varies with sex and age such that females usually grow faster than males (Guest and Gunter 1958, Tabb 1961, Overstreet 1983, Mercer 1984, Wieting 1989), and larvae and early juveniles grow more rapidly than adults (McMichael and Peters 1989).

Fable et al. (1978) observed that hatchery reared larvae grew from 1.5 mm at hatching to 4.5 mm at 15 days of age. Taniguchi (1981) also reared larvae and found that larvae about 7.6 mm metamorphosed 12 days after hatching. McMichael and Peters (1989) reported a similar growth rate for wild-caught larvae from Tampa Bay, Florida. Peebles and Tolley (1988) observed a larval growth rate of around 0.4 mm/day in southwest Florida. Growth rates of two day old larvae stocked in ponds and reared to juveniles in 20-30 days averaged 0.96±0.04 mm/day (Colura et al. 1992). McMichael and Peters (1989) provided the following equations to describe growth of early larvae and juveniles to 50 mm SL:

$$L = 0.509A$$

or

$$A = 2.476L - 0.012L^2$$

where L = standard length in mm
and A = age in days

Taniguchi (1980) reported that differences in larval growth rates are probably related to differences in food types and abundance.

Growth rates for juveniles also vary greatly based on the previously mentioned factors and conditions. Beginning at about 10-12 mm, juveniles grow rapidly throughout the warmer months following metamorphosis. McMichael and Peters (1989) reported growth rates of wild caught larval spotted seatrout as 13-18 mm/month during the fall. Juvenile spotted seatrout 25-100 mm TL, raised in stocked ponds, were reported to grow at a rate of 0.7 mm/day (Colura et al. 1991) while Sackett et al. (1979) reported growth rates in juveniles 100-112 mm TL at 2.08 mm/day in October and 0.33 mm/day in November. In laboratory experiments, Bumguardner and Maciorowski (1989) noted maximum specific growth rates for juvenile spotted seatrout (50-85 mm TL) of 2.39%/day at 28°C.

These reported growth rates for larvae and early juveniles are relatively similar throughout the Gulf States; however, reported growth rates for juveniles and adults over 100 mm TL vary greatly throughout the literature. These differences are due to biological, environmental, and habitat variations, as well as differences in study designs, techniques, and methods. Because of the extent of these differences as well as differences in age at maturity and maximum age, these parameters are discussed in the following subsections by individual state and scientific study.

Table 3.1. Length (mm, total length) at age of spotted seatrout. Techniques are for aging (scales or otoliths) and length at age (back calculated[1] and observed[2]) are indicated. The average length at age on the theoretical birthday.

State	Location	Sex	Author	Tech	Length (mm TL) at Age											
					1	2	3	4	5	6	7	8	9	10	11	12
FL	Apalachicola Bay	M	Klima and Tabb 1959	Scales[2]	141	225	295	357	399	431	----	----	----	----	----	----
FL	Florida Bay	M	Stewart 1961	Scales[1]	160	253	317	369	409	----	----	----	----	----	----	----
FL	Florida Bay	M	Rutherford 1982	Scales[1]	259	309	345	385	441	471	----	----	----	----	----	----
FL	Charlotte Harbor	M	Murphy and Taylor 1994	Otoliths[1]	237	305	345	384	417	480	500	550	585	----	----	----
FL	Apalachicola Bay	M	Murphy and Taylor 1994	Otoliths[1]	225	316	368	426	490	----	----	----	----	----	----	----
FL	Apalachicola Bay	F	Klima and Tabb 1959	Scales[2]	144	228	304	369	434	492	508	----	----	----	----	----
FL	Florida Bay	F	Stewart 1961	Scales[1]	170	282	332	405	469	506	525	----	----	----	----	----
FL	Florida Bay	F	Rutherford 1982	Scales[1]	253	314	362	415	470	490	567	----	----	----	----	----
FL	Charlotte Harbor	F	Murphy and Taylor 1994	Otoliths[1]	242	357	434	495	541	572	584	588	----	----	----	----
FL	Apalachicola Bay	F	Murphy and Taylor 1994	Otoliths[1]	234	376	478	564	631	631	----	----	----	----	----	----
AL	Baldwin County	C	Tatum 1980	Scales[2]	225	330	415	450	480	525	----	----	----	----	----	----
AL	Baldwin County	C	Wade 1984	Scales[1]	270	354	439	496	551	624	----	----	----	----	----	----
MS	Biloxi Bay	M	Warren 1995	Otoliths[1]	113	265	333	378	----	----	----	----	----	----	----	----
MS	Biloxi Bay	M	Warren and Engel 1997	Otoliths[2]	214	327	385	415	430	----	----	----	----	----	----	----
MS	Biloxi Bay	F	Warren 1995	Otoliths[1]	125	317	433	533	----	----	----	----	----	----	----	----
MS	Biloxi Bay	F	Warren and Engel 1997	Otoliths[2]	246	398	491	548	583	----	----	----	----	----	----	----
LA		M	Wieting 1989	Otoliths[1]	213	302	370	435	401	----	----	----	----	----	----	----
LA		F	Wieting 1989	Otoliths[1]	220	360	469	509	515	----	----	----	----	----	----	----
TX	Matagorda Bay	M	Colura et al. 1984	Scales[1]	182	250	302	344	392	431	----	----	----	----	----	----
TX	Galveston Bay	M	Maciena et al. 1987	Otoliths[1]	227	372	429	463	464	480	491	525	570	593	610	631
TX	All Bays	M	Colura personal communication	Otoliths[2]	295	347	388	419	443	462	476	488	496	----	----	----
TX	Matagorda Bay	F	Colura et al. 1984	Scales[1]	236	308	367	414	456	491	520	----	----	----	----	----
TX	Galveston Bay	F	Maciena et al. 1987	Otoliths[1]	209	421	520	588	612	635	657	674	705	----	----	----
TX	All Bays	F	Colura personal communication	Otoliths[2]	317	400	473	538	596	647	693	733	769	----	----	----

Methodologies used to age fish have improved greatly within the last decade. Until the mid 1980s, many investigators used scales to determine age by observing the banding that occurred on the scale margins which were believed to be annuli in most cases. More recently, ageing procedures have been revised and improved with the advent of otolith sectioning. Reading annual growth increments in otoliths gives a much more accurate and consistent estimate of age. Difficulties arise in comparing length-estimation techniques.

Length-at-age estimates and subsequent growth rates are usually derived from techniques that can give the best estimate of age and the best estimate of length at the known age. Back-calculated length at age is a technique that uses the relationship of otolith growth and growth in body length (preferably a direct linear relationship) to calculate the length a fish would have been when the fish was depositing an opaque ring on the otolith. Rings on the otolith, when validated by various methods, represent fixed increments of time. For most fish, the increment is an annual deposition of one opaque ring. The first ring, however, is usually not deposited one year from birth which introduces an error in assuming each ring can be directly related to age in whole years. This error is introduced in both back-calculated and observed age (length) at capture. An adjustment in the actual age at each opaque band is required. Even if adjustments to age are made, back calculation uses estimated lengths at age without actually having fish of that age available for verification. If only limited number of fish are available, this methodology represents the best available data. The use of observed length and age at capture is more widely used. This technique uses the observed length at capture and the number of rings observed on the otolith (or other hard part) and then refines the calendar year age of the fish by adjusting for the time from birth to the first ring formation and the time from the last ring formation to capture.

3.2.2.1 <u>Florida</u>

Growth of spotted seatrout in Florida is highly variable. Early studies relied on direct proportionality when reading scales to estimate spotted seatrout length at age (Klima and Tabb 1959, Moffett 1961, Stewart 1961, Iversen and Tabb 1962) while recent studies use more accurate techniques to back-calculate and observed length at the time of annulus formation using scales (Rutherford 1982) and otolith sections (Murphy and Taylor 1994) (Table 3.1). Rutherford (1982) used a correction factor for a non-zero y-intercept to back-calculate length at age to estimate growth of spotted seatrout in Everglades National Park from scales. His results were similar to previous growth estimates by Stewart (1961) for spotted seatrout at age-3 through age-7 but found age-1 and age-2 spotted seatrout to be larger than previous estimations. In addition, Rutherford (1982) also determined that female spotted seatrout in southeast Florida were significantly smaller than males at age-1 and larger after age-2 which contradicts earlier studies using direct proportionality.

Murphy and Taylor (1994) estimated similar growth rates to those of Rutherford (1982) for male spotted seatrout; however, their study indicated a linear growth rate for males and estimated a much higher growth rate for female spotted seatrout at age-1 slowing markedly with age suggesting asymptotic growth. The difference between the two studies is probably due to the increased reliability in otolith annuli when back-calculating length at age and the lack of small specimens in Murphy and Taylor's samples leading to an oversimplified growth equation for males. Maciena et al. (1987) also examined otolith data for spotted seatrout in the northwestern gulf and found higher growth rates than in previous studies using scales (Klima and Tabb 1959, Wade 1984).

3.2.2.2 Alabama

Data on age and growth of spotted seatrout is limited in Alabama waters. Two studies (Tatum 1980 and Wade 1984) utilized landings from annual fishing rodeos to examine growth of spotted seatrout from the Mobile Bay area (Table 3.1). Tatum (1980) indicated that although age-1+ fish do experience fishing mortality, only fast growing age-1+ fish show up in rodeo data due to the 11-inch size limit. Tatum's data indicated that spotted seatrout in the Mobile Bay area reach comparable if not greater sizes at scale annulus formation as the Texas spotted seatrout reported by Guest and Gunter (1958). The minimum size limit was changed after 1979 to 12 inches. Otolith work in progress may change current length-at-age calculations (AMRD unpublished data).

Similar results were found by Wade (1984). Also using catches from the fishing rodeo, Wade determined that there was no difference between male and female spotted seatrout based on the length-weight relationship. Wade was unable to locate male fish older than age-3+ but found females attaining ages of 6+. Both authors were unable to characterize growth prior to age-1 due to the lack of small fish which were excluded from the rodeo as undersized fish (12-inch minimum limit).

In 1995 and 1996, the Alabama Department of Conservation and Natural Resources/Marine Resource Division (ADCNR/MRD) (unpublished data) examined 521 female and 293 male spotted seatrout otoliths. The oldest female was age 7+, the oldest male was 8+ years.

3.2.2.3 Mississippi

Warren (1995) found high variability in length at age for both male and female spotted seatrout in Mississippi waters using back-calculated length at age from otolith measurements (Table 3.1). Subsequent studies (Warren et al. 1998) provided a total of 1,921 fish (1,490 female and 431 male) from 1992 to 1997 that were analyzed for number of opaque rings present on the sagittal otolith at the time of capture. A mean birth date of July 1 was determined from the appearance of postlarvae in seine and beam plankton net samples taken over a 25 year period in Mississippi waters. In conjunction with the number of rings observed on the otolith, the month of capture and the estimated average birthday, a calendar age was assigned to each fish to the nearest tenth of a year. Because wide variation in lengths occurred for most ages represented, an average age was computed. Ages ranged from 0 to 6+ years of age. The mean lengths at age were then fitted to the von Bertalanffy growth equation using a nonlinear, least-squares regression analysis. Females exhibited faster growth rate and attained a greater size at age than males (Table 3.1). Warren (personal communication) stated that growth decreased with age similar to the results from other studies of Gulf spotted seatrout populations indicating asymptotic growth in the Mississippi population. Asymptotic length was approximately 641 mm TL for males and 769 mm TL for females. While the oldest fish used in the analysis were 6+ years of age for both males and females, recent collections have included a single age-7 male.

3.2.2.4 Louisiana

Growth rates of spotted seatrout along the Louisiana coastline have been described by Arnoldi (1982) and Wieting (1989) (Table 3.1). In general, female spotted seatrout in Louisiana exhibit similar growth patterns to other Gulf populations with females growing faster than males and females achieving a larger maximum size (Wieting 1989). Wieting (1989) was unable to determine differential growth patterns between males and females due to a small number of fish greater than age-2 in her study.

3.2.2.5 Texas

Several studies have shown the high degree of variability that exists in spotted seatrout growth rates along the Texas coast (Aransas and Corpus Christi bays, Pearson 1929; Aransas and San Antonio bays, Miles 1951; Matagorda Bay, Colura et al. 1984; Galveston Bay, Maciena et al. 1987) (Table 3.1). These same studies indicate that female spotted seatrout experience a higher growth rate than males and reach a larger maximum size. Maciena et al. (1987) was the first study which used otoliths to estimate growth rates and back-calculate length at age for Texas spotted seatrout. Their results indicate much higher growth rates than previously reported, and while females did grow faster than males, both displayed asymptotic growth. Maciena et al. (1987) also noted a high degree of variability in growth within year classes and suggest that it is probably due to the prolonged spawning period of spotted seatrout.

Recent work by the Texas Parks and Wildlife Department (TPWD) has recovered otoliths from several coastal archaeological sites near the Corpus Christi Bay and upper Laguna Madre systems. Otoliths have been recovered from layers of strata dating from 1200 A.D. to 3000 B.C. Results indicate prehistoric growth rates were slower, but the authors caution this could be biased due to size selective fishing practiced by prehistoric cultures (Colura and Vickers 1998).

3.2.3 Genetics and Reproduction

3.2.3.1 Genetics

Various researchers have attempted to ascertain the genetic diversity of spotted seatrout in the Gulf and the possible existence of genetically distinct subpopulations. Early speculation was based on tagging studies that showed very little movement among bay systems (Iversen and Tabb 1962). Morphological differences such as shape and growth characteristics of scales and otoliths have also led to separate subpopulation conclusions (Colura and King 1989).

Weinstein and Yerger (1976) studied protein banding patterns and concluded there were separate subpopulations in each of seven estuaries from the east coast of Florida to Texas. They also reported that differences were more distinct with geographic distance with a “faunal break” occurring between populations on the Gulf coast of Florida and those west of the Mississippi River.

Other electrophoretic studies contradict genetic distinctions of separate subpopulations of spotted seatrout that are typical of some marine and anadromous species (Paschall 1986, Ramsey and Wakeman 1987, King and Pate 1992, King et al. 1995). King and Pate (1992), King and Zimmerman (1993), and King et al. (1995) reported clinal variations in allele frequencies and average individual heterozygocity for spotted seatrout collected along the Texas coast and noted that the degree of variation increased with distance apart. These studies, along with Ramsey and Wakeman (1987), found low levels of genetic variability, high gene flow, and little population differentiation and concluded that there was insufficient evidence for independent subpopulations (stocks). However, observed clinal variation in subpopulations may represent adaptations to spatially variable features (i.e., salinity); therefore, such "genetic structuring" should be considered carefully when making management decisions.

The most recent analysis of mitochondrial DNA haplotypes (Gold and Richardson 1998) confirms the presence of significant population substructuring among Gulf spotted seatrout and further suggests the existence of a unique subpopulation in the Laguna Madre, Texas. Gold et al. (1999) compared spotted seatrout across the Gulf of Mexico and parts of the Atlantic and determined that isolation-by-distance indeed occurs and may preclude Gulf-wide management of the species. This isolation could result from two sources; the first being natal site philopatry or homing, and the second being the limited migration away from natal bays or estuaries.

3.2.3.2 Reproduction

3.2.3.2.1 Maturation

Female spotted seatrout appear to begin maturation in the form of yolked ova beginning in March. The timing and duration of the spawning season across the northern Gulf varies slightly but generally begins in April and continues through September with two peak spawning periods in roughly May and August (Hein and Shepard 1979a, Tucker and Faulkner 1987, Wieting 1989). Because of their extended spawning season, spotted seatrout are considered multiple spawners (Brown-Peterson et al. 1988), capable of spawning many times during the reproductive season. Colura et al. (1988) pointed out that due to this extended season, the percentage of females spawning at any given time is difficult to determine.

The maturation of female spotted seatrout in Texas waters is a function of size, not age. Brown-Peterson et al. (1988) found 50% of 231-240 mm SL females, 91% of 271-280 mm SL females, and 100% of 281-290 mm SL females were reproductively mature. Bumguardner et al. (1998) reported no female spotted seatrout <270 mm TL were mature, 67% of females 270-320 mm TL were mature, and all females >320 mm TL were mature. Based on gonosomatic index and presence of postovulatory follicles, 68% of age-1 female spotted seatrout in Texas waters are sexually mature (Bumguardner et al. 1998). Hydrated oocytes have been observed in five age-1 spotted seatrout females collected in Texas bays (TPWD unpublished data). The presence and number of postovulatory follicles and hydrated oocytes are criteria used to estimate spawning frequency and batch fecundity in multiple spawning fish (Hunter et al. 1985, Hunter and Macewicz 1985). The presence of postovulatory follicles and hydrated oocytes in age-1 spotted seatrout females provides evidence of spawning by this age class of fish in Texas waters.

In Louisiana, Sundararaj and Suttkus (1962) dismissed the possibility of such young fish (age-1) actually spawning and suggested that although these fish were "mature," they would not actively spawn until their second summer. Similar findings by Warren (unpublished data) suggest that age-1 "mature" female spotted seatrout in a spent condition have not been collected in Mississippi waters providing further evidence that gonadal maturity does not imply active spawning. Crabtree and Adams (1998) showed that some age-0 spotted seatrout spawn in Indian River Lagoon.

These females contained hydrated oocytes and fresh post-ovulatory follicles during the spawning season.

3.2.3.2.2 Gonadal Development

Spotted seatrout are multiple spawners and intermittently produce batches of eggs over a protracted spawning period (Overstreet 1983, Hunter et al. 1985, Tucker and Faulkner 1987, Brown-Peterson et al. 1988, Wieting 1989). Gonadal development is continuous over the entire spawning period as each batch of eggs is produced, and in southwest Florida, development may be continuous throughout the year (Murphy and Taylor 1994). Throughout most of the Gulf, however, ripening generally begins in the early spring, perhaps as early as January (Adkins et al. 1979) but usually by late February to early March. Temperature, salinity, and photoperiod are key factors initiating gonadal development and spawning and will be discussed in detail in later sections. Hein and Shepard (1979a) noted that male gonads appeared to ripen earlier than females in a given year. Miles (1951) studied gonadal development in both maturing and adult spotted seatrout. He described seven stages of ovarian and testicular development and decline: 1) immaturity, 2) maturation, 3) granular, 4) ripe, 5) running, 6) spent, and 7) resting.

3.2.3.2.3 Fecundity and Spawning Frequency

It is difficult to estimate fecundity of a species that spawns in batches and has a protracted spawning season, e.g., spotted seatrout (Overstreet 1983). The wide variation of seasonal fecundity estimates could be the result of actual differences or differences in study design and techniques (Lassuy 1983) or both. Estimates of annual fecundity that do not consider continuous oocyte recruitment over the season or those that measure fecundity based on growing and vitellogenic oocytes probably underestimate annual fecundity (Brown-Peterson et al. 1988). In addition, the frequency of spawning reported in the literature may cause estimates of fecundity to be poorly estimated (Brown-Peterson et al. 1988). Consequently, the most accurate estimates of annual fecundity are obtained by determining the number of eggs spawned in a batch and multiplying by the number of batches produced in a season for various size and age groups (Hunter and Leong 1981, Conover 1985, Brown-Peterson et al. 1988, Wieting 1989). These estimates may be flawed because batch sizes may not be similar for individual fish over the spawning season (Colura et al. 1988). Significant error may also occur as a result of variations in oocyte counting techniques and the fact that some residual oocytes may degenerate and not be spawned (Overstreet 1983).

Fecundity estimates vary greatly based on the size and age of fish as well as geographic area and season. Environmental conditions (salinity, temperature, moon phase, etc.) may cause great variability by season; however, the size and age structure of populations in a given area can affect fecundity in both a particular season and over an extended period of time. Fecundity estimates may also vary because of differential growth rates and maturity schedules between sexes and sex ratios in a given area or season. Miles (1951) believed that actual spawning occurred over a period of several days to perhaps three or four weeks. In the laboratory, Tucker and Faulkner (1987) noted that spawning in tanks may occur every night for a 6-12 day period during spawning peaks. They also found that spawning may cease for up to 47 days and start again both continuously and intermittently. In Texas, Brown-Peterson et al. (1988) reported spawning frequencies for a six month season based on four different criteria: 1) running-ripe females (every 3.6 days or 50 times); 2) final oocyte maturation (every 2.3 days or 80 times); 3) post ovulatory follicles (every 7.6 days or 24 times); and 4) laboratory conditions (every 21 days or eight times). Considering a spawning year of April through September, Saucier and Baltz (1993) reported spawning every 16-21 days or about 8-11 times per year in Louisiana. Likewise, Tucker and Faulkner (1987) and Wieting (1989) noted that individual spotted seatrout spawned about eight times per spawning season in Florida and Louisiana waters. During April-September in 1995-1997, spotted seatrout in the southern Indian River Lagoon, Florida, spawned every 3.2 days (Crabtree and Adams 1998). Older fish spawned more frequently than did younger fish. For example, age-3 and 4 fish spawned every 2.5 days whereas age-0 and 1 fish spawned every 3.7-4.0 days. Adkins et al. (1979), Adkins and Bourgeois (1982), Tucker and Faulkner (1987), and McMichael and Peters (1989) have suggested a monthly periodicity in spawning associated with a full moon. Bumguardner et al. (1998) found age-1 spotted seatrout female spawning frequency of once every nine days, based on presence of post-ovulatory follicles. This was only slightly less frequent than the 7.6 days Brown-Peterson et al. (1988) reported based on the presence of post-ovulatory follicles.

Median batch fecundity was estimated by Colura et al. (1988) as 258 eggs/g of ovary-free body weight for naturally spawning spotted seatrout and 453 eggs/g for hormonally induced spawning fish. Brown-Peterson et al. (1988) calculated a mean batch fecundity of 451±43 eggs/g of ovary-free body weight from 14 fish with hydrated oocytes and no post-ovulatory follicles. For example, using the equation from Brown-Peterson et al. (1988) (batch fecundity = 459 x weight - 56,066), a 2 lb spotted seatrout spawning eight times in a season would produce about 3.0 million eggs. Relative fecundity for spotted seatrout in the Indian River, Florida, ranged from 156-656 oocytes per gram gonad-free body weight (Crabtree and Adams 1998). Batch fecundity (FEC) was related to gonad-free body weight (WT) by the relation: FEC = 5663 + 307.8 WT, n = 82, $r^2 = 0.761$.

Recent work by the TPWD (unpublished data) indicated that mean batch fecundity, based on hydrated egg counts, are 420 eggs/g TW. Mean $\pm$ SD batch and relative batch fecundity of age-1 spotted seatrout based on post-ovulatory follicle counts from histological samples were 320,557 $\pm$ 163,223 eggs/female and 1,089 $\pm$ 529 eggs/g body weight for all coastal areas combined (Bumguardner et al. 1998). Recently, 45 captive broodfish maintained at a state-operated fish hatchery in Texas spawned 251 million eggs over a nine month period (TPWD unpublished data).

3.2.3.2.4 Spawning

3.2.3.2.4.1 Season and Times

Spotted seatrout spawning season varies throughout the Gulf but begins as early as March and ends after October with peaks of activity occurring from April-July (Pearson 1929, Gunter 1945, Moody 1950, Miles 1951, Simmons 1951, Reid 1954, Klima and Tabb 1959, Springer and Woodburn 1960, Moffett 1961, Stewart 1961, Sundararaj and Suttkus 1962, Fontenot and Rogillio 1970, Jannke 1971, Christmas and Waller 1973, Rogillio 1975, Hein and Shepard 1979a, Lorio and Perret 1980, Arnoldi 1982, Colura et al. 1988, McMichael and Peters 1989, Wieting 1989). Spawning peaks usually occur in mid-summer (July and August) near the middle of the spawning season (Sundararaj and Suttkus 1962, Arnoldi 1982, Wieting 1989, Helser et al. 1993) but have been observed to occur as early as April or May (Klima and Tabb 1959, Hein and Shepard 1979a, Arnoldi 1982, Overstreet 1983, Tucker and Faulkner 1987, Brown-Peterson et al. 1988, Murphy and Taylor

1994). Unimodal or bimodal peaks in spawning activity of spotted seatrout can appear and may vary temporally and geographically (Stewart 1961, Hein and Shepard 1979a, Arnoldi 1982, Tucker and Faulkner 1987, Brown-Peterson and Thomas 1988, Wieting 1989). In southwest Florida and south Texas, spawning may occur over all months (Stewart 1961, Roessler 1967, Jannke 1971). Table 3.2 summarizes the timing of spotted seatrout spawning across the Gulf by state.

Table 3.2. Spotted seatrout spawning season by Gulf state. Citation for specific season is included in parentheses. Multiple time periods indicate multiple peak spawning seasons.

State	Spawning Season (Citation)
Florida	May; June - September (Tucker and Faulkner 1987) Spring; Summer (McMichael and Peters 1989) March - October (Moody 1950, Lorio and Perret 1980) April - May and Fall (Klima and Tabb 1959)
Alabama	May - May - September, peaks early June and late August (ADCNR/MRD unpublished data)
Mississippi	May - June; July - August (Overstreet 1983) April - October (Warren 1995)
Louisiana	April - October (Hein and Shepard 1979a, Wieting 1989)
Texas	April - October (Pearson 1929, Miles 1950, Brown-Peterson and Thomas 1988, Colura et al. 1988, Brown-Peterson et al. 1988)

Warren (1995) reports that gross observations of gonadal development corresponded with the timing of occurrence of postlarval spotted seatrout in monthly samples taken in Mississippi's coastal waters from 1974 to 1994. Postlarvae (<20 mm) were present in samples from April through October. Female ovaries were found to be in a ripe stage from April through August with the only running ripe fish observed in July. While no running ripe males were observed, fish with close to maximum developed testes were observed during April, May, and June.

Spawning generally begins around sunset (1800 hours) and continues for three or four hours (Mok and Gilmore 1983, Holt et al. 1985, Brown-Peterson et al. 1988, Saucier et al. 1992); however, some residual spawning may occur for up to six hours in Florida and Louisiana (Mok and Gilmore 1983, Saucier and Baltz 1993).

When spawning begins there are generally about 13.5 hours of daylight per day (Hein and Shepard 1979a, Tucker and Faulkner 1987). The combination of increasing photoperiod with temperature may initiate spawning; however, when spawning ceases in September-October, temperatures are typically higher suggesting that the decreasing photoperiod may be a more important factor in spawning cessation (Hein and Shepard 1979a, Tucker and Faulkner 1987, Brown-Peterson et al. 1988).

3.2.3.2.4.2 Courtship and Spawning Behavior

Male spotted seatrout are typically capable of spawning sooner in the season than females and generally move to spawning grounds earlier (Miles 1951, Hein and Shepard 1979a). During evening hours, males produce drumming or croaking sounds to attract females (Tabb 1966, Mok and Gilmore 1983). The red sonic muscle in the male spotted seatrout enlarges during the summer spawning season and becomes dormant during the winter months since sound production is primarily used for reproduction (Hein and Shepard 1979a).

Unlike other sciaenids, sound production in spotted seatrout appears to be exclusive to males (Smith 1907, Stewart 1961, Hein and Shepard 1979a). Females possess the red sonic muscle, but it appears to remain dormant throughout their life history (Smith 1907, Pearson 1929, Stewart 1961, Tabb 1966, Hein and Shepard 1979a). Four distinctive sounds are produced during spawning: 1) a grunt followed by a series of knocks, 2) aggregated grunts, 3) a long grunt, and 4) a staccato (Mok and Gilmore 1983, Saucier et al. 1992); however, their significance is speculative.

As spawning ensues, the school moves about with great intensity and much side-to-side contact (Miles 1950, Tabb 1966). As noted by Miles (1951), only slight pressure on the abdomen during the running stage will discharge sperm and ova, and the intensity of contact during spawning may cause the tissues around the pelvic fins, lower abdomen, and vent to become inflamed in males following spawning (Miles 1950).

3.2.3.2.4.3 Location and Effects of Salinity, Temperature, and Photoperiod

Spawning locations for spotted seatrout vary greatly based on habitat types and environmental conditions from year-to-year and within individual spawning seasons. These are described in detail in Section 4.5.

3.2.3.2.5 Incubation

Smith (1907) reported hatching in 40 hours after fertilization at 25°C; however, both Arnold et al. (1976) and Fable et al. (1978) reported hatching at 18 hours at 26°C. Fable et al. (1978) also noted that the incubation period was reduced to 15 hours at 27°C and increased to 21 hours at 23°C. TPWD biologists reported a 82% hatch rate within a range of 16-18 hours at 25°-28°C (TPWD unpublished data).

3.2.4 Parasites and Disease

Spotted seatrout may be infected by a wide variety of pathogens and parasites (Lorio and Perret 1980, Overstreet 1983), and many of those agents have probably not been adequately identified or described (Overstreet 1983). The most complete listing of parasites infecting spotted seatrout was developed by Overstreet (1983), and the following discussion includes his findings as well as those of other researchers.

The viral disease lymphocystis was found in spotted seatrout (Howse and Christmas 1970, Overstreet 1983), and various bacteria have been known to infect spotted seatrout, particularly when stressed by environmental conditions (e.g., low water temperatures) or injury (Overstreet and Howse 1977, Adkins et al. 1979). A common infestation has been termed "fin rot syndrome" and includes responses to both bacteria and fungi (Mahoney et al. 1973, Overstreet and Howse 1977, Sindermann 1979). Some potentially pathogenic bacteria infecting the spotted seatrout include species in the genera *Pseudomonas, Aeromonas, Vibrio*, and others (Overstreet and Howse 1977). Although most species usually do not have detrimental effects to the host, bacteria may be most influential on the survival of eggs and larvae (Overstreet 1983).

The protozoans *Amyloodinium ocellatum* and a trichodinid have been found on gills of spotted seatrout by Lawler (1980) and Overstreet (1983). Saunders (1954) observed *Haemogregarina* sp. in leucocytes of spotted seatrout, and Overstreet (1983) found *Pleistophora* sp. in the liver. Overstreet (1978, 1983) noted the presence of the myxozoan *Henneguya* sp. on the dorsal and caudal fins of spotted seatrout in Mississippi.

Perhaps the most conspicuous parasite of spotted seatrout to fishermen is the metacestode stage of the tapeworm *Poecilancistrium caryophyllum*. Infected fish are often referred to as 'spaghetti trout,' these whitish worms appear to be tunneled in the flesh of spotted seatrout. Although harmless to humans, the worms are repulsive to many people who refuse to eat infected spotted seatrout. The worms also do not appear to cause harm to adult spotted seatrout; however, they are seldom found in fish smaller than 140 mm SL suggesting that either smaller infected fish are killed or not infected due to spatial or temporal isolation or to the size of the intermediate host (Overstreet 1983). Spotted seatrout larger than 140 mm are usually infected with an average of 2.0-2.5 worms per fish; however, the number may increase in fish over 400 mm (Overstreet 1977), and Collins et al. (1984) reported a maximum of ten worms per spotted seatrout. Additionally, the prevalence of infection increases with size (virtually all spotted seatrout over 500 mm have at least one worm), and infestations are more prevalent in higher salinity areas and seasons (Overstreet 1983).

Overstreet (1977) also found a metacestode stage of tetrarhynchean in the muscle of spotted seatrout in Mississippi and Louisiana. Other tetrarhyncheans, including *Otobothrium crenacolle*, have been observed in the mesentery and viscera of spotted seatrout (Overstreet 1983). Tetraphyllidean cestodes of the group name *Scolex polymorphus* and other *Scolex* spp. have been reported from the digestive system of spotted seatrout; however, they do not cause any apparent harm.

The monogeneans *Neoheterobothrium cynoscioni* (as *Choriocotyle cynoscioni*), *Diplectanum bilobatum*, and *Cynoscionicola heteracantha* were reported from the gills of spotted seatrout in Florida, Mississippi, and Louisiana (Hargis 1955a, 1955b, 1956; Thatcher 1959, Overstreet 1983). Overstreet (1983) also found *N. cynoscioni* on the mouth and skin of spotted seatrout in Mississippi.

Considerably more digenetic flukes have been observed in spotted seatrout than any other kinds of parasites. *Stephanostomum interruptum* was observed in the spotted seatrout's intestine in Florida, Mississippi, Louisiana, and Texas (Sparks 1958, Sparks and Thatcher 1958, Nahhas and Short 1965, Overstreet 1983), and *Cardicola laruei* was found in the heart. *Bucephalus cynoscion* and *Bucephaloides caecorum* were reported in the pyloric caeca and other parts of the spotted seatrout digestive system in Mississippi, Louisiana, and Texas (Hopkins 1956; Sparks 1958, 1960;

Corkum 1967, 1968; Overstreet 1983). Overstreet (1983) found metacercaria, larval digenetic flukes, from the family Didymozoidae in the stomach of spotted seatrout in Mississippi. Hemiurids *Lecithochirium* sp. and *Parahemiurus merus* were reported from the stomach by Overstreet (1983) and Nahhas and Short (1965), respectively. Another metacercian, *Stomachicola magna,* was observed in muscles, parts of the body cavity, and organ walls by Loftin (1960), Nahhas and Short (1965), and Overstreet (1983). *Pleorchis americanus* was found in the intestines of spotted seatrout in Florida (Sogandares-Bernal and Hutton 1959, Hutton and Sogandares-Bernal 1960, Loftin 1960, Hutton 1964, Nahhas and Short 1965, Nahhas and Powell 1971, Overstreet 1983).

Nematode juveniles (*Hysterothylacium* type SMA, MB, and MD) have been reported from the mesentery of spotted seatrout (Deardorff and Overstreet 1981), and one of these, type MB, can cause mucosal hemorrhaging and focal eosinophilia in rhesus monkeys, white mice, and probably humans (Overstreet and Meyer 1981). The adult nematode *Spirocamallanus cricotus* was detected in the intestine, and an undescribed Philometrinae was found encapsulated in the mouth (Overstreet 1983).

Numerous crustacean parasites are common on the gills and in the mouth of spotted seatrout. The copepod *Lernanthropus gisleri* was observed on gills in Florida, Louisiana, and Texas by Bere (1936), Pearse (1952), and Causey (1953a, 1953b). Also, *L. pomatomi*, *L. pupa, Caligus bonito, C. praetextus,* and *C. rapax* were found on the gills in Texas (Causey 1953b, Simmons 1957). *Caligus sciaenops* was noted on the roof of the mouth, and *Cybicola elongata* was also found (Pearse 1952). Cressey (1978) and Overstreet (1983) identified the branchiuran *Argulus alosae* from the mouth and gills of spotted seatrout in Mississippi.

The isopod *Lironeca ovalis* is one of the most conspicuous external parasites of spotted seatrout (Overstreet 1983). It usually attacks the gills of younger fish and may cause stunted growth and mortalities (Pearson 1929, Overstreet 1983). *Cymothoa exigua* was also found on the gill arches by Comeaux (1942).

3.2.5 Feeding, Prey, and Predators

Spotted seatrout have been characterized as opportunistic carnivores (Perret et al. 1980) that feed primarily on crustaceans and fish (Pearson 1929, Gunter 1945, Miles 1950, Moody 1950, Klima and Tabb 1959, Tabb 1961, Lorio and Schafer 1966, Tabb 1966, Fontenot and Rogillio 1970, Rogillio 1975, Peeler et al. 1976, Adkins et al. 1979, Adkins and Bourgeois 1982, Hettler 1989). Primary components of spotted seatrout diets have been reported to vary based on the size of fish (Gunter 1945, Moody 1950, Seagle 1969, Futch 1970, Dietz 1976, Perret et al. 1980, McMichael and Peters 1989) and season (Gunter 1945, Tabb 1961, Lorio and Schafer 1966, Dietz 1976); however, availability is probably the most important factor in food selection (Gunter 1945, Tabb 1961, Lorio and Schafer 1966, Tabb 1966, Fontenot and Rogillio 1970, Futch 1970, Rogillio 1975). Although seasonal changes may affect the availability of certain food organisms, primary food sources may vary considerably based on habitat types throughout the Gulf (Dietz 1976, Perret et al. 1980, McMichael and Peters 1989).

Larvae and juvenile spotted seatrout have been reported to feed primarily on invertebrates (Moody 1950, Springer and Woodburn 1960, Seagle 1969). Houde and Lovdal (1984) reported that larval spotted seatrout feed primarily on copepod nauplii, copepodites, and adult copepods with larvae of tintinnids, bivalves, and gastropods also present in stomachs. McMichael and Peters (1989) found that copepods were the predominant food for spotted seatrout larvae <15 mm. Juvenile spotted seatrout were shown to feed primarily on increasingly larger invertebrates from copepods, amphipods, and mysids to caridean shrimp (Moody 1950, Springer and Woodburn 1960, Tabb 1966, Dietz 1976, and McMichael and Peters 1989); however, McMichael and Peters (1989) stated that many studies have reported fish as food in spotted seatrout as small as 15-30 mm; and Arnold et al. (1976) observed cannibalism beginning at ten days of age. Mason and Zengel (1996) examined juvenile spotted seatrout between 10-100 mm TL and reported a reliance on decapod crustaceans. Copepods, amphipods, grass shrimp, species of *Penaeus*, and a few small fish were the major diet components for spotted seatrout less than 60 mm TL (Mason and Zengel 1996). After 60 mm TL, a shift was noted in the diets to include larger prey (fish and shrimp) and a move away from consumption of copepods and amphipods (Mason and Zengel 1996). Moody (1950) noted that penaeid shrimp became the predominant food from about 150-250 mm; however, other researchers have reported a lack of importance of penaeids at this size (Darnell 1958, McMichael and Peters 1989).

Literature varies on the importance of invertebrates, particularly penaeid shrimp, in the diets of adult spotted seatrout. Pearson (1929), Gunter (1945), Kemp (1949), and Stewart (1961) reported that penaeid shrimp were the main food item of adult spotted seatrout when they were available, and Rogillio (1975) found that crustaceans occurred more frequently than fish in stomachs containing food. Other studies noted that fish became the dominant food for adult spotted seatrout, particularly those over 350 mm (Darnell 1958, Moody 1950, Seagle 1969, Fontenot and Rogillio 1970, Adkins et al. 1979, Lorio and Perret 1980). Finfish species reported as prey include: anchovies (*Anchoa* spp.), mullets (*Mugil* spp.), Atlantic croaker (*Micropogonias undulatus*), Gulf menhaden (*Brevoortia patronus*), mojarras (*Eucinostomus* spp.), sailors choice (*Haemulon parra*), code goby (*Gobiosoma robustum*), sheepshead minnows (*Cyprinodon variegatus*), and others (Miles 1951, Darnell 1958, Lorio and Schafer 1966, Tabb 1966, Overstreet 1983).

Darnell (1958) examined stomach volumes and concluded that spotted seatrout fed more heavily in early to midmorning. He also noted that while feeding spotted seatrout appeared to regurgitate portions of food which floated to the surface and created an oil slick. This phenomenon would explain why fishermen often look for "slicks" when attempting to locate feeding and schooling spotted seatrout.

Adkins et al. (1979) observed that record shrimp harvests were occurring during their food habits study; however, spotted seatrout were not utilizing them to any great extent. Although shrimp, *Penaeus aztecus*, were present, Miles (1951) found that mullet were the preferred food for spotted seatrout. Darnell (1958) speculated that *P. aztecus* and *P. setiferus* may be a lesser food source because their burrowing habits make them more difficult to catch. This hypothesis is supported by Minello and Zimmerman (1984) who found that spotted seatrout selected juvenile *P. aztecus* over juvenile spot, *Leiostomus xanthurus*, and juvenile pinfish, *Lagodon rhomboides*, in tanks without substrate.

Although Odum (1971) and Day et al. (1973) considered spotted seatrout as a "top carnivore" feeding near the top of the food web (Johnson and Seaman 1986), they are also a prey for numerous other species. A partial list of spotted seatrout predators includes: striped bass (*Morone saxatilis*), snook (*Centropomus undecimalis*), tarpon (*Megalops atlanticus*), alligator gar (*Lepisosteus spatula*), great barracuda (*Sphyraena barracuda*), Spanish mackerel (*Scomberomorus maculatus*), king mackerel (*Scomberomorus cavalla)*, bluefish (*Pomatomus saltatrix*), silver perch (*Bairdiella chrysoura*), gafftopsail catfish (*Bagre marinus*), crevalle jack (*Caranx hippos*), and mangrove snapper (*Lutjanus griseus*) (Klima and Tabb 1959).

3.2.6 Behavior

Few references to behavior of spotted seatrout are available in the literature. Arnold et al. (1976) described feeding behavior of larval spotted seatrout. They noted that at three to seven days of age, spotted seatrout dispersed throughout the water column and fed on prey within one to two body lengths. At 7-14 days of age, larvae stalked prey by moving slowly to within a body length and then lunging forward to capture it. Tabb (1966) stated that movements of spotted seatrout are usually slow and deliberate except when frightened or feeding, when short darting or dashing motions were observed.

Schooling behavior in spotted seatrout was described by Tabb (1966). He stated that schooling began at 6-8 weeks of age (1-2 inches in length) and continued until about 5-6 years of age. Fish in excess of six years of age were primarily large, semi-solitary females referred to by fishermen as “sow” or “gator” trout (Tabb 1966).

Sound production is generally associated with courtship and spawning behavior (Tabb 1966, Mok and Gilmore 1983, Saucier et al. 1992, Saucier and Baltz 1993) and were previously described in Section 3.2.3.2.4.2.

3.2.7 Movement and Migration

Various tagging studies throughout the Gulf have confirmed that spotted seatrout are basically nonmigratory (Moffett 1961, Ingle et al. 1962, Iversen and Tabb 1962, Topp 1963, Beaumariage and Wittick 1966, Fontenot and Rogillio 1970, Rogillio 1975, Adkins et al. 1979, Rogillio 1980, Arnoldi 1982, Baker et al. 1986, Bryant et al. 1989, Marwitz 1989, Baker and Matlock 1993). In Florida, spotted seatrout seldom moved more than 30 miles from the point of release, and most fish never left the estuary. However, a few fish moved considerable distances (Moffett 1961, Iversen and Tabb 1962). Moffett (1961) compared tagging results from three areas in Florida: Apalachicola, Cedar Key, and Fort Meyers. He found that the least frequency of movement occurred in the Fort Meyers area with only one fish moving more than 30 miles (traveling 95 miles to the north); greatest frequency of movement occurred in the Cedar Key area with 18 fish traveling more than 30 miles (mostly to the south and up to 180 miles); however, this area had the lowest percentage of returns. The Apalachicola area exhibited the highest recovery rate (17.3%), but only three fish moved more than 30 miles. One fish, however, moved the greatest distance (315 miles to Grand Isle, Louisiana).

Of the 477 spotted seatrout tagged in Alabama, 58 returns were received, and 53% exhibited no movement. The greatest tendency of movement was westward, but the greatest distance moved was less than 32 km. Tagging data from Mississippi have also supported the conclusion that spotted seatrout are primarily recaptured in the same area as released, and movement was generally less than 32 km.

Warren et al. (1998) reported that of the 7,423 spotted seatrout tagged in Mississippi's coastal waters, 221 (3%) were recaptured. Of the 221 fish recaptured, 199 (90%) were recaptured within 8 km of their release location.

Adkins et al. (1979) tagged over 2,600 spotted seatrout and received 30 returns with 20 coming from the release point. Similar findings were reported by Rogillio (1980, 1982) with 98% of the returns coming within 1.5 km of the release point; however, Arnoldi (1982) noted that two spotted seatrout tagged in Calcasieu Lake were recaptured over 160 km east in Atchafalaya Bay, Louisiana. Bowling (1996) indicated that of 20,912 spotted seatrout released in Texas marine waters, 1,367 were recaptured. About 84% were caught in the same bay where released, 8% were caught in another bay, and 5% were recaptured in the Gulf. Of 588 spotted seatrout tagged in the Gulf surf, 14 were recaptured (12 in the Gulf and two in Texas bays). The greatest distance traveled by any Texas spotted seatrout released in the Gulf was 106 km and in the bay, was 219 km. These findings were similar to those of Guest and Gunter (1958), Bryan (1971), Simmons and Breuer (1976), Matlock and Weaver (1979), McEachron and Matlock (1980), Baker et al. (1986), and Baker and Matlock (1993).

Various researchers have speculated on the reasons for spotted seatrout movements and migrations. Spotted seatrout have been reported to move to deeper waters as winter and colder temperatures approach (Pearson 1929, Tabb 1958, Tabb 1966, Fontenot and Rogillio 1970, Adkins et al. 1979, Rogillio 1980, Rogillio 1982, Baker et al. 1986) and to the nearest deep waters with severe cold fronts (Adkins et al. 1979, Rogillio 1980, Rogillio 1982). Movements by spotted seatrout in the spring have been suggested as a precursor to spawning (Simmons 1951, Iversen and Tabb 1962, Adkins et al. 1979, Baker et al. 1986, Helser et al. 1993). General movement between bayous (deep water) and bays (shallow water) occur several times during the year possibly in response to temperature changes and spawning urges (Baker et al. 1986). Abrupt changes in salinity resulting from hurricanes and floods have been reported to cause movements by spotted seatrout (Tabb 1966). Helser et al. (1993) noted that spotted seatrout may move to preferred salinities; however, biotic and abiotic factors associated with salinity may be involved.

Lastly, food availability may be a key factor influencing movement by spotted seatrout (Guest and Gunter 1958, Rogillio 1982, Arnoldi 1984, Helser et al. 1993). Rogillio (1982) stated that the response to food availability could be as strong as or stronger than the response to temperature changes. Deegan and Thompson (1985) observed an inshore movement in the fall by other sciaenids (*Cynoscion arenarius* and *M. undulatus*) in response to up-river migrations of juvenile Gulf menhaden, *B. patronus*, and bay anchovy, *A. mitchilli*.

3.3 Aquaculture

In six years of saltwater pond culture of spotted seatrout larvae on the central Texas coast, Colura et al. (1992) found that polychaete larvae density, especially during the latter days of culture, was statistically the most significant factor associated with production of larvae to 30 mm TL. Polychaete larvae are thought to have provided the additional forage necessary for survival to a size that would allow successful harvest and handling of the juvenile fish. Water quality parameters measured explained little of the variation observed among production rates. Temperature appeared to play the most important role, having a slight negative relationship to production as temperature increased from 24° to 29°C. Salinity had only a minor role in production, although marked declines in percent harvest at salinities less than approximately 17‰ were observed. Low survival in ponds with <17‰ may have been more of a response to inadequate forage than to the direct effect of salinity since those ponds typically had fewer polychaete larvae. In support of this hypothesis, lowest mean salinities observed in this study (14‰) fell well within the 5‰-30‰ salinity range spotted seatrout typically inhabit (Tabb 1966). Further, 14‰ salinity is close to the 15‰ salinity reported as one of the best salinities for successful hatching of spotted seatrout eggs from Matagorda Bay, Texas (Gray and Colura 1988). It appeared that spotted seatrout juveniles can withstand dissolved oxygen concentrations of 1 ppm at least on occasion without production being affected.

4.0 DESCRIPTION OF THE HABITAT OF THE STOCK(S) COMPRISING THE MANAGEMENT UNIT

4.1 Description of Essential Habitat

The GSMFC has endorsed the definition of essential fish habitat (EFH) as found in the NMFS guidelines for all federally-managed species under the revised Magnuson-Stevens Act of 1996. The NMFS guidelines define EFH as:

> "those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. For the purpose of interpreting the definition of essential fish habitat: 'Waters' include aquatic areas and their associated physical, chemical, and biological properties that are widely used by fish, and may include aquatic areas historically used by fish where appropriate; 'substrate' includes sediment, hard bottom, structures underlying the waters, and associated biological communities; 'necessary' means the habitat required to support a sustainable fishery and the 'managed species' contribution to a healthy ecosystem; and 'spawning, breeding, feeding, or growth to maturity' covers a species' full life cycle."

For the purposes of describing those habitats that are critical to spotted seatrout in this FMP, we will utilize this definition but refer to such areas as "essential habitats" to avoid confusion with the EFH mandates in the Magnuson-Stevens Act. These mandates include the identification and designation of EFH for all federally-managed species, development of conservation and enhancement measures including those which address fishing gear impacts, and required federal agency consultation regarding proposed adverse impacts to those habitats.

4.2 Gulf of Mexico

Although spotted seatrout are basically nonmigratory (Section 3.2.7), spawning occurs throughout the summer months (Section 3.2.3.2.4, Table 3.2) and over a wide range of habitat types and locations (Section 4.5). An overview of the prevailing Gulf circulation, sediments, and inshore nursery characteristics is key in understanding how young spotted seatrout are passively and actively transported through critical habitats toward maturity.

Galstoff (1954) summarized the geology, marine meteorology, oceanography, and biotic community structure of the Gulf of Mexico. Later summaries include those of Jones et al. (1973), Beckert and Brashier (1981), Holt et al. (1982), and the GMFMC (1998). In general, the Gulf is a semi-enclosed basin connected to the Atlantic Ocean and Caribbean Sea by the Straits of Florida and the Yucatan Channel, respectively. The Gulf has a surface water area of about 1,600,000 km^2 (GMFMC 1998); a coastline measuring 2,609 km; one of the most extensive barrier island systems in the United States; and is the outlet for 33 rivers and 207 estuaries (Buff and Turner 1987). Oceanographic conditions throughout the Gulf are influenced by the Loop Current and major episodic freshwater discharge events from the Mississippi/Atchafalaya rivers. The Loop Current directly affects species dispersal throughout the Gulf while discharge from the Mississippi/Atchafalaya rivers creates areas of high productivity that are occupied by many commercially and recreationally important marine species.

The Gulf coast wetlands and estuaries provide habitat for an estimated 95% of the finfish and shellfish species landed commercially and 85% of the recreational catch of finfish landed in the United States Gulf of Mexico (Thayer and Ustach 1981). Five of the top-ten commercial fishery ports in the United States are located in the Gulf and account for an estimated 559.7 million kg of fish and shellfish harvested annually from the Gulf (USDOC 1998). The Gulf fishery accounts for 18% of the nation's total commercial landings and supports the most valuable shrimp fishery in the United States (USDOC 1998). Additionally, the Gulf of Mexico's wetlands, coastal estuaries, and barrier islands also support large populations of wildlife (e.g., waterfowl, shorebirds), play a significant role in flood control and water purification, and lessen wind damage and storm surges from hurricanes.

4.2.1 Circulation Patterns and Tides

Hydrographic studies depicting general circulation patterns of the Gulf of Mexico include those of Parr (1935), Drummond and Austin (1958), Ichiye (1962), Nowlin (1971), and Jones et al. (1973). Circulation patterns in the Gulf are dominated by the influence of the upper-layer transport system of the western North Atlantic. Driven by the northeast trade winds, the Caribbean Current flows westward from the junction of the Equatorial and Guiana Current, crosses the Caribbean Sea, and continues into the Gulf through the Yucatan Channel eventually becoming the eastern Gulf Loop Current. Upon entering the Gulf through the Yucatan Channel, the Loop Current transports 700-840 thousand m^3/sec of water (Cochrane 1965).

Moving clockwise, the Loop Current dominates surface circulation in the eastern Gulf and generates permanent eddies over the western Gulf. During late summer and fall, the progressive expansion and intrusion of the loop reaches as far north as the continental shelf off the Mississippi River Delta. Nearshore currents are driven by the impingement of regional Gulf currents across the shelf, passage of tides, and local and regional wind systems. The orientation of the shoreline and bottom topography may also place constraints on speed and direction of shelf currents.

When the Loop Current is north of 27° N latitude, a large anticyclonic eddy about 300 km in diameter usually separates. These warm core eddies originate as pinched off northward penetrations of Loop Current meanders. In the following months, the eddy migrates westward at about 4 km/day until it reaches the western Gulf shelf where it slowly disintegrates over a span of months. The boundary of the Loop Current and its associated eddies is a dynamic zone with meanders and strong convergences and divergences that can concentrate planktonic organisms including fish eggs and larvae.

Gulf tides are small and noticeably less developed than along the Atlantic or Pacific coasts. Normal tidal ranges are seldom more than 0.5 m. Despite the small tidal range, tidal current velocities are occasionally high, especially near the constricted outlets that characterize many of the bays and lagoons. Tide type varies widely throughout the Gulf with diurnal tides (one high tide and one low tide each lunar day of 24.8 hrs) existing from St. Andrew's Bay, Florida, to western Louisiana. The tide is semi-diurnal in the Apalachicola Bay area of Florida and mixed in west Louisiana and Texas.

4.2.2 Sediments

Two major sediment provinces exist in the Gulf of Mexico: carbonate sediments found predominantly east of Desoto Canyon and along the Florida west coast and terrigenous sediments commonly found west of Desoto Canyon and into Texas coastal waters (GMFMC 1998). Bottom sediments are coarse in nearshore waters extending northward from the Rio Grande River to central Louisiana and are also the dominant bottom type in deeper waters of the central Gulf. Fine sediments are common in the central Gulf and south of the Rio Grande due to the influence of the Mississippi and Rio Grande, respectively, and are also found in deeper shelf waters (>80 m) (Darnell et al. 1983).

West of Mobile Bay, fine-grained organic-rich silts and clays of terrestrial origin are brought to the shelf by distributaries of the Mississippi, Pearl, and other rivers (Darnell and Kleypas 1987). These fine sediments spread eastward from the Louisiana marshes to Mobile Bay, but off the Mississippi barrier islands, they are interrupted by a band of coarser, quartz sand. Fine sediments are also found southwestward of the Everglades extending the full length of the Florida Keys. Another area of fine sediments lies along the eastern flank of DeSoto Canyon.

Quartz sand predominates in the nearshore environment from the Everglades northward along the coast of Florida. However, from below Apalachicola to Mobile bays, it covers the entire shelf except the immediate eastern flank of DeSoto Canyon. The outer one-half to two-thirds of the Florida shelf is covered with a veneer of carbonate sand of detrital origin. Between the offshore carbonate and nearshore quartz, there lies a band of mixed quartz/carbonate sand.

4.2.3 Submerged Vegetation

Submerged vegetation comprised an estimated 1,475,000 ha of seagrasses and associated macro algae in the estuarine and shallow coastal waters of the Gulf in 1983 (Holt et al. 1983). Turtle grass *(Thalassia testudinum)*, shoal grass (*Halodule wrightii*), manatee grass (*Syringodium filiforme*), star grass (*Halophila engelmanni*), and widgeon grass (*Ruppia maritima*) are the dominant seagrass species (GMFMC 1998). Distribution of seagrasses in the Gulf throughout the mid 1980s was predominant (98.5%) along the Florida and Texas coasts (Minerals Management Service 1983) with 910,000 ha of seagrass located on the west Florida continental shelf, contiguous estuaries, and embayments (Iverson and Bittaker 1985). Macro algae species including *Caulerpa*, *Udotea*, *Sargassum*, and *Penicillus* are found throughout the Gulf but are most common on the west Florida shelf and in Florida Bay.

Loss of seagrass beds has occurred Gulf wide, and the extent of recovery varies. For example, Mississippi has seen an approximate 50% loss of submerged vegetation from 1969 to 1992. Since 1992, submerged vegetation has increased primarily due to increased abundance of shoal grass (Moncreiff et al. 1998).

4.2.4 Emergent Vegetation

Emergent vegetation is not evenly distributed along the Gulf coast. Marshes in the Gulf of Mexico consist of several species of marsh grasses, succulents, mangroves, and other assorted marsh compliments. In Texas, emergents include shore grass (*Monanthochloe littoralis*), saltwort (*Batis maritima*), smooth cordgrass (*Spartina alterniflora*), saltmeadow cordgrass (*Spartina patens*), saltgrass (*Distichlis spicata*), black needlerush (*Juncus roemerianus*), coastal dropseed (*Sporobolus virginicus*), saltmarsh bulrush (*Scirpus robustus*), annual glasswort (*Salicornia bigelovii*), seacoast bluestem (*Schizachyrium scoparium*), sea blite (*Suaeda linearis*), sea oat *(Uniola paniculata*), and gulfdune paspalum (*Paspalum monostachyum*) (Diener 1975, GMFMC 1998). The southern-most reaches of Texas also have a few isolated stands of black mangrove (*Avicennia germinans*). Over 247,670 ha of fresh, brackish, and salt marshes occur along the Texas coastline.

Louisiana marshes comprise more than 1.5 million ha or over 60% of all the marsh habitat in the Gulf (GMFMC 1998). They include a diverse number of species including smooth cordgrass, glasswort, black needlerush, black mangrove, saltgrass, saltwort, saltmeadow cordgrass, threecorner grass (*Scirpus olneyi*), saltmarsh bulrush, deer pea (*Vigna luteola*), arrowhead (*Sagittaria* sp.), wild millet (*Echinochloa walteri*), bullwhip (*Scirpus californicus*), sawgrass (*Cladium jamaicense*), maiden cane *(Panicum hemitomon*), pennywort (*Hydrocotyl*e sp.), pickerelweed (*Pontederia cordata*), alligator-weed (*Alternanthera philoxeroides*), and water hyacinth (*Eichhornia crassipes*) (Perret et al. 1971).

Mississippi and Alabama, combined, have 40,246 ha of mainland marsh habitat (26,237 and 14,009 ha, respectively). Mississippi marshes were dominated by black needlerush, smooth cordgrass, saltmeadow cordgrass, and threecorner grass (Eleuterius 1973, Wieland 1994). Other common species of saltmarsh vegetation include saltgrass, torpedo grass (*Panicum repens*), sawgrass, saltmarsh bulrush, sea myrtle (*Baccharis halimifolia*), sea ox-eye (*Borrichia frutescens*), marsh elder (*Iva frutescens*), wax myrtle (*Myrica cerifera*), poison bean (*Sesbania drummondii*), pennywort, and marsh pink (*Sabatia stellaris*) (C. Moncreiff personal communication). Alabama marshes contain the same complement of species as Mississippi with the addition of big cordgrass (*Spartina cynosuroides*), common reed (*Phragmites communis*), and hardstem bullrush (*Scirpus californicus*). In addition, the barrier islands within Mississippi Sound contain about 860 ha of saltmarsh habitat (GMFMC 1998).

Florida's west coast and panhandle include 213,895 ha of tidal marsh (GMFMC 1998). Emergent vegetation is dominated by black needlerush but also includes saltmarsh cordgrass, saltmeadow cordgrass, saltgrass, perennial glasswort (*Salicornia perennis*), sea ox-eye, saltwort, and sea lavender (*Limonium carolinianum*). An additional 159,112 ha of Florida's west coast is covered in red mangrove (*Rhizophora mangle*), black mangrove, and buttonwood (*Conocarpus erectus*). A fourth species, white mangrove (*Laguncularia racemosa*), occurs on the west coast but is much less abundant.

4.3 Estuaries

Gulf estuaries provide essential habitat for a variety of commercially and recreationally important species, serving primarily as nursery grounds for juveniles but also as habitat for adults during certain seasons. The Gulf of Mexico is bordered by 207 estuaries (Buff and Turner 1987) that extend from Florida Bay to Lower Laguna Madre. The Cooperative Gulf of Mexico Estuarine Inventory (GMEI) reported 5.62 million ha of estuarine habitat in the Gulf States including 3.2 million ha of open water and 2.43 million ha of emergent tidal vegetation (Lindall and Salomon

1977). Emergent tidal vegetation includes 174,000 ha of mangrove and one million ha of salt marsh (USDOC 1991); submerged vegetation covers 324,000 ha of estuarine bottom throughout the Gulf (GMFMC 1998). Most of the Gulf's salt marshes are located in Louisiana (63%), whereas the largest expanses of mangroves (162,000 ha) are located along the southern Florida coast (GMFMC 1998).

4.3.1 Eastern Gulf

The eastern Gulf of Mexico extends from Florida Bay northward to Perdido Bay on the Florida/Alabama boundary and includes 40 estuarine systems covering 1.2 million ha of open water, tidal marsh, and mangroves (McNulty et al. 1972). Considerable changes occur in the type and acreage of submergent and emergent vegetation from south to north. Mangrove tidal flats are found from the Florida Keys to Naples. Sandy beaches and barrier islands occur from Naples to Anclote Key and from Apalachicola Bay to Perdido Bay (McNulty et al. 1972). Tidal marshes are found from Escambia Bay to Florida Bay and cover 213,895 ha with greatest acreage occurring in the Suwanee Sound and Waccasassa Bay. The coast from Apalachee Bay to the Alabama border is characterized by wide, sand beaches situated either on barrier islands or on the mainland. Beds of mixed seagrasses and/or algae occur throughout the eastern Gulf with the largest areas of submerged vegetation found from Apalachee Bay south to the tip of the Florida peninsula. About 9,150 ha of estuarine area, principally in Tampa Bay, have been filled for commercial or residential development (GMFMC 1998).

Coastal waters in the eastern Gulf may be characterized as clear, nutrient-poor, and highly saline. Rivers which empty into the eastern Gulf carry little sediment load. Primary production is generally low except in the immediate vicinity of estuaries or on the outer shelf when the nutrient-rich Loop Current penetrates into the area. Presumably, high primary production in frontal waters is due to the mixing of nutrient rich, but turbid, plume water (where photosynthesis is light limited) with clear, but nutrient poor, Gulf of Mexico water (where photosynthesis is nutrient limited), creating good phytoplankton growth conditions (GMFMC 1998).

4.3.2 Northern Central Gulf

The northern central Gulf includes Alabama, Mississippi, and Louisiana. Total estuarine area for Louisiana includes 29 major water bodies covering 2.9 million ha of which 1.3 million ha is surface water and 1.5 million ha is marsh (Perret et al. 1971). The eastern and central Louisiana coasts are dominated by sandy barrier islands and associated bays and marshes. The most extensive marshes in the United States are associated with the Mississippi/Atchafalaya river deltas. Loss of wetlands along the Louisiana Coastal Zone is estimated to be 6,600 ha/yr (USEPA 1994). The shoreline of the western third of Louisiana is made up of sand beaches with extensive inland marshes. A complex geography of sounds and bays protected by barrier islands and tidal marshes acts to delay mixing resulting in extensive areas of brackish conditions. The Alabama and Mississippi coasts are bounded offshore by a series of barrier islands which are characterized by high energy, sand beaches grading to saltmarsh in the interior. The mainland shoreline is made up of saltmarsh, beach, seawall, and brackish-freshwater marsh in the coastal rivers. About 26,000 ha of mainland marsh existed in southern Mississippi in 1968 (GMFMC 1981). Salt marsh on the barrier islands covers 860 ha.

About 2,928 ha of submerged vegetation, including attached algae, have been identified in Mississippi Sound and in the ponds and lagoons on Horn and Petit Bois islands (C. Moncreiff personal communication). Approximately 4,000 ha of marsh along the Mississippi Coastal Zone have been filled for industrial and residential use since the 1930s (Eleuterius 1973). Seagrasses in Mississippi Sound declined 40%-50% since 1969 (Moncreiff et al. 1998). The Alabama coastal zone contains five estuarine systems covering 160,809 ha of surface water and 14,008 ha of tidal marsh (Crance 1971). Acreage for submerged vegetation is unknown. Crance (1971) reported that over 800 ha of estuarine habitat have been filled for commercial or residential development.

In general, estuaries and near shore Gulf waters of Louisiana and eastern Mississippi are low saline, nutrient-rich, and turbid due to the high rainfall and subsequent discharges of the Mississippi, Atchafalaya, and other coastal rivers. The Mississippi River deposits 684 million metric tons of sediment annually near the mouth (Holt et al. 1982). Average (1980-1988) discharge for the Mississippi and Atchafalaya rivers was 1,400m^3/sec and 6.02m^3/sec, respectively. As a consequence of the large fluvial nutrient input, the Louisiana near shore shelf is considered one of the most productive areas in the Gulf of Mexico.

4.3.3 Western Gulf

The shoreline of the western Gulf includes the salt marshes and barrier islands of Texas. The estuaries are characterized by extremely variable salinities and reduced tidal action. Eight major estuarine systems are located in the western Gulf and primarily include the Texas coast. These systems contain 620,634 ha of open water and 462,267 ha of tidal flat and marshlands (GMFMC 1998). Submerged seagrass covers about 92,000 ha. Riverine influence is highest in Sabine Lake and Galveston Bay, Texas. Estuarine wetlands along the western Gulf decreased 10% between the mid 1950s and early 1960s with an estimated loss of 24,130 ha (Moulton et al. 1997).

4.4 Distribution and Preferred Habitats

Spotted seatrout are primarily an estuarine-dependent species (Tabb 1961) found in varied estuarine environments along the United States Atlantic coast and the northern coast of the Gulf of Mexico (Mahood 1974). See Section 3.1 for detailed distribution.

Spotted seatrout are essentially nonmigratory (Gold and Richardson 1998). Their entire life history is spent in the estuarine habitat, principally the nontidal areas where seasonal fluctuations in temperature and salinity rather than daily fluctuations are the controlling factors (Tabb 1961, Wagner 1973). Spotted seatrout are euryhaline and found in salinity ranges of 0.2‰-75‰ (Perret et al. 1971, Simmons 1957). They are often found associated with seagrass beds in the warmer months and deeper holes within the estuaries during colder periods. Spotted seatrout do not migrate far from the estuaries where they are spawned (Overstreet 1983), and it is rare that tagged specimens are captured more than 50 km from the tagging location (Iversen and Tabb 1962, Beaumariage 1969, Overstreet 1983, Baker and Matlock 1993, Bowling 1996). Seaward movement of spotted seatrout through tidal inlets in response to environmental extremes has been observed suggesting that inlets provide important escape from abnormally severe declines in temperature or salinity (Tabb 1961). Wide tolerance to change in the estuarine habitat has permitted the species to occupy niches that are not used by other seatrout species.

Spotted seatrout have an extended spawning period (Section 3.2.3.2.4.1). Larvae utilize seagrass beds as nursery habitat where they forage and find shelter. This association with estuaries and estuarine habitats is vital to their survival. Spotted seatrout abundance can be associated with general declines in estuary and bay water quality, including reductions in grass beds. Measures of growth rate, average size, and egg production may be useful gauges in detecting subtle but important changes in the health and overall condition of nearshore and coastal ecosystems (Bortone and Wilzbach 1997). Destruction of the estuarine habitat will have an immediate and direct effect on the abundance of the spotted seatrout and reversal of such effects will be slow (Tabb 1961).

4.5 Spawning Habitat

4.5.1 General Conditions

Spawning locations for spotted seatrout vary greatly based on habitat types and environmental conditions from year to year and within individual spawning seasons. There is no consensus on the preferred spawning habitat of spotted seatrout. Many studies have reported spawning in or near grass beds (Holt et al. 1985, Brown-Peterson et al. 1988, McMichael and Peters 1989). In Louisiana, gravid spotted seatrout were collected in various habitats within Barataria Bay including shallow water along sandy beaches, in turbulent passes, and on natural sand and shell reefs (Hein and Shepard 1979b). Adkins et al. (1979) reported that most ripe females were taken from stations in Terrebonne Bay that were close to the Gulf, and the number of gravid fish decreased in an inland direction. Spawning was also reported in the lower Calcasieu Ship Channel and in near shore waters adjacent to Calcasieu Pass (Arnoldi 1982). In the absence of submerged vegetation, spotted seatrout may use large drifting masses of detritus as a spawning site (Sabins 1973, Tarbox 1974, Arnoldi 1982). Spawning probably occurs in water that is 3.0-4.6 m deep (Pattillo et al. 1997). It may also occur in tidal passes and areas with little or no vegetation, and in Louisiana, it may occur in the higher salinity waters of lower bays and the nearshore Gulf (Sabins and Truesdale 1975, Allshouse 1983, Herke et al. 1984, Helser et al. 1993). Several studies have indicated that spawning may occur farther offshore (Stewart 1961, Tabb and Manning 1961, Jannke 1971, King 1971, LDWF unpublished data).

Spotted seatrout are adaptable to a wide variety of general spawning habitats. Saucier and Baltz (1993) observed that spawning locations may shift with changes in environmental conditions. Saucier (1991) reported that spawning aggregations were significantly correlated with an interaction of salinity and current velocity and may have represented environmental conditions that promote survival and dispersal of eggs. Spotted seatrout aggregations were typically reported when salinities ranged from 7.0‰-25.8‰ and temperatures ranged from 24.5°-33.5°C (Saucier and Baltz 1993). These spawning sites (Barataria, Caminada, and Timbalier bays) were frequently found in areas of tidal movement such as between barrier islands and in open water channels where deep moving waters ranged in depth from 3-50 m, but 91% of moderate to large drumming aggregations were observed between depths of 2-10 m (Saucier and Baltz 1993).

4.5.2 Salinity, Temperature, and Dissolved Oxygen Requirements

The diversity of general habitats reported as spawning locations suggests that numerous factors are important in determining actual locations. Spawning is controlled largely by water temperature, salinity (Lorio and Perret 1980, Perret et al. 1980), and photoperiod (Arnold et al. 1976, Colura et al. 1988). Salinity is a limiting factor and may change the location of spawning from year to year (Jannke 1971). Spotted seatrout may spawn in a wide range of salinities from as low as 10‰ (Overstreet 1983) to upwards of 40‰ (Tucker and Faulkner 1987, Gray et al. 1991), but most spawning has been observed at salinities ranging from 17‰-35‰ (Tabb 1966, Benson 1982, Tucker and Faulkner 1987, Brown-Peterson et al. 1988, McMichael and Peters 1989, Saucier et al. 1992, Saucier and Baltz 1993). Taniguchi (1979) predicted 100% survival of eggs and larvae at salinities ranging from 18.6‰-37.5‰ with an optimum spawning salinity of 28‰. In Florida, peak spawning occurred when estuarine salinities reached 30‰-35‰ (Tabb 1966). Hein and Shepard (1979a) collected gravid seatrout between salinities of 17‰-26‰. In the laboratory, Arnold et al. (1976) found spotted seatrout spawning over a salinity range of 25‰-30‰ at 26°C. However, spawning was not observed in the Texas Laguna Madre at salinities greater than 45‰ (Simmons 1957).

Temperature and photoperiod appear to be the two most important environmental factors resulting in the initiation and cessation of spawning (Rogillio 1975, Arnold et al. 1976, Hein and Shepard 1979a, Perret et al. 1980, Overstreet 1983, Tucker and Faulkner 1987, Brown-Peterson et al. 1988, Brown-Peterson and Thomas 1998, Colura et al. 1988). However, the literature differs as to which factor may be the most important. Spawning typically begins in late winter to early spring as water temperatures rise to about 20°C (Rogillio 1975), 20.4°C (McMichael and Peters 1989), 21°C (Simmons 1951), 23°C (Brown-Peterson et al. 1988), and 24°C (Jannke 1971). In Louisiana, Rogillio (1975) found gonadal development directly proportional to increasing water temperature, with spawning beginning at 20°C and ending when temperatures exceeded 30°C. Other investigators found spawning over a range from 24.1°-30.0°C (Fontenot and Rogillio 1970, Sabins 1973, Hein and Shepard 1979a). Spawning continues as temperatures increase, and peak spawning occurs at temperatures ranging between 25°-30°C (Sabins 1973, Hein and Shepard 1979a, Saucier et al. 1992). Optimum spawning temperature is about 28°C (Taniguchi 1980, Saucier et al. 1992). Extensive studies in Texas have resulted in very precise photoperiod/temperature maturation cycles for hatchery spawned spotted seatrout (R. Vega personal communication, Table 4.1). The spotted seatrout spawning season along the south Texas coast occurs from April through September (Brown-Peterson et al. 1988) when temperatures range between 20°-32°C and salinities are 30‰ or higher (Rice et al. 1988). Brown-Peterson et al. (1988) reported that peak spawning occurred as water temperatures reached 23°C in April and speculated 23°C as the minimum temperature for successful spawning.

McMichael and Peters (1989) reported minimum temperatures and salinities in Tampa Bay during spawning were lower than previously reported; 30‰ (Tabb 1966), 21°C and 26‰ (Music and Pafford 1984). Brown (1981) concluded that annual temperature cycle may be more important than absolute temperature in stimulating initial gonad maturation in Chesapeake Bay.

Lunar cycles are also important in spotted seatrout spawning periodicity. Adkins et al. (1979) noted increased gonad maturity near the full moon and spent gonads afterward. McMichaels and Peters (1989) reported spotted seatrout in Tampa Bay spawned on or near the full moon and spawning peaks occurred every month from May-September (Section 3.2.3.2.4.1).

Table 4.1. Optimal 150 day photoperiod/temperature maturation cycle for hatchery spawned spotted seatrout in Texas (R. Vega personal communication).

Date	Light Hrs	Temperature (°C)
November 1	11	22 (start)
November 16	10	21
December 1	10	19
December 16	10	17
January 1	9	16
January16	9	17
February 1	10	19
February 15	10	21
March 1	11	23
March 8	11	24
March 16	11	25
April 1	12	26 (spawning occurs)

4.6 Egg and Larval Habitat

4.6.1 General Conditions

Spotted seatrout eggs are found from marine to estuarine environments, are buoyant or demersal depending on salinity, and generally associated with grass beds at or near barrier island passes. They are also found in areas devoid of vegetation in fine to medium textured detritus (Sabins and Truesdale 1975). S. Holt (personal communication) indicated that in Texas waters, spotted seatrout and other sciaenid eggs are not typically collected in association with seagrass beds. Since the eggs hatch in <24 hrs, their location more or less reflects the spawning areas. Holt reported collecting spotted seatrout eggs both in the inlet (Aransas and Laguna Madre) and throughout the bays. Sampling shows eggs distributed widely over the open bay.

Spotted seatrout larvae are distributed over a wide variety of substrates. Larvae can be found in bottom vegetation or demersal in deep channels with shell rubble (Tabb 1966), seagrass beds (Pearson 1929, Miles 1950, Vetter 1977), and deep channels near grass beds (Benson 1982, Tabb 1961). Jannke (1971) and King (1971) reported capturing 5-6 mm SL larvae in tidal inlets and Sabins (1973) collected larvae in areas of detrital deposition. Larval spotted seatrout were regularly collected in ichthyoplankton surveys in Florida Bay and adjacent waters (Powell et al. 1989) in channels, passes, and creeks bordering Florida Bay (Rutherford et al. 1989).

Spotted seatrout larvae should be divided into two phases: early larvae (2-6 mm) which are pelagic, found throughout the bays with much the same distribution as eggs; and late larvae (6-18 mm) which are for the most part demersal and almost exclusively associated with structure such as seagrass (S. Holt personal communication). In Texas, larval spotted seatrout are found in greatest abundance in *Halodule* seagrasses in the Laguna Madre (Tolon et al. 1997) and in Aransas and Redfish bays (Rooker et al. 1998).

4.6.2 Salinity, Temperature, and Dissolved Oxygen Requirements

The highest hatch rates for experimentally-incubated eggs were reported to occur at 15‰-25‰ and 19‰-38‰ (Shepard 1986, Gray and Colura 1988). Egg survival may be reduced at lower salinities in the wild (Tabb 1966). Optimum salinity for eggs has been reported to be 28.1‰ (Killam et al. 1992). Killam et al. (1992) reported that all eggs died at any temperature when the salinity was 45‰. A critical minimum (0‰) and a critical maximum (50‰) has been determined that corresponds to 0% embryo survival at 28°C (Shepard 1986). Salinity acclimation of parents may also affect salinity tolerance of eggs (Gray and Colura 1988). Holt and Banks (1988) successfully hatched spotted seatrout eggs in the laboratory between 10‰-40‰ at 25°-27°C and found that acclimation of the embryos increased salinity tolerance. Gray et al. (1991) used temperature-photoperiod induced spawn to find that hypersalinity ($\geq$40‰) and temperatures of 20°C adversely affected hatching success of spotted seatrout eggs. The study suggested that spotted seatrout spawning success in Texas bays may be reduced when salinities exceed 40‰, which can occur during droughts; however, their occurrence in these hypersaline areas suggest that they may spawn with limited success. This study contradicts previous findings of Gray and Colura (1988) who reported 0% hatch at salinities above 45‰. Gray et al. (1991) also suggested reduced spawning success at 20°C.

Arnold et al. (1976) used laboratory-cultured eggs and larvae to determine optimal spawning salinities and temperatures of between 20‰-35‰ and 20°-30°C, respectively. Gray et al. (1991) found that the hatching success of eggs was highest at 23°C when salinities were below 40‰, and 26°C when salinities exceeded 40‰. For hatching of eggs and survival of yolk-sac larvae, Taniguchi (1980) reported an optimum temperature of 28°C and optimum salinity of 28.1‰, and predicted 100% survival of eggs and yolk-sac larvae between 23.1°-32.9°C over a salinity range of 18.6‰-37.5‰.

Spotted seatrout larvae are considered the most euryhaline of all sciaenid larvae (Killam et al. 1992). They have been collected in Florida from 8‰-40‰ (Rutherford et al. 1989, Killam et al. 1992). Texas is conducting a study to determine an optimal salinity regime for larvae. At present it appears that 30‰ is optimal (R. Vega personal communication). Larvae and juveniles have been found in temperatures of 5°-36°C (Wang and Raney 1971, Perret et al. 1980, Benson 1982, Rutherford et al. 1989, Killam et at. 1992). Where inshore salinities can be fairly low due to the influence of the Mississippi River, larval habitat is probably higher salinity lower bays and near shore Gulf of Mexico (Herke et al. 1984).

Spotted seatrout larvae do not withstand rapid temperature or salinity changes well. Colura et al. (1992) found temperature explained more of the variation observed in spotted seatrout pond production than did any other water quality parameters. Temperatures >24°C appeared to be most conducive to production. Low dissolved oxygen was not detrimental to spotted seatrout pond culture provided it did not fall below 1 ppm and was short in duration. Salinity did not significantly affect production but empirical data suggested mean salinities <17‰ were detrimental to production. It should be noted that food production was more important than measured water quality parameters in spotted seatrout. Spotted seatrout exposed to water with supersaturated gases, especially nitrogen, developed exophthalmia and died (Parker et al. 1978). Almost all larvae died when DO in all but the top 15 cm of water in Texas ponds dropped below 4.0 ppm (Colura et al. 1976). Larvae failed to survive to metamorphosis at 23.5°C but developed well at 28°C (Colura 1974).

4.7 Juvenile and Adult Habitat

4.7.1 General Conditions

Seasonal abundance of juvenile and adult spotted seatrout is primarily associated with estuarine zones with different estuarine habitats utilized during different life history states (Helser et al. 1993). Habitat utilization by spotted seatrout varies by geographic location within the Gulf of Mexico based on the habitat types available in a particular area. Juveniles and adults are generally associated with seagrasses, particularly *Halodule* and *Thalassia,* but they are common over sand, sand-mud, or muddy areas, oil platforms, and shell reefs (Benson 1982, Peterson 1986, Rutherford et al. 1989, McMichael and Peters 1989, Chester and Thayer 1990, Killam et at. 1992).

4.7.1.1 Juveniles

Although seagrass appears to be a critical habitat for juvenile and adult spotted seatrout, back-waters (bayous, tidal creeks, slow flowing rivers), marshes, and other areas without extensive seagrass beds can contain substantial numbers of juveniles (Van Hoose 1987, McMichael and Peters 1989, Killam et al. 1992). Abundance and distribution of juveniles may be influenced by seagrass biomass, shoot density, and species composition of seagrass beds. Spotted seatrout have been found in association with several species of seagrass including *Thalassia testudinum* (turtle grass), *Syringodium filiforme* (manatee grass), and *Halodule wrightii* (shoal grass) (Hettler 1989, Killam et al. 1992).

Spotted seatrout juveniles in Florida Bay were most prevalent in habitats of deep, organic sediment with high densities and biomass of manatee grass (*Syrinogodium filiforme*) (Chester and Thayer 1990) and have been reported from a depth range of 0.5 to 2.2 m (Rutherford et al. 1989). Rutherford et al. (1989) found juveniles in mangrove creeks, channels, shorelines, banks, basins, and bays. In Mississippi, over 70% of juvenile spotted seatrout less than 50 mm SL were collected in shallow areas with grassy bottoms (Loman 1978, J. Warren unpublished data). In Alabama, early juveniles move into tidal rivers in late fall to overwinter (Van Hoose 1987).

In Louisiana, the preferred habitat is along relatively shallow marsh edges of small, saline water bodies dominated by *Spartina alterniflora* (Peterson 1986, McMichael and Peters 1989, Chester and Thayer 1990). Juveniles and adults occur in a variety of estuarine habitats including seagrass beds, mangrove-lined depressions, channels and canals (Mok and Gilmore 1983, Van Hoose 1987). Juveniles typically remain in submerged vegetation during summer months but may migrate to deeper water during winter months when water temperatures drop. Adults also occur in the surf zones of barrier islands especially in fall months (Perry 1970).

The seasonal occurrence, abundance, and habitat of juvenile spotted seatrout in Louisiana was described by Laska (1973); Herke et al. (1984); Arnoldi (1982, 1984); Peterson (1986); Rakocinski et al. (1992); and Baltz et al. (1993). Rakocinski et al. (1992) utilized 1.2 m^2 drop samplers in the Barataria basin and found juvenile spotted seatrout common only in summer with distribution centered in the mid-estuary at depths up to 1 m and associated with emergent vegetation. Baltz et al. (1993) also confirmed greatest abundance of juvenile spotted seatrout in spring and summer at high water temperatures. These authors reported that "marsh edge is critical habitat for many species especially during intermediate and low tidal stages when adjacent salt marsh is not flooded."

In Texas, several estuarine reports emphasized the importance of vegetated shorelines as nursery habitat. Pearson (1929) collected juveniles (20-30 mm TL) along grassy shorelines of Texas bays, small bayous, and creeks. Juvenile spotted seatrout in Lavaca Bay, Texas, were more abundant on marsh surfaces than in non-vegetated habitat at the marsh edge and were significantly more abundant during fall in all marsh habitats (Zimmerman et al. 1990a). In a related study, Zimmerman et al. (1990b) reported short-term lowering of salinity following freshwater floods did not prevent spotted seatrout juveniles from using deltaic marshes but suggested that long-term changes might be detrimental to nursery habitats of spotted seatrout. Juvenile spotted seatrout in Galveston Bay, Texas, had peak abundances in summer and fall at mid-bay sites in marsh habitats at salinities of 15.1‰ and 15.4‰ (Zimmerman et al. 1990a).

4.7.1.2 Adults

Most movement in adults occurs seasonally in association with thermal and salinity tolerances and with spawning activities (Tabb 1966, Bryant et al. 1989, Helser et al. 1993). Larger adults often seek cooler, deeper water during the summer and deeper, warmer waters of bays or the nearshore Gulf of Mexico during the winter (Pearson 1929, Gunter 1945). Spotted seatrout have been shown to be estuary-specific, especially in Florida, with very little movement between estuaries (Section 3.2.7).

In Florida and Mississippi, spotted seatrout are most common in large areas of shallow, brackish water that contain extensive submerged vegetation and adjacent deep areas that can be used as refuge from extreme summer and winter temperatures (Pearson 1929, Tabb 1958, Lorio and Perret 1980, Zieman 1982). Tabb (1966) reported that spotted seatrout in Florida prefer brackish, non-tidal estuarine areas over outer beach and near shore waters of the open ocean and Gulf. However, in Alabama, tidal rivers appear to be the preferred habitat in fall and winter, with oyster reefs and other inshore reef areas be prefered in spring and summer (M. VanHoose personal communication).

The preferred habitat of adult spotted seatrout in Louisiana is "near or over sandy bottoms, around submerged or emergent islands, shell reefs, areas of submerged vegetation, areas where some type of structure exists [e.g., nearshore oil platforms (Stanley and Wilson 1990)], and deep bayous and canals within inshore areas of the Gulf" (Lorio and Perret 1980). Spotted seatrout are found throughout the water column with no preference for any level and may be found throughout their range in clear to very turbid waters (Lorio and Perret 1980). Offshore habitat of adults is poorly known, but Stanley and Wilson (1990) reported that spotted seatrout and red snapper (*Lutjanus campechanus*) were the most commonly caught species around oil and gas structures off Louisiana. Perret et al. (1980) reported that spotted seatrout are likely found in areas containing suitable salinity and temperature regimes combined with a sufficient food source.

Spotted seatrout in Texas are found in all shallow water habitats (L. McEachron personal communication), in deeper bays around oyster reefs (Hoese and Moore 1977), in submerged beds of widgeon grass (*Ruppia maratima*) and shoal grass (Miles 1950), and in stretches of beach near passes (Pearson 1929).

4.7.2 <u>Salinity, Temperature, and Dissolved Oxygen Requirements</u>

Juvenile and adult spotted seatrout seem to be equally tolerant to environmental variations typical of nearshore habitats; however, abrupt changes in the environment affect them (Tabb 1966). In a series of experiments investigating growth rates in juvenile spotted seatrout subjected to a range of temperatures (11.5°-32°C), Bumguardner and Maciorowski (1989) found the optimum temperature for growth occurred at ≥28°C (specific growth rate of 2.39% at a mean TL of 78 mm). Mahood (1974) reported that adult spotted seatrout prefer temperatures from 15°-27°C and may move seaward if estuarine temperatures become extreme. In Florida, the preferred temperature for adults ranged from 15°-27°C (Tabb 1958). Simmons (1957) found that spotted seatrout live and feed actively at temperatures between 4°-33°C if they are gradually acclimated to the extremes of this range. Work completed by the TPWD indicate that spotted seatrout can tolerate temperatures down to 3°C (TPWD unpublished data).

Juveniles seem to prefer mesohaline and polyhaline waters where salinities range from 8‰-25‰ (Peterson 1986). They have been collected in waters with salinities ranging from 0‰-48‰ (Gunter 1945, Wagner 1973, Peterson 1986, Rutherford et al. 1989, Killam et al. 1992). Adults are considered euryhaline and have been collected over a salinity range of 0.2‰-75‰ (Simmons 1957, Perret et al. 1971, Mercer 1984, Killam et al. 1992). Juveniles and adults appear to prefer moderate salinities (Wagner 1973). Optimum salinities, as judged by swimming performance, occurred at 20‰-25‰ (for fish 174-438 mm TL) but were reduced above and below these salinities (Wakeman and Wohlschlag 1977). Spotted seatrout are rarely collected below 10‰ or above 45‰ in south Texas waters. In Louisiana, however, Thomas (1999) reported relatively high catch rates of juvenile spotted seatrout at 2.0 ‰ and 5.0‰ in routine Louisiana Department of Wildlife and Fisheries Department (LDWF) seine samples taken statewide between 1986 and 1996, and some presence of juveniles in waters <2‰. Czapla et al. (1991) reported that in the Louisiana Terrebonne Bay system, adult spotted seatrout were greater in the marine salinity zone (>25‰) than in either the tidal fresh (0.0‰-0.5‰) or mixing zones (0.5‰-25.0‰).

Although no reports were found specifically relating the distribution of spotted seatrout to dissolved oxygen (DO) concentrations, Breitburg et al. (1994) demonstrated that DO, which is controlled in part by temperature and salinity, can affect the distribution of many species of juvenile and adult fish within an estuary. Estuarine DO concentrations may not be a limiting factor for spotted seatrout because of the continuous inflow of fresh water and the mixing between salt and fresh waters; however, great changes in the DO can impact the metabolic activities of fish. Vetter (1977) reported differences in metabolic rates of spotted seatrout for summer and winter conditions. He indicated that the rates ranged from 123 mgO_2/kg/hr at 30°C to a low of 49 mgO_2/kg/hr during winter at 15°C.

4.8 Essential Habitat

The identification of essential habitat which support the fishery is now recognized as critical in continuing to effectively manage spotted seatrout in the Gulf of Mexico. Problems arise when those critical and necessary habitats are impacted whether by natural or man-made (anthropogenic) causes.

4.8.1 Natural Impacts

4.8.1.1 Hypoxia

Anoxic bottom conditions have not been reported for most of the eastern Gulf with the exceptions of local hypoxic events in Mobile Bay and several bay systems in Florida (Tampa, Sarasota, and Florida bays). However, extensive areas (1,820,000 ha) of low bottom oxygen levels (<2 ppm) occur in the Gulf off of Louisiana and Texas during summer (Rabalais et al. 1997). Increased levels of nutrient influx from freshwater sources coupled with high summer water temperatures, strong salinity-based stratification, and periods of reduced mixing appear to contribute to what is now referred to in the popular press as "the dead zone," an area approximately 18,200 square km located south of Louisiana on the continental shelf (Justić et al. 1993). Spotted seatrout appear to be only moderately susceptible to the low oxygen levels and generally move out of the area when dissolved oxygen levels get too low resulting in displacement rather than mortality. The close association that spotted seatrout have with estuaries during the hot summer months tends to decrease the effects these offshore hypoxic areas have on the population. Minor inshore hypoxic events have been documented frequently in the Gulf of Mexico (Rabalais et al. 1991) and its estuaries; however, the impact of these events typically does not lead to significant spotted seatrout mortality.

Mortality of spotted seatrout due to low DO concentrations has been reported throughout the Gulf of Mexico (Gunter 1941, Gunter and Hildebrand 1951, Overstreet 1974, Etzold and Christmas 1979). In contrast, high levels of DO can cause additional problems for fishes. Renfro (1963) reported mortalities of spotted seatrout from gas bubble disease in Galveston Bay. Gas bubbles formed in the bloodstream of the fish during a period when waters were supersaturated with dissolved oxygen from a phytoplankton bloom.

4.8.1.2 Turbidity

Spotted seatrout mortalities associated with natural perturbations were documented by several authors. Tabb and Manning (1961), Tabb et al. (1962), and Perret et al. (1980) observed spotted seatrout strandings due to rapidly receding waters following hurricanes and subsequent mortalities due to suffocation in excessively turbid waters. Spotted seatrout appear to prefer areas of low turbidity (Pearson 1929). Florida estuaries have a normal salinity range of 5‰-30‰, but sudden changes in salinity associated with tropical storms or hurricanes may cause mass migrations or mortalities (due to high turbidity which clogged gills) of spotted seatrout (Tabb 1966).

4.8.1.3 Temperature and Cold Kills

Sudden and extreme temperature decreases accompanying cold fronts often result in mass mortalities of spotted seatrout (Gunter 1941, Gunter and Hildebrand 1951, Moore 1976, Wohlschlag and Wakeman 1978, Adkins et al. 1979). In 1983, over 623,000 spotted seatrout were killed in Texas during a December freeze, and over 759,000 were killed in 1989 in two separate freezes (McEachron et al. 1994). The rate of temperature reduction as well as salinity probably influence the tolerance of spotted seatrout to low temperatures (Overstreet 1974, 1983).

4.8.1.4 Algal Blooms

Springer and Woodburn (1960) listed spotted seatrout as one of the species killed by red tide (*Gymnodinium breve*) in Tampa Bay, Florida, in 1957. Prior to 1996, Texas had documented only six red tide events since 1935 and none were documented in Alabama, Mississippi, and Louisiana. In the fall and winter of 1996 and 1997, unprecedented toxic algal blooms occurred in the northern Gulf of Mexico resulting in a significant number of finfish deaths from Texas to Florida. The best estimates indicate that a minimum of three to four million finfish were killed in the 1996 event and a minimum of twenty-two million in the 1997 event in Texas waters alone by the red tide. Included were species such as spotted seatrout, red drum, flounder sp., black drum, and Atlantic croaker. Additional fish kills were documented in the other Gulf states as well. These algal blooms were a naturally occurring organism, *Gymnodinium breve,* usually found in very low amounts in the Gulf, typically off Florida. Brevitoxin, the toxic compound produced and released by red tide cells, affect spotted seatrout and other top predators through bioaccumulation in planktivorous prey fish which ingest the cells or when spotted seatrout swim through a bloom. Other toxic algae occur in the Gulf of Mexico and include a second species of *Gymnodinium* which occurs occasionally in Florida; *Gonyaulax monilata* which has been documented in Mississippi Sound; four species of *Prorocentrum*; and about six *Pfiesteria*-like species which primarily occur in Florida (C. Moncrieff personal communication).

This contribution to natural mortality is difficult to quantify and perhaps impossible to predict. Algae blooms occur under particular chemical-physical conditions, thus great variability exists in the frequency of occurrence, distribution, and potential impact that these blooms may have on the fishery in any given year.

4.8.1.5 Wetland Loss

According to Dahl and Johnson (1991), estuarine vegetated wetlands decreased in the United States by 28,734 ha from the mid 1970s through the mid 1980s with the majority of these losses occurring along the Gulf of Mexico coast. Most of this loss was due to the shifting of emergent wetlands to open saltwater bays. This figure does not encompass all wetland loses; additional loses occurred in palustrine emergent and palustrine forest wetlands as well. The most dramatic coastal wetland losses in the United States are in the northern Gulf of Mexico. This area contains 41% of the national inventory of coastal wetlands and has suffered 80% of the nation's total wetlands loss (Turner 1990, Dahl 1990). These wetlands support 28% of the national fisheries harvest, the largest fur harvest in the United States, the largest concentration of overwintering waterfowl in the United States, and provide the majority of the recreational fishing landings (Turner 1990). Most estuarine wetland losses occurred along the northern Gulf coast, especially in Louisiana. It is estimated that Louisiana marshes are disappearing at a rate of about 64,750 ha/year (USEPA 1994). Land loss is the synergistic culmination of both natural and man-induced factors (Craig et al. 1979). In addition, some researchers also forecast that sea level will rise due to global warming, which could compound the loss of critical estuarine areas in the Gulf of Mexico (Klima 1988). Except in terms of lost acreage, effects of this development on overall estuarine productivity in the Gulf are largely undocumented.

4.8.2 Anthropogenic Impacts

Many of the factors which impact spotted seatrout populations in the Gulf of Mexico overlap and, at times, are almost impossible to separate. In an effort to provide a broad description of the sources of present, potential, and perceived threats to habitat, many of the issues presented here could be placed in multiple categories. This section attempts to offer a general overview of these impacts which include negative, positive, and benign habitat issues.

4.8.2.1 Point and Nonpoint Source Pollution

Discharge of toxic substances and pesticides into the Gulf of Mexico is primarily due to increased industrial activity in the region and the continued use of agriculturally-related pesticides throughout the Mississippi River drainage basin as well as the other 32 river systems and 207 estuaries bordering the Gulf. Point sources for introduction of these contaminants include discharge from industrial facilities, municipal wastewater treatment plants, and accidental spills. Nonpoint sources include urban storm water runoff, air pollutants, and agricultural activities. About 13 million pounds of toxic substances are discharged annually into the Gulf of Mexico estuarine drainage areas, and about five million pounds of pesticides were applied to agricultural fields in Gulf coastal counties in 1990 (USEPA 1994). Effects of these substances on aquatic organisms include: 1) interruption of biochemical and cellular activities, 2) alterations in populations dynamics, and 3) sublethal effects on ecosystem functions (Capuzzo and Moore et al. 1988).

Toxic chemicals may impact spotted seatrout. The acute lethal effects of sodium hypochlorite chloramine and 5-chlorouracil on eggs and larvae of spotted seatrout were investigated by Johnson et al. (1977). They concluded that in areas subjected to discharges of chlorinated effluent, considerable mortality of spotted seatrout larvae would occur when the level of sodium hypochlorite reached 0.17 ppm. Johnson et al. (1979) exposed spotted seatrout larvae to sublethal concentrations (0.00-1.00 ppm) of fuel oil (water soluble fraction) and found a general decrease in total length (TL), and as oil concentrations increased, the percentage of larvae with unpigmented eyes also increased. Butler (1969) and Butler et al. (1970) measured DDT residues as high as 8 ppm in the gonads of six generations of spotted seatrout from Laguna Madre, Texas, and postulated that breeding ceased for at least one to two years as a result. Daniels et al. (1987) determined median lethal concentrations (LC_{50}) of nitrite and ammonia for spotted seatrout eggs, larvae, and juveniles.

4.8.2.2 Habitat Alteration

The high degree of natural variation and proximity to human activities makes estuarine areas the weakest link of the life cycle of estuarine-dependent organisms. Human population growth in southeastern coastal regions, accompanied by industrial growth, is responsible for the alteration or destruction of about one percent of estuarine habitats required for commercial and recreational species (Klima 1988). Human activities in inshore and offshore habitats of spotted seatrout that may affect recruitment and survival of stocks include: 1) projects, ports, marinas, and maintenance dredging for navigation; 2) discharges from wastewater plants and industries; 3) dredge and fill for land use development; 4) agricultural runoff; 5) ditching, draining, or impounding wetlands; 6) oil spills; 7) thermal discharges; 8) mining, particularly for phosphates and petroleum; 9) entrainment and impingement from cooling operations associated with industrial activities; 10) dams; 11) alteration of freshwater inflows to estuaries; 12) saltwater intrusion; and 13) nonpoint source discharges of contaminants (Lindall et al. 1979).

4.8.2.3 Dredge and Fill

Shallow water dredging for sand, gravel, and oyster shell not only alters the bottom directly, but may also change local current patterns leading to erosion or siltation of productive habitats. Destruction of wetlands by development of waterfront properties results directly in loss of productive habitat acreage and in the reduction of detrital production. Channeling or obstruction of water courses emptying into estuaries can result in loss of wetland acreage and/or changes in the salinity profile of the estuaries. Lowered flow rates of drainage systems can reduce the amount of nutrients that are washed into estuaries and permanently alter the composition of shoreline communities.

Early degradation of Gulf coast estuarine habitat can be traced to the early 1900s, when exploration for and exploitation of oil and gas, with its concomitant development of refineries and chemical companies, began in the northern Gulf (Texas and Louisiana) along major rivers and bays. In the 1930s and 1940s, alteration of marshes and coastal waters for oil exploration included seismic blasting, dredging of canals, construction of storage tanks and field buildings, and other types of development. These activities caused a number of problems for juvenile spotted seatrout habitat, including saltwater intrusion into brackish water areas and direct reductions in the amount of marsh habitat.

In Louisiana, there were 7,360 km of canals dredged south of the Intracoastal Waterway by 1970 (Barrett 1970). Canal construction results in wetland degradations far beyond the direct loss of habitat seen at dredge sites. Additional marsh loss is produced through secondary hydrologic effects: increased erosive energy, salinity intrusion, and disruption of natural flow effects. Some affected areas experience excessive sediment drying, while others undergo extended flood periods (Turner and Cahoon 1988); both effects produce loss of vegetative cover and increased conversion to open water. Freshwater storage effects, where freshwater inputs are held for gradual release through the seaward marshes, are also disrupted (Gagliano 1973). Direct wetland loss from canal dredging accounted for 120 km^2 of the total loss (about 16%) between 1955 and 1978; the combined contribution of direct and indirect effects from canal building is estimated at 30% to 59% of the total marsh loss in Louisiana in this period (Turner and Cahoon 1988).

4.8.2.4 Thermal Discharge

Power plants produce large quantities of heated effluent so that thermal pollution is now a consideration in habitat alteration. Roessler and Zieman (1970) found that the area in which all plants and animals were killed or greatly reduced in number was adjacent to a nuclear plant outflow in Biscayne Bay, Florida, corresponded closely to the area delineated to the +4°C isotherm.

4.8.2.5 Industrial and Agricultural Run-off

Recent algal blooms in the Gulf of Mexico have caused problems for many of the Gulf fisheries including spotted seatrout (Section 4.8.1.4). Although these blooms are naturally occurring, it has been suggested by many researchers that these blooms have been 'fed' by additional nutrient inputs resulting from agricultural run-off. The high prevalence of Pfiesteria and Pfiesteria-like organisms along the Atlantic coast have been blamed on agriculture and livestock activities. Excessive waste in combination with favorable meteorologic and environmental conditions have elevated the densities of these organisms to near critical levels. Other events prevalent in the Gulf which can be linked, in part, to the increased influx of nutrients in the form of run-off includes the red tide events of 1996 and 1997 and the persistent 'dead zone' off the Louisiana and Texas coasts (Section 4.8.1.1).

4.8.2.6 Loss of Seagrass Beds

Seagrass loss due to human activities is increasing at an alarming rate in the Gulf of Mexico. Prop-scarring and pleasure boat grounding continue to contribute to seagrass loss throughout the Gulf. In addition, repeated groundings by industrial barge traffic on grass beds surrounding the barrier islands in Mississippi Sound leave long-lasting scars which take years to recover (C. Moncreiff personal communication).

The primary concern to seagrass beds is the increasing turbidity associated with commercial activities in and around these areas. Commercial trawlers and barge traffic stir up large amounts of mud and can significantly increase the turbidity around submerged grass beds. This increase in turbidity can lead to a reduction in growth of beds and a decrease in primary production (GMFMC 1998).

4.8.2.7 Wetland Impoundment and Water Management

Marsh loss, wetland impoundments, and saltwater intrusion are critical topics with regard to management of estuarine dependent species such as spotted seatrout. Subsidence, eustatic sea-level rise, and erosion due to storms and wave/wind action are naturally occurring factors. Man-induced factors include levee construction along the lower Mississippi River (which eliminated the major source of sediment introduction to marshes), canal construction, dredge and fill activities, and land reclamation. In addition, damming of tributaries to the Mississippi River has led to a decrease in its sediment load, further reducing accretion. Salinity levels may have increased in portions of coastal Louisiana in association with marsh loss and canal construction. About 30% of the total wetland area in the Louisiana coastal zone was intentionally impounded before 1985 (Day et al. 1990).

Impoundment of marshes could increase in the future due to interest in mariculture and development of marsh management units to combat coastal marsh loss (Herke and Rogers 1989).

Habitat and hydrological changes occurring in other coastal states could have detrimental impacts on spotted seatrout. Biological productivity increases temporarily in deteriorating marshes (Gagliano and Van Beek 1975) possibly due to an increase in "edge" (marsh-water) habitat and in detrital input to the estuarine food web. However, biological productivity will eventually decrease as the conversion of marsh habitat to open water continues and suitable marsh habitat of appropriate salinity regimes declines below the critical point. Marsh management by means of levees and weirs, or other water control structures, is usually detrimental to fisheries in the short term because of interference with migratory cycles of estuarine dependent species (Herke 1979, Rogers and Herke 1985, Herke et al. 1987, Herke and Rogers 1989).

Levees built in the early 1900s to protect urban and agricultural areas from flooding along the Mississippi River have deprived marshlands the replenishment of needed water and sediments. Agricultural development and urban expansion in Florida have caused similar negative effects on the Everglades which may have negatively affected Florida Bay. Urban centers such as Orlando, Tampa, and Miami have tapped water from the Everglades system to the point that freshwater run-off into Florida Bay has decreased significantly. Fluctuations in salinity as a result of these alterations may have caused the die-off of many seagrass beds in Florida Bay.

In Louisiana a unique situation occurs. Although total land loss is high statewide, there are discrete basins which contribute more to the overall loss than others (i.e., Barataria Basin). In most of the basins, loss continues but at a reduced rate since 1978. The Sabine-Calcasieu and Mississippi River basins exhibited the highest percentage of total loss from 1956-1978 but exhibited marked decreases in percentage of total land area loss from 1978-1990 (Barras et al. 1994). The center points out that this may indicate a stabilization in the loss rates within these basins. Unfortunately, some “stabilization” is probably due to the fact that many of the most susceptible marshes have already converted to open water (Thomas 1999). Louisiana is still losing some 90 km^2 of coastal wetlands every year (Barras et al. 1994).

In contrast to land loss throughout most of coastal Louisiana, delta development in Atchafalaya Bay began in the 1950s as major features of the Atchafalaya Basin Floodway were being completed. The Atchafalaya River flow began to increase in the mid 1800s, after removal of a massive log jam in the upper reaches of the river that restricted flow (Latimer and Schweizer 1951). Atchafalaya River flow increased this century from 17% of the Mississippi River flow in 1910 to 30% in 1963 when the Old River Control Structure was completed. The gradual increase has resulted in reduced tidal influence in Atchafalaya Basin wetlands to such an extent that they are now fresh and dominated by riverine processes. Mainland wetland losses are minimal (0.1%/year) and more than 23,000 acres of wetlands are projected to develop in the active delta over the next 50 years (Louisiana C.W.C.R. Task Force 1993).

Although deltaic wetlands are forming in Atchafalaya Bay, the full potential of delta development is not being realized largely because of the Atchafalaya River navigation channel, which extends from the river mouth, through the delta, and terminates well offshore. The channel has impaired growth in the main subdelta such that recent growth rates for the subdelta of the smaller

Wax Lake Outlet now exceed that of the main delta (Louisiana C.W.C.R. Task Force 1993). Restoration projects to maximize nearshore deposition of main channel sediments have been completed, and others are planned.

4.8.2.8 Freshwater Diversion

Changes in the amount and timing of freshwater inflow may have a major effect on the early life history of spotted seatrout which use estuaries as nursery habitat. Wetlands are maintained by rivers that transport sediment and nutrients. Reduction in freshwater inflow decreases the nutrients necessary for healthy wetland growth. Activities affecting freshwater inflow include leveeing of rivers (eliminating overflow into surrounding marshes), damming of rivers, channelization, and pumping water for redistribution.

5.0 FISHERY MANAGEMENT JURISDICTIONS, LAWS, AND POLICIES AFFECTING THE STOCK(S)

Spotted seatrout are somewhat unusual among the more important marine fish species in the Gulf because they usually do not move great distances throughout their lifetime. They are usually associated with estuaries and Gulf nearshore waters. Although their geographic range is perhaps more limited than many other species, they are nonetheless both directly and indirectly affected by numerous state and federal management institutions. The following is a partial list of some of the more important agencies and a brief description of the laws and regulations that could potentially affect spotted seatrout and their habitat. All are subject to change at any time. Individual Gulf States and federal agencies should be contacted for specific and up-to-date state laws and regulations.

5.1 Management Jurisdictions

Spotted seatrout are most abundant in state waters, although they can be found in the exclusive economic zone (EEZ) of the Gulf of Mexico. The commercial and recreational fisheries (where allowable) are almost exclusively conducted in state management jurisdictions; consequently, laws and regulations of federal agencies primarily affect spotted seatrout populations by maintaining and enhancing habitat, preserving water quality and food supplies, and abating pollution. Federal laws may also be adopted to protect consumers through the development of regulations to maintain the quality of spotted seatrout as seafood.

5.1.1 Federal

5.1.1.1 Regional Fishery Management Councils

With the passage of the Magnuson Fishery Conservation and Management Act of 1976 (MFCMA) and its 1996 reauthorization as the Magnuson-Stevens Fishery Conservation and Management Act (Mag-Stevens), the federal government assumed responsibility for fishery management within the EEZ, a zone contiguous to the territorial sea and whose inner boundary is the outer boundary of each coastal state. The outer boundary of the EEZ is a line 200 miles from the (inner) baseline of the territorial sea. Management of fisheries in the EEZ is based on FMPs developed by regional fishery management councils. Each council prepares plans for each fishery requiring management within its geographical area of authority and amends such plans as necessary. Plans are implemented as federal regulation through the United States Department of Commerce (USDOC).

The councils must operate under a set of standards and guidelines, and to the extent practicable, an individual stock of fish shall be managed as a unit throughout its range. Management shall, where practicable, promote efficiency, minimize costs, and avoid unnecessary duplication (Mag-Stevens Title III, §301a).

The GMFMC has not developed a management plan for spotted seatrout. Furthermore, there is no significant fishery for spotted seatrout in the EEZ of the United States Gulf of Mexico.

5.1.1.2 National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), United States Department of Commerce (USDOC)

The Secretary of Commerce, acting through the NMFS, has the ultimate authority to approve or disapprove all FMPs prepared by regional fishery management councils. Where a council fails to develop a plan, or to correct an unacceptable plan, the Secretary may do so. The NMFS also collects data and statistics on fisheries and fishermen. It performs research and conducts management authorized by international treaties. The NMFS has the authority to enforce the Magnuson Act and Lacey Act and is the federal trustee for living and nonliving natural resources in coastal and marine areas.

The NMFS exercises no management jurisdiction other than enforcement with regard to spotted seatrout in the Gulf of Mexico. It conducts some research and data collection programs and comments on all projects that affect marine fishery habitat.

The USDOC, in conjunction with coastal states, administers the National Estuarine Research Reserve and National Marine Sanctuaries Programs as authorized under Section 315 of the Coastal Management Act of 1972. Those protected areas serve to provide suitable habitat for a multitude of estuarine and marine species and serve as sites for research and education activities relating to coastal management issues.

5.1.1.3 Office of Ocean and Coastal Resource Management (OCRM, NOAA)

The OCRM asserts management authority over marine fisheries through the National Marine Sanctuaries Program. Under this program, marine sanctuaries are established with specific management plans that may include restrictions on harvest and use of various marine and estuarine species. Harvest of spotted seatrout could be directly affected by such plans.

The OCRM may influence fishery management for spotted seatrout indirectly through administration of the Coastal Zone Management Program and by setting standards and approving funding for state coastal zone management programs. These programs often affect estuarine habitat on which spotted seatrout depend.

5.1.1.4 National Park Service (NPS), Department of the Interior (DOI)

The NPS under the DOI may regulate fishing activities within park boundaries. Such regulations could affect the harvest of spotted seatrout if implemented within a given park area. The NPS has regulations preventing commercial fishing within one mile of the barrier islands in the Gulf Islands National Seashore off Mississippi and in regulating various fishing activities in Everglades National Park in Florida.

5.1.1.5 United States Fish and Wildlife Service (USFWS), DOI

The USFWS has no direct management authority over spotted seatrout. The USFWS may affect the management of spotted seatrout through the Fish and Wildlife Coordination Act, under which the USFWS and the NMFS review and comment on proposals to alter habitat. Dredging, filling, and marine construction are examples of projects that could affect spotted seatrout habitat.

In certain refuge areas, the USFWS may directly regulate fishery harvest. This harvest is usually restricted to recreational limits developed by the respective state. Special use permits may be required if commercial harvest is to be allowed in refuges.

5.1.1.6 United States Environmental Protection Agency (USEPA)

The USEPA through its administration of the Clean Water Act and the National Pollutant Discharge Elimination System (NPDES) may provide protection for spotted seatrout and their habitat. Applications for permits to discharge pollutants into estuarine waters may be disapproved or have specific conditions to protect these marine resources.

5.1.1.7 United States Army Corps of Engineers (USACOE), Department of the Army

Spotted seatrout populations may be influenced by the USACOE's responsibilities pursuant to the Clean Water Act and Section 10 of the Rivers and Harbors Act. Under these laws, the USACOE issues or denies permits to individuals and other organizations for proposals to dredge, fill, and construct in wetland areas and navigable waters. The USACOE is also responsible for planning, construction, and maintenance of navigation channels and other projects in aquatic areas, and these projects could affect spotted seatrout, their habitat, and food sources.

5.1.1.8 United States Coast Guard

The United States Coast Guard is responsible for enforcing fishery management regulations adopted by the USDOC pursuant to management plans developed by the GMFMC. The Coast Guard also enforces laws regarding marine pollution and marine safety, and they assist commercial and recreational fishing vessels in times of need.

Although no regulations have been promulgated for spotted seatrout in the EEZ, enforcement of laws affecting marine pollution and fishing vessels could influence spotted seatrout populations.

5.1.1.9 The United States Food and Drug Administration (FDA)

The FDA may directly regulate the harvest and processing of fish through its administration of the Food, Drug, and Cosmetic Act and other regulations that prohibit the sale and transfer of contaminated, putrid, or otherwise potentially dangerous foods.

5.1.2 Treaties and Other International Agreements

There are no treaties or other international agreements that affect the harvesting or processing of spotted seatrout. No foreign fishing applications to harvest spotted seatrout have been submitted to the United States.

5.1.3 Federal Laws, Regulations, and Policies

The following federal laws, regulations, and policies may directly and indirectly influence the quality, abundance, and ultimately the management of spotted seatrout.

5.1.3.1 Magnuson Fishery Conservation and Management Act of 1976 (MFCMA); Magnuson-Stevens Conservation and Management Act of 1996 (Mag-Stevens) and Sustainable Fisheries Act

The MFCMA mandates the preparation of FMPs for important fishery resources within the EEZ. It sets national standards to be met by such plans. Each plan attempts to define, establish, and maintain the optimum yield for a given fishery. The 1996 reauthorization of the MFCMA included three additional national standards to the original seven for fishery conservation and management, included a rewording of standard number five, and added a requirement for the description of essential fish habitat and definitions of overfishing.

5.1.3.2 Interjurisdictional Fisheries Act of 1986 (P.L. 99-659, Title III)

The Interjurisdictional Fisheries (IJF) Act of 1986 established a program to promote and encourage state activities in the support of management plans and to promote and encourage management of IJF resources throughout their range. The enactment of this legislation repealed the Commercial Fisheries Research and Development Act (P.L. 88-309).

5.1.3.3 Federal Aid in Sport Fish Restoration Act (SFRA); the Wallop-Breaux Amendment of 1984

The SFRA provides funds to states, the USFWS, and the GSMFC to conduct research, planning, and other programs geared at enhancing and restoring marine sportfish populations.

5.1.3.4 Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA), Titles I and III and The Shore Protection Act of 1988 (SPA)

The MPRSA provides protection of fish habitat through the establishment and maintenance of marine sanctuaries. The MPRSA and the SPA act regulate ocean transportation and dumping of dredged materials, sewage sludge, and other materials. Criteria for issuing such permits include consideration of effects of dumping on the marine environment, ecological systems, and fisheries resources.

5.1.3.5 Federal Food, Drug, and Cosmetic Act of 1938 (FDCA)

The FDCA prohibits the sale, transfer, or importation of "adulterated" or "misbranded" products. Adulterated products may be defective, unsafe, filthy, or produced under unsanitary conditions. Misbranded products may have false, misleading, or inadequate information on their labels. In many instances, the FDCA also requires FDA approval for distribution of certain products.

5.1.3.6 Clean Water Act of 1981 (CWA)

The CWA requires that a USEPA approved National Pollution Discharge Elimination System (NPDES) permit be obtained before any pollutant is discharged from a point source into waters of the United States including waters of the contiguous zone and the adjoining ocean. Discharges of toxic materials into rivers and estuaries that empty into the Gulf of Mexico can cause mortality to marine fishery resources and may alter habitats.

Under Section 404 of the CWA the USACOE is responsible for administration of a permit and enforcement program regulating alterations of wetlands as defined by the act. Dredging, filling, bulk-heading, and other construction projects are examples of activities that require a permit and have potential to affect marine populations. The NMFS is the federal trustee for living and nonliving natural resources in coastal and marine areas under United States jurisdiction pursuant to the CWA.

5.1.3.7 Federal Water Pollution Control Act of 1972 (FWPCA) and MARPOL Annexes I and II

Discharge of oil and oily mixtures is governed by the Federal Water Pollution Control Act (FWPCA) and 40 Code of Federal Regulations (CFR), Part 110, in the navigable waters of the United States, discharge of oil and oily substances by foreign ships or domestic ships operating or capable of operating beyond the United States territorial sea is governed by MARPOL Annex I.

MARPOL Annex II governs the discharge at sea of noxious liquid substances primarily derived from tank cleaning and deballasting. Most categorized substances are prohibited from being discharged within 12 nautical miles of land and at depths of less than 25 meters.

5.1.3.8 Coastal Zone Management Act of 1972 (CZMA), as amended

Under the CZMA, states receive federal assistance grants to maintain federally-approved planning programs for enhancing, protecting, and utilizing coastal resources. These are state programs, but the act requires that federal activities must be consistent with the respective states' CZM programs. Depending upon the individual state's program, the act provides the opportunity for considerable protection and enhancement of fishery resources by regulation of activities and by planning for future development in the least environmentally damaging manner.

5.1.3.9 Endangered Species Act of 1973, as amended

The Endangered Species Act provides for the listing of plant and animal species that are threatened or endangered. Once listed as threatened or endangered, a species may not be taken, possessed, harassed, or otherwise molested. It also provides for a review process to ensure 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 habitats that are determined by the Secretary of the DOI to be critical.

5.1.3.10 National Environmental Policy Act of 1970 (NEPA)

The 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, the NEPA requires that federal agencies prepare an environmental impact statement prior to undertaking major federal actions that significantly affect the quality of the human environment. Within these statements, alternatives to the proposed action that may better safeguard environmental values are to be carefully assessed.

5.1.3.11 Fish and Wildlife Coordination Act of 1958

Under the Fish and Wildlife Coordination Act, the USFWS and NMFS review and comment on fish and wildlife aspects of proposals for work and activities sanctioned, permitted, assisted, or conducted by federal agencies that take place in or affect navigable waters, wetlands, or other critical fish and wildlife habitat. The review focuses on potential damage to fish, wildlife, and their habitat; therefore, it serves to provide some protection to fishery resources from activities that may alter critical habitat in nearshore waters. The act is important because federal agencies must give due consideration to the recommendations of the USFWS and NMFS.

5.1.3.12 Fish Restoration and Management Projects Act of 1950

Under this act, the DOI is authorized to provide funds to state fish and game agencies for fish restoration and management projects. Funds for protection of threatened fish communities that are located within state waters could be made available under the act.

5.1.3.13 Lacey Act of 1981, as amended

The Lacey Act prohibits import, export, and interstate transport of illegally-taken fish and wildlife. As such, the act provides for federal prosecution for violations of state fish and wildlife laws. The potential for federal convictions under this act with its more stringent penalties has probably reduced interstate transport of illegally-possessed fish and fish products.

5.1.3.14 Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA or "Superfund")

The CERCLA names the NMFS as the federal trustee for living and nonliving natural resources in coastal and marine areas under United States jurisdiction. It could provide funds for "clean-up" of fishery habitat in the event of an oil spill or other polluting event.

5.1.3.15 MARPOL Annex V and United States Marine Plastic Research and Control Act of 1987 (MPRCA)

MARPOL Annex V is a product of the International Convention for the Prevention of Pollution from Ships, 1973/1978. Regulations under this act prohibit ocean discharge of plastics from ships; restrict discharge of other types of floating ship's garbage (packaging and dunnage) for up to 25 nautical miles from any land; restrict discharge of victual and other recomposable waste up to 12 nautical miles from land; and require ports and terminals to provide garbage reception facilities. The MPRCA of 1987 and 33 CFR, Part 151, Subpart A, implement MARPOL V in the United States.

5.1.3.16 Fish and Wildlife Act of 1956

This act provides assistance to states in the form of law enforcement training and cooperative law enforcement agreements. It also allows for disposal of abandoned or forfeited property with some equipment being returned to states. The act prohibits airborne hunting and fishing activities.

5.2 State Authority, Laws, Regulations, and Policies

Table 5.1 outlines the various state management institutions and authorities.

5.2.1 Florida

5.2.1.1 Florida Fish and Wildlife Conservation Commission

Florida Fish and Wildlife Conservation Commission
620 South Meridian Street
Tallahassee, FL 32399
Telephone: (904) 487-0554

The agency charged with the administration, supervision, development, and conservation of natural resources is the Florida Fish and Wildlife Conservation Commission (FWC). This commission is not subordinate to any other agency or authority of the executive branch. The administrative head of the FWC is the executive director. Within the FWC, the Division of Marine Fisheries is empowered to conduct research directed toward management of marine and anadromous fisheries in the interest of all people of Florida. The Division of Law Enforcement is responsible for enforcement of all marine, resource-related laws, and all rules and regulations of the Commission.

The FWC, a ten-member board (that will eventually be seven members) appointed by the governor and confirmed by the senate, was created by constitutional amendment in November 1998, effective July 1, 1999. This commission was delegated rule-making authority over marine life in the following areas of concern: gear specification, prohibited gear, bag limits, size limits, quotas and trip limits, species that may not be sold, protected species, closed areas, seasons, and quality control codes.

Florida has habitat protection and permitting programs and a federally-approved CZM program.

Table 5.1. State management institutions - Gulf of Mexico.

State	Administrative Body and Its Responsibilities	Administrative Policy-making Body and Decision Rule	Legislative Involvement in Management Regulations
FLORIDA	FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION ·administers management programs ·enforcement ·conducts research	·creates rules in conjunction with management plans ·ten member commission	·responsible for setting fees, licensing, and penalties.
ALABAMA	DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES ·administers management programs ·enforcement ·conducts research	·Commissioner of department has authority to establish management regulation ·Conservation Advisory Board is a thirteen-member board and advises the commissioner ·has authority to amend and promulgate regulations	·authority for detailed management regulations delegated to commissioner ·statutes concerned primarily with licensing
MISSISSIPPI	MISSISSIPPI DEPARTMENT OF MARINE RESOURCES ·administers management programs ·conducts research ·enforcement	COMMISSION ON MARINE RESOURCES ·seven-member board establishes ordinances on recommendation of executive director (MDMR)	·authority for detailed management regulations delegated to commission ·statutes concern licenses, taxes and some specific fisheries laws
LOUISIANA	DEPARTMENT OF WILDLIFE AND FISHERIES ·administers management programs ·enforcement ·conducts research ·makes recommendations to legislature	WILDLIFE AND FISHERIES COMMISSION ·seven-member board establishes policies and regulations based on majority vote of a quorum (four members constitute a quorum) consistent with statutes	·detailed regulations contained in statutes ·authority for detailed management regulations delegated to commission
TEXAS	PARKS AND WILDLIFE DEPARTMENT ·administers management programs ·enforcement ·conducts research ·makes recommendations to Texas Parks & Wildlife Commission (TPWC)	PARKS AND WILDLIFE COMMISSION ·nine-member body establishes regulations based on majority vote of quorum (five members constitute a quorum) ·granted authority to regulate means and methods for taking, seasons, bag limits, size limits and possession	·licensing requirements and penalties are set by legislation

5.2.1.2 Legislative Authorization

Prior to 1983, the Florida Legislature was the primary body that enacted laws regarding management of spotted seatrout in state waters. Chapter 370 of the Florida Statutes, annotated, contained the specific laws directly related to harvesting, processing, etc. both statewide and in specific areas or counties. In 1983, the Florida Legislature established the Florida Marine Fisheries Commission (FMFC) and provided the commission with various duties, powers, and authorities to promulgate regulations affecting marine fisheries. Title 46, Chapter 46-37 contains regulations regarding spotted seatrout. On July 1, 1999, the FMFC (including the Florida Marine Patrol) and the Florida Game and Freshwater Fish Commission were merged into one commission. Marine fisheries rules of the new FWC are now codified under Chapter 68B, Florida Administrative Code.

5.2.1.3 Reciprocal Agreements and Limited Entry Provisions

5.2.1.3.1 Reciprocal Agreements

Florida statutory authority provides for reciprocal agreements related to fishery access and licenses. Florida has no statutory authority to enter into reciprocal management agreements.

5.2.1.3.2 Limited Entry

Florida has no statutory provisions for limited entry in the spotted seatrout fishery.

5.2.1.4 Commercial Landings Data Reporting Requirements

Fishermen are required to sell their saltwater products to licensed wholesale dealers [Chapter 370.06(2), Florida Statutes], and those dealers are required to report each purchase on a trip ticket [Chapter 370.07(5), Florida Statutes]. Trip tickets contain the saltwater product license number of the fisherman, wholesale dealer number, date of purchase, time fished (time away from the dock), county where the saltwater products were landed, area fished, water depth, gear fished, number of traps if used, soak time if traps were used, species landed, market size code, and price per pound. Dealers are required to submit their trip tickets each week if the tickets contain quota managed species such as Spanish mackerel; otherwise, tickets are submitted every month. These data are collected, computerized, and, after extensive editing, entered into the FWC, Florida Marine Research Institute's marine fisheries information system.

5.2.1.5 Penalties for Violations

Penalties for violations of Florida laws and regulations are established in Florida Statutes, Section 370.021. Additionally, upon the arrest and conviction of any license holder for violation of such laws or regulations, the license holder is required to show just cause as to reasons why his saltwater license should not be suspended or revoked.

5.2.1.6 Annual License Fees

Resident Wholesale Seafood Dealer	
· county	$300.00
· state	450.00
Nonresident Wholesale Seafood Dealer	
· county	500.00
· state	1,000.00
Alien Wholesale Seafood Dealer	
· county	1,000.00
· state	1,500.00
Resident Retail Seafood Dealer	25.00
Nonresident Retail Seafood Dealer	200.00
Alien retail Seafood Dealer	250.00
Saltwater Products License	
· resident-individual	50.00
· resident-vessel	100.00
· nonresident-individual	200.00
· nonresident-vessel	400.00
· alien-individual	300.00
· alien-vessel	600.00
Recreational Saltwater Fishing License	
· resident	
ten day	11.50
annual	13.50
· nonresident	
three day	6.50
seven day	16.50
annual	31.50
Annual Commercial Vessel Saltwater Fishing License (recreational for hire)	
· 11 or more customers	801.50
· 5-10 customers	401.50
· four or less customers	201.50
Optional Pier Saltwater Fishing License (recreational users exempt from other licenses)	501.50
Optional Recreational Vessel License (recreational users exempt from other licenses)	2,001.50

5.2.1.7 Laws and Regulations

Florida's laws and regulations regarding the harvest of spotted seatrout vary by region. Variances are most notable for size limits by seasons. The following discussions are general summaries of laws and regulations, and the FWC and/or their law enforcement division should be contacted for more specific information. The restrictions discussed in this section are current to the date of this publication and are subject to change at any time thereafter.

5.2.1.7.1 Size Limits

A minimum size limit of 15 inches TL and a maximum size limit of 20 inches TL have been established for the recreational fishery in the Southwest Region (waters between the Dade-Monroe and the Pinellas-Pasco county line). Minimum and maximum size limits of 15 inches TL and 24 inches TL, respectively, have been established for the recreational fishery in the Northwest Region (waters between the Pasco-Pinellas County line and the Florida-Alabama border). Recreational fishermen may land one fish per person per day that is larger than the maximum size limit established for the respective region being fished.

A minimum size limit of 15 inches TL and a maximum size limit of 24 inches TL have been established for the commercial fishery in all Florida waters.

5.2.1.7.2 Gear Restrictions

Since January 1, 1996, spotted seatrout can only be harvested with hook and line or cast nets, and all other gears (e.g., purse seines, gill nets, trammel nets, pound nets, other entangling nets, haul seines, beach seines, etc.) are prohibited throughout Florida territorial waters. Additionally, possession of spotted seatrout aboard any vessel carrying gill nets or other entangling nets is prohibited.

5.2.1.7.3 Closed Areas and Seasons

There are no closed areas for the harvest of spotted seatrout in Florida. In the Southwest Region, the harvest of spotted seatrout by both commercial and recreational fishermen is prohibited from November 1 through December 31 of each year. Harvest by either group is annually prohibited in the Northwest Region from February 1 through the last day of February. The commercial season for spotted seatrout in Florida has been established for the period June 1 through August 31 of each year, and the sale or purchase of spotted seatrout after September 5 of each year is prohibited unless the fish have entered Florida through interstate commerce with proper documentation.

5.2.1.7.4 Quotas and Bag/Possession Limits

A bag and possession limit of five fish per person per day has been established for the recreational fishery in the Southwest Region, and a bag and possession limit of seven fish per person per day has been established for the Northwest Region.

Commercial fishermen are restricted by a daily possession limit of 75 fish per person per day during the open season. This limit also applies to vessels regardless of the number of licensees aboard. Commercial fishermen are required to have a "Restricted Species Endorsement" to their saltwater products license. A Restricted Species Endorsement requires commercial fishermen to show by *bona fide* means (i.e., trip tickets, sales receipts, etc.) that a minimum of $5,000 of their gross income has come from the sale of any saltwater species during at least one of the past three years.

5.2.1.7.5 Other Restrictions

Spotted seatrout must be landed "whole" with heads, tails, fins, and flesh attached; however, they may be eviscerated and/or have the gills removed. The use of any multiple hook (e.g., treble hook) with live or dead bait and snagging (snatch hooking) to catch spotted seatrout is prohibited.

5.2.1.7.6 Historical Changes to Regulations

Other than a few local laws, there were no regulations on the harvest of spotted seatrout until Florida's Legislature implemented a 12-inch minimum size in 1957 [Chapter 370.11, Section 2a(4), Florida Statutes]. The 12-inch minimum size applied statewide, although a few Panhandle counties were able to prevail upon the Legislature to exempt them from this regulation.

In 1983, the Legislature created the FMFC to manage Florida's marine resources subject to approval by the Governor and Cabinet.

The FMFC implemented a suite of management regulations effective November 1, 1989 under Chapter 46-37 of the Florida Administrative Code. These regulations included:

- designating spotted seatrout as a "restricted species"
- prohibiting snatch hooking and the use of multiple hooks when fishing for seatrout with natural baits
- establishing a 14-inch minimum size and a 24-inch maximum size with the allowance of one fish over 24 inches may be kept per day
- establishing a daily bag limit and on water possession limit of ten fish per person
- setting a 3-inches minimum net mesh size for the harvest of seatrout (the minimum size becomes 3.5 inch on January 1, 1993)
- regulating commercial harvest by dividing the state into three regions - East Coast (Florida/Georgia line to Dade/Monroe county line), Southwest Coast (Dade/Monroe county line to Pinellas/Pasco county line), and Northwest Coast (Pinellas/Pasco county line to Florida/Alabama line); season begins November 1 in each region and continues until October 31 of the following year for each region; harvest limits set at 70% of the average harvest taken from 1984-1987; a 500 lb daily vessel limit applies until 50% of the harvest is reached, then a 200 lb daily vessel limit applies until the season limit is harvested; commercial harvest of spotted seatrout ends in each region when the 200 lb season is closed, and no sale of native spotted seatrout is allowed beginning when all three regional quotas are met until the following November 1

Effective January 1, 1996, the FMFC revised their regulations to manage spotted seatrout to include:

- prohibiting all harvest of spotted seatrout in state waters from the Pinellas/Pasco county line to the Florida/Alabama line in February, and in all other state waters in November and December each year

- establishing daily recreational bag limits of seven spotted seatrout harvested in state waters from the Pinellas/Pasco county line to the Florida/Alabama line and five spotted seatrout harvested from all other state waters
- raising the minimum size limit for spotted seatrout to 15 inches TL
- establishing a 24 inch TL maximum size limit for spotted seatrout harvested in state waters from Pinellas/Pasco county line to the Florida/Alabama line, and a 20 inch TL maximum size limit for spotted seatrout harvested in all other state waters (an allowance for the daily harvest of one fish larger than the respective maximum lengths applies statewide)
- allowing the commercial harvest and sale of spotted seatrout in June, July, and August only a 75 fish daily vessel limit and a 15 inch TL minimum/24 inch TL maximum size limit applies during these months for all commercial harvest of spotted seatrout statewide
- allowing only the use of hook and line gear and cast nets for all harvest of spotted seatrout
- prohibiting the simultaneous possession aboard a vessel of any gill net or entangling net together with any spotted seatrout
- requiring all spotted seatrout to be landed in a whole condition, and prohibits the possession of spotted seatrout that are not in a whole condition in or on state waters, on any public or private fishing pier, on a bridge or catwalk attached to a bridge from which fishing is allowed, or on any jetty
- defining "total length" for spotted seatrout to mean the length of the fish measured from the most forward point of the head to the hindmost point of the tail.

Effective August 1, 1996, the FMFC replaced the November/December closed seasons to the harvest of spotted seatrout with a December through February closure in Nassau through Flagler counties only.

5.2.2 Alabama

5.2.2.1 Alabama Department of Conservation and Natural Resources

Alabama Department of Conservation and Natural Resources (ADCNR)
Alabama Marine Resources Division (MRD)
P.O. Box 189
Dauphin Island, Alabama 36528
Telephone: (334) 861-2882

Management authority of fishery resources in Alabama is held by the Commissioner of the Department of Conservation and Natural Resources. The Commissioner may promulgate rules or regulations designed for the protection, propagation, and conservation of all seafood. He may prescribe the manner of taking, times when fishing may occur, and designate areas where fish may or may not be caught; however, all regulations are to be directed at the best interest of the seafood industry.

Most regulations are promulgated through the Administrative Procedures Act approved by the Alabama Legislature in 1983; however, bag limits and seasons are not subject to this act. The

Administrative Procedures Act outlines a series of events that must precede the enactment of any regulations other than those of an emergency nature. Among this series of events are: (a) the advertisement of the intent of the regulation, (b) a public hearing for the regulation, (c) a 35-day waiting period following the pubic hearing to address comments from the hearing, and (d) a final review of the regulation by a joint house and senate review committee.

Alabama also has the Alabama Conservation Advisory Board that is endowed with the responsibility to provide advice on policies and regulations of the ADCNR. The board consists of the governor, the ADCNR commissioner, the Director of the Auburn University Agriculture and Extension Service, and ten board members.

The AMRD has responsibility for enforcing state laws and regulations, for conducting marine biological research, and for serving as the administrative arm of the commissioner with respect to marine resources. The division recommends regulations to the commissioner.

Alabama has a habitat protection and permitting program and a federally-approved coastal zone management (CZM) program.

5.2.2.2 Legislative Authorization

Chapters 2 and 12 of Title 9, Code of Alabama, contain statutes that affect marine fisheries.

5.2.2.3 Reciprocal Agreements and Limited Entry Provisions

5.2.2.3.1 Reciprocal Agreements

Alabama statutory authority provides for reciprocal agreements with regard to access and licenses. Alabama has no statutory authority to enter into reciprocal management agreements.

5.2.2.3.2 Limited Entry

Alabama has no statutory provisions for limited entry in the spotted seatrout fishery.

5.2.2.4 Commercial Landings Data Reporting Requirements

Although spotted seatrout may not be commercially caught, they may be imported, and Alabama law requires that wholesale seafood dealers file monthly reports to the ADCNR. Thorough records were not collected prior to 1982; however, records of sales of seafood products are now collected jointly by the NMFS and ADCNR port agents.

5.2.2.5 Penalties for Violations

Violations of the provisions of any statute or regulation are considered Class C, Class B, or Class A misdemeanors and are punishable by fines up to $2,000 and up to one year in jail. Conviction for some violations may result in forfeiture of boat, vehicle, and other related equipment/gear.

5.2.2.6 Annual License Fees

The following list of license fees is current to the date of this publication; however, these fees are subject to change at any time.

Recreational Saltwater Fishing License*	
· resident	$16.00
· nonresident**	31.00
Seafood Dealer	
· resident	201.00
· nonresident**	401.00

*Seines 25 ft or less in length are exempt from licensing.
**Nonresident fees for recreational and seafood dealer licenses may vary based on the charge for similar fishing activities in the applicant's state of residence.

5.2.2.7 Laws and Regulations

Alabama laws and regulations regarding the harvest of spotted seatrout are primarily directed to the recreational fishery. The following is a general summary that is current to the date of this publication, and restrictions are subject to change at any time thereafter. The ADCNR, MRD should be contacted for specific and up-to-date information.

5.2.2.7.1 Size Limits

A minimum size of 14 inches TL has been established for spotted seatrout taken from Alabama waters; however, two undersized fish are allowed in a person's daily bag limit.

5.2.2.7.2 Gear Restrictions

Spotted seatrout may only be taken with hook and line gear in Alabama waters, and those incidentally caught with nets, trawls, or seines must be immediately returned to the water.

5.2.2.7.3 Closed Areas and Seasons

There are no closed areas or seasons for taking spotted seatrout by legal means in Alabama.

5.2.2.7.4 Quotas and Bag/Possession Limits

There are no quotas for the recreational fishery, and commercial fishing is prohibited. A possession limit of ten fish per person has been established.

5.2.2.7.5 Other Restrictions

It is unlawful to use any hook and line device containing more than five hooks in Alabama's saltwaters.

Unwanted and undersized spotted seatrout must be returned to the water as soon as possible and uninjured to the greatest extent possible.

Spotted seatrout that are caught or purchased outside of Alabama and aquaculturally-produced spotted seatrout must comply with reporting, documentation, and other requirements established by the ADCNR when they are imported or transported in Alabama. The ADCNR should be contacted concerning these regulations.

5.2.3 Mississippi

5.2.3.1 Mississippi Department of Marine Resources

Mississippi Department of Marine Resources (MDMR)
1141 Bayview Avenue, Suite 101
Biloxi, Mississippi 39530
Telephone: (228) 374-5000

The MDMR administers coastal fisheries and habitat protection programs. Authority to promulgate regulations and policies is vested in the Mississippi Commission on Marine Resources (MCMR), the controlling body of the MDMR. The commission consists of seven members appointed by the Governor. One member is also a member of the Mississippi Commission on Wildlife, Fisheries and Parks and serves as a liaison between the two agencies. The MCMR has full power to "manage, control, supervise and direct any matters pertaining to all saltwater aquatic life not otherwise delegated to another agency" (Mississippi Code Annotated 49-15-11).

Mississippi has a habitat protection and permitting program and a federally-approved CZM plan. The MCMR is charged with administration of the Mississippi Coastal Program which requires authorization for all activities that impact coastal wetlands. Furthermore, the state has an established CZM program approved by National Oceanic and Atmospheric Administration (NOAA). The CZM program reviews activities which would potentially and cumulatively impact coastal wetlands located above tidal areas. The Executive Director of the MDMR is charged with administration of the CZM program.

5.2.3.2 Legislative Authorization

Title 49, Chapter 15 of the Mississippi Code of 1972, annotated, contains various statutes regarding the harvest of marine species. This chapter also authorizes the MDMR to promulgate regulations affecting the harvest of marine fishery resources. Title 49, Chapter 27 contains the Wetlands Protection Act and its provisions are also administered by the MDMR.

5.2.3.3 Reciprocal Agreements and Limited Entry Provisions

5.2.3.3.1 Reciprocal Agreements

Section 49-15-15 provides statutory authority for the MDMR to enter into interstate and intrastate agreements for the purposes of protecting, propagating, or conserving seafood. Such agreements may provide for reciprocal agreements for licensing, access, or management provided that they do not conflict with other statutes.

5.2.3.3.2 Limited Entry

State Statute 49-15-16 , Mississippi Code of 1972, annotated, provides that the MCMR may develop a limited entry fisheries management program for all user groups.

5.2.3.4 Commercial Landings Data Reporting Requirements

Ordinance Number 9.001 of the MDMR establishes reporting requirements for various fisheries and types of fishery operations. It also provides for confidentiality of data and penalties for falsifying or refusing to supply such information.

5.2.3.5 Penalties for Violations

Penalties for violations of Mississippi laws and regulations regarding spotted seatrout are provided in Section 49-15-63, Mississippi Code of 1972, annotated.

5.2.3.6 Annual License Fees

The following is a list of resident license fees for activities related to the capture, sale, or transport of spotted seatrout. They are current to the date of this publication but are subject to change at any time. Nonresident fees may vary based on the charge for similar fishing activities in the applicant's state of residence.

Commercial Hook and Line Vessel License	$100.00
Commercial Hook and Line Fisherman License	100.00
Charter Boats and Party Boats	200.00
Trammel Nets, Gill Nets and Seines*	
· resident	100.00
· nonresident	300.00
Purse Seine (other than menhaden)	
· resident	100.00
· nonresident	300.00
Seafood Processor	200.00
Wholesale Dealers	100.00
Recreational Hook and Line	4.00

*Small mesh beach seines (less than 0.25-inch bar, 0.5-inch stretched mesh) that do not exceed 100 ft in length are exempt from licensing.

5.2.3.7 Laws and Regulations

5.2.3.7.1 Size Limits

A minimum size of 14 inch TL has been established for both the commercial and recreational fisheries in Mississippi.

5.2.3.7.2 Gear Restrictions

A minimum mesh size of 1.5-inch bar, 3.0-inch stretched has been established for gill nets and trammel nets, except that from October 15 through December 15 of each year these nets must be 1.75-inch bar, 3.5-inch stretched mesh or larger. These nets may not exceed 1,200 ft in length, and they may not be fished within a quarter mile of another such net. No boat or vessel may carry more than one such net, and they must be constantly attended with the attendee located within a boats length of the net at all times. These nets must be marked by visible buoys every 100 ft containing the owners license number or full name. A minimum mesh size of 0.5-inch bar, 1.0-inch stretched mesh has been established for purse seines, and they may not exceed 1,500 ft in length.

5.2.3.7.3 Closed Areas and Seasons

Commercial fishing is prohibited in all waters north of the CSX railroad bridge. Gill and trammel nets are prohibited one-half mile from the shoreline. Nets, other than gill and trammel nets, may not be used within 1,200 ft of any public pier or hotel/motel pier, and they are prohibited within 1,200 ft of private piers that are at least 75 ft in length. Nets, other than gill and trammel nets, are also prohibited within 1,200 ft of the shoreline of Deer Island and within 1,500 ft of the shoreline between the U.S. Highway 90 bridge and the north shore of Bayou Caddy in Hancock County. The aforementioned nets are also prohibited in and within 100 ft of the mouth of rivers, bays, bayous, streams, lakes, and other tributaries to Mississippi saltwaters, except as follows:

> Point aux Chenes Bay, Middle Bay, Jose Bay, L'Isle Chaude, Heron Bayou, Pascagoula Bay south of a line that generally runs from Camp Lamotte to the southernmost point of Twin Islands to the southernmost point of Rabbit Island to the eastern side of Litton Shipbuilding to the entrance of Yazoo Lake, South Rigolets, and Biloxi Bay south of a line between Marsh Point and Grand Bayou. Additionally, these nets may not be used in a manner that would block the mouth of any bay, bayou, stream, river, lake, or other tributary to saltwaters of the state.

Gill nets, trammel nets, purse seines, and other commercial nets are prohibited within one mile of the shoreline of Cat Island, Ship Island, Horn Island, Petit Bois Island, Round Island, and the shoals of Telegraph Keys and Telegraph Reef from May 15 to September 15 of each year. Federal regulations prohibit any commercial fishing within the Gulf Islands National Seashore (one mile from the shoreline of Ship, Horn, and Petit Bois islands).

Purse seines are prohibited within one mile of the shoreline of Harrison and Hancock counties. Recreational cast nets may be used only in waters south of Interstate Highway 10.

There are no closed seasons on spotted seatrout in Mississippi, except when quotas are reached; however, various time closures have been implemented. Gill and trammel nets are prohibited within ½ mile of the shoreline. Additionally, the use of gill and trammel nets is prohibited from 6:00 a.m. to 6:00 p.m. on all legal holidays and year-round from 6:00 a.m. on Saturday to 6:00 p.m. on Sunday in all marine waters of Mississippi.

5.2.3.7.4 Quotas and Bag/Possession Limits

An annual total allowable catch (TAC) of 40,000 lbs has been established for the commercial fishery with the fishing year beginning October 1 and ending September 30 of the following year.

A daily bag and possession limit of 15 fish has been established for the recreational fishery.

5.2.3.7.5 Other Restrictions

On or before January 1, 1997, all gill and trammel nets must be constructed of an approved degradable material.

Prior to delivery to the final destination, it is unlawful for commercial or recreational fishermen to possess spotted seatrout with heads, tails, or flesh removed; however, they may be eviscerated, scaled, or have the gills removed. Spotted seatrout may be filleted during recreational and charter fishing trips that last in excess of 24 hours provided that these fishermen have complied with specific requirements as adopted by the MDMR including but not limited to the filing of a float plan for each trip.

Multiple point hooks (e.g., treble hooks) are prohibited when using any live, dead, or cut bait; however, they are legal when used on artificial lures.

5.2.3.7.6 Historical Changes to Regulations

1978 - recreational (50 fish bag, three day possession), commercial (12-inch minimum).

1986 - recreational (25 fish bag limit, 14-inch minimum size, three day possession limit, five undersized fish may be retained), commercial (14-inch minimum)

July 1991 - Ordinance 7.008 eliminated the possession of five fish under the minimum 14-inch size limit. Bag limit 25 fish per person.

May 1992 - Ordinance 7.009 reinstated the possession of five fish under the minimum 14-inch size limit. Bag limit 25 per person.

November 1995 - Ordinance 7.018 reduced the bag limit from 25 fish per person to ten fish per person and eliminates the possession of five fish under the minimum 14-inch size limit.

November 1995 - Ordinance 5.012 established a 40,000 pounds commercial quota, which begins October 1 of each year.

February 1996 - Ordinance 7.019 increased the bag limit from ten fish per person to 15 fish per person. 14-inch minimum length.

5.2.4 Louisiana

5.2.4.1 Louisiana Department of Wildlife and Fisheries

Louisiana Department of Wildlife and Fisheries (LDWF)
P.O. Box 98000
Baton Rouge, Louisiana 70898-9000
Telephone: (225) 765-2800

The LDWF is one of 21 major administrative units of the Louisiana government. A seven-member board, the Louisiana Wildlife and Fisheries Commission (LWFC), is appointed by the Governor. Six of the members serve overlapping terms of six years, and one serves a term concurrent with the Governor. The commission is a policy-making and budgetary-control board with no administrative functions. The legislature has authority to establish management programs and policies; however, the legislature has delegated certain authority and responsibility to the LWFC and the LDWF. The LWFC may set possession limits, quotas, places, seasons, size limits, and daily take limits based on biological and technical data. The Secretary of the LDWF is the executive head and chief administrative officer of the department and is responsible for the administration, control and operation of the functions, programs and affairs of the department. The Secretary is appointed by the Governor with consent of the Senate.

Within the administrative system, an Assistant Secretary is in charge of the Office of Fisheries. In this office a Marine Fisheries Division, headed by the Division Administrator, performs "the functions of the state relating to the administration and operation of programs, including research relating to oysters, water bottoms and seafood including, but not limited to, the regulation of oyster, shrimp, and marine fishing industries" (Louisiana Revised Statutes 36:609). The Enforcement Division, in the Office of the Secretary, is responsible for enforcing all marine fishery statutes and regulations.

Louisiana has habitat protection and permitting programs and a federally-approved CZM program. The Coastal Management Division of the Louisiana Department of Natural Resources is the lead agency for Louisiana coastal zone management. The Federal Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) was passed in 1990. It funds wetland enhancement projects nationwide, including substantial work in Louisiana. The CWPPRA Task Force recommends projects to be funded under this initiative. The Task Force is made up of five federal agencies (Department of Agriculture, USDOC, Department of Army, DOI, and EPA) and the state of Louisiana, represented by the Executive Assistant for Coastal Activities in the Governor's Office. Each project has a federal sponsor.

5.2.4.2 Legislative Authorization

Title 56, Louisiana Revised Statutes (L.R.S.) contains statutes adopted by the Legislature that govern marine fisheries in the state and that empower LWFC to promulgate rules and regulations regarding fish and wildlife resources of the state. Title 36, L.R.S. creates the LDWF and designates the powers and duties of the department. Title 76 of the Louisiana Administrative Code contains rules and regulations adopted by the LWFC and the LDWF that govern marine fisheries.

Section 325.3, 326.1, 326.3 of Title 56 (L.R.S.) authorizes the LWFC to promulgate rules for the harvest of spotted seatrout including seasons, daily take and possession limits, permits, and other aspects of harvest; and it provides authority to adopt interim rules until the LWFC can implement permanent rules. Additionally, the LWFC has regulatory authority to set possession limits, quotas, places, seasons, size limits, and daily take limits for all freshwater and saltwater finfishes based upon biological and technical data.

5.2.4.3 Reciprocal Agreements and Limited Entry Provisions

5.2.4.3.1 Reciprocal Agreements

The LWFC is authorized to enter into reciprocal management agreements with the states of Arkansas, Mississippi, and Texas on matters pertaining to aquatic life in bodies of water that form a common boundary. The LDWC is also authorized to enter into reciprocal licensing agreements.

Residents of Texas 65 years of age or older or under 17 years of age may fish in all Louisiana/Texas border waters without a recreational fishing license. Reciprocally, Louisiana residents 60 years of age or older or those under 16 years of age may fish in all Texas/Louisiana border waters, excluding the Gulf of Mexico, without a fishing license. As of October 1, 1999 Louisiana residents 60 and older and Texas residents 65 and older, will be required to purchase non-resident fishing licenses when fishing the inland waters of each state. Anglers must have a birth certificate, driver's license, or a military record as proof of age.

5.2.4.3.2 Limited Entry

Louisiana has adopted limited access restrictions for the commercial harvest of spotted seatrout. Section 333 of Title 56 (L.R.S.) as amended in 1995 provides that spotted seatrout permits and commercial rod and reel licenses may only be issued to persons who have held saltwater gill net licenses in two of the years 1993, 1994, and 1995; have derived 50% or more of their income from commercial fishing in at least two of those years; and have not applied for economic assistance for training under 56:13.1(C). Additionally, any person previously convicted of a Class 3 or greater violation cannot be issued a commercial rod and reel license, and any person convicted of any subsequent violation of fisheries law shall forfeit this license and is forever barred from receiving such license.

5.2.4.4 Commercial Landings Data Reporting Requirements

Commercial fishermen may transport and sell their own catch to any licensed wholesale/retail dealer located within Louisiana (R.S. 56:303.4). Wholesale/retail dealers as well as commercial fishermen holding a fresh products license (R.S. 56:303.11) who sell directly to a consumer are required to report each purchase on a trip ticket (R.S. 56:303.7). Trip tickets contain the commercial fisherman's name, license number, vessel name, USCG documented vessel number or Louisiana vessel registration number, wholesale/retail dealer name and license number, trip time (time away from the dock), area fished, gear used, transaction date, species landed and species code, unit code, market condition code, price per pound, total value, and permit type (state or federal) and number if applicable. Fishermen and dealers are required to provide signatures, and dealers are required to submit their trip tickets along with monthly summary sheets.

5.2.4.5 Penalties for Violations

All violations of Louisiana laws and regulations regarding spotted seatrout are in the Class 3 category. First offenses are punishable by fines ranging from $250 to $500 and/or 90 days in jail. Second offenses carry fines from $500 to $800 and 60 to 90 days in jail with forfeiture of all equipment involved with the violation. Third offenses have fines from $750 to $1,000; 90 to 120 days in jail; and forfeiture of all equipment involved with the illegal activity. Conviction of any offense involving commercial saltwater fishing also results in the revocation of commercial permits and licenses and precludes the perpetrator from ever purchasing such a license. Civil penalties may also be imposed.

5.2.4.6 Annual License Fees

The following list of license fees is current to the date of this publication. They are subject to change any time thereafter. Also, nonresident fees may vary based on the charge for similar fishing activities in the applicant's state of residence.

Commercial	
Commercial Fisherman License	
· resident	$55.00
· nonresident	460.00
Charter Boat Fishing Guide (*up to six passengers*)	
· resident	250.00
· nonresident	1,000.00
Charter Boat Fishing Guide (*more than six passengers*)	
· resident	500.00
· nonresident	2,000.00
Vessel License	
· resident	15.00
· nonresident	60.00
Saltwater Rod and Reel	
· resident	250.00
· nonresident	1,000.00

Spotted Seatrout Permit*	
· resident	100.00
· nonresident	400.00
Wholesale/Retail Dealer (Business)	
· resident	250.00
· nonresident	1,105.00
Wholesale/Retail Dealer (Vehicle)	
· resident	250.00
· nonresident	1,105.00
Seafood Retail Dealer (Business)	105.00
Seafood Retail Dealer (Vehicle)	105.00
Transport License**	30.00

*Required in addition to fisherman, vessel, and gear licenses.
**Allows transport of saltwater gill nets through state waters.

Recreational

Basic Recreational Fishing License	
· Resident	9.50
· Nonresident	60.00
Saltwater Angling License*	
· Resident	5.50
· Nonresident	50.00
Temporary Basic Recreational Fishing License (three day)	
· Nonresident	30.00
Temporary Saltwater Angling License (three day)**	
· Nonresident	40.00
Lifetime Resident Fishing	300.00
Nonresident Charter Trip Fishing License (three day)	5.00

*Required in addition to Basic Recreational Fishing License
**Required in addition to Temporary Basic or Basic Recreational Fishing License

5.2.4.7 Laws and Regulations

Louisiana laws and regulations regarding the harvest of spotted seatrout include gear restrictions, seasons, and other provisions. The following is a general summary of these laws and regulations. They are current to the date of this publication and are subject to change at any time thereafter. The LDWF should be contacted for specific and up-to-date information.

5.2.4.7.1 Size Limits

A minimum size limit of 14 inches TL has been established for the commercial fishery; however, 5% of the total number in possession may be undersized. Recreational fishermen may not possess any spotted seatrout smaller than 12 inches TL.

5.2.4.7.2 Gear Restrictions

Spotted seatrout may only be caught by commercially permitted fishermen with licensed rod and reel gear.

Spotted seatrout may be taken recreationally by means of rod, fishing pole, hook and line, trolling line, handline, bait casting, fly casting apparatus, yo-yo, bow and arrow, recreational hoop nets, recreational slat traps, standard spearing equipment used by skin divers sport fishing in salt and fresh water when submerged in the water, recreational pipes, recreational buckets, recreational drums, recreational tires, and recreational cans and by no other means.

5.2.4.7.3 Closed Areas and Seasons

Commercial harvest is prohibited on federal refuges and state operated refuges and wildlife management areas. The commercial spotted seatrout season begins on the third Monday in November and is closed when the commercial quota of 1,000,000 lbs of spotted seatrout is harvested, or on May 1, whichever comes first.

5.2.4.7.4 Quotas and Bag/Possession Limits

A 1,000,000 lbs annual quota has been established for the commercial fishery. The daily bag limit for recreational fishermen is 25 spotted seatrout per person per day. The possession limit is 25 spotted seatrout per person per day on the water and twice the daily bag limit while not on the water.

5.2.4.7.5 Other Restrictions

Spotted seatrout must be landed "whole" with heads and tails attached; however, they may be eviscerated and/or have the gills removed. For the purpose of consumption at sea while onboard the harvesting vessel, a person shall have no more than two pounds of finfish parts per person provided that the vessel is equipped to cook such finfish. These provisions shall not apply to bait species.

5.2.4.7.6 Historical Changes to Regulations

Prior to 1976, the commercial spotted seatrout fishery was regulated by a minimum size limit of 10 inches TL, bar-mesh minimum sizes of 1.5 inches for saltwater gillnets, a 1.0-inch minimum for the inside wall of saltwater trammel nets, and a 0.875-inch minimum for saltwater fish seines. All nets used in the fishery were restricted to maximum lengths of 2,000 ft. Additionally, recreational fishermen were required to possess a basic fishing license. Changes in gear, size, daily and possession limits, and licensing requirements following 1976 are listed chronologically.

1977 - **Commercial** - Monofilament webbing banned in all saltwater nets except those on properly permitted vessels engaged in the pompano and black drum underutilized species program. Maximum net lengths were reduced to 1,200 ft and new minimum bar-mesh sizes of 2.0 inches for saltwater gillnets, 1.0 inches for the inside wall of trammel nets, and 1.0 inches for saltwater fish seines were enacted. A Commercial

Angler's License at a cost of $250 was established for the take of spotted seatrout using rod and reel gear.

Recreational - Restricted daily limit to a combined total of 50 red drum and spotted seatrout with an allowable two-day catch in possession.

1980 - **Commercial** - Established a minimum mesh size of 3.0-inch bar in the outer wall of saltwater trammel nets.

1983 - **Commercial** - Required all saltwater trammel nets to consist of three walls. A Saltwater Seller's License at a cost of $105 was established for the sale of commercial finfish.

1984 - **Commercial** - Increased the minimum size limit to 12 inches TL. Required minimum bar-mesh sizes of 1.75 inches for saltwater gillnets and 1.625 inches for the inside wall of saltwater trammel nets and a maximum mesh size of 12-inch bar for the outer wall of trammel nets. Mandated a mesh size of 1.0-inch bar for saltwater fish seines, discontinued Commercial Angler's License, and gear license fees were increased.

Recreational - Reduced possession limit to the daily limit. Required saltwater fishing license for all anglers fishing south of the officially established "saltwater line" for saltwater species.

1986 - **Commercial** - Saltwater Seller's License discontinued.

1987 - **Commercial** - Increased minimum size limit to 14 inches TL. Established minimum bar-mesh sizes of 1.75 inches for saltwater gillnets, saltwater fish seines and the inside wall of saltwater trammel nets. Set an annual harvest quota of one million lbs.

Recreational - Established minimum size limit of 12 inches TL.

1988 - **Commercial** - Prohibited the use of unattended nets and established a seasonal framework (September 1-until quota filled) for an increased 1.25 million lbs harvest quota.

Recreational - Reduced daily limit to 25 with an allowable one-day catch in possession.

1992 - **Commercial** - Reduced seasonal harvest quota to one million lbs and adjusted seasonal framework to September 15-April 30. Harvest prohibited between sunset Friday through sunrise Monday.

1995 - **Commercial** - Set season from third Monday in November through April 30 of the following year. Prohibited harvest after sunset and before sunrise as well as between sunset Friday through sunrise Monday. Commercial take prohibited except by special non-transferable spotted seatrout permit with qualifying criteria. Established commercial rod and reel gear license with qualifying criteria and restricted harvest with the use of mullet strike nets and all other legal gears to a seasonal framework and eventual prohibition with exclusive exception of commercial rod and reel gear.

Recreational - Required possession of Marine Resources Conservation Stamp by all saltwater anglers (three-year period).

1998 - **Recreational** - Increased possession limit to twice the daily limit; however, only the daily limit may be in possession while on the water.

5.2.5 Texas

5.2.5.1 Texas Parks and Wildlife Department

Texas Parks and Wildlife Department (TPWD)
Coastal Fisheries Division
4200 Smith School Road
Austin, Texas 78744
Telephone: (512) 389-4862

The TPWD is the administrative unit of the state charged with management of the coastal fishery resources and enforcement of legislative and regulatory procedures under the policy direction of the Texas Parks and Wildlife Commission (TPWC). The commission consists of nine members appointed by the Governor for six-year terms. The commission selects an Executive Director who serves as the administrative officer of the department. Directors of Coastal Fisheries, Inland Fisheries, Wildlife, Law Enforcement, and Resource Protection are named by the Executive Director. The Coastal Fisheries Division, headed by a Division Director, is under the supervision of the Executive Director.

Texas has habitat protection and permitting programs and a federally-approved CZM program. The Texas General Land Office (TGLO) is the lead agency for the Texas Coastal Management. The Coastal Coordination Council monitors compliance of the state Coastal Management Program and reviews federal regulations for consistency with that plan. The Coastal Coordination Council is an 11 member group whose members consist of a chairman (head of TGLO) and representatives from Texas Natural Resource Conservation Commission, Texas Parks and Wildlife Commission, the Railroad Commission, Texas Water Development Board, Texas Transportation Commission, and the Texas Soil and Water Conservation Board. The remaining four places of the council are appointed by the governor and are comprised of an elected city or county official, a business owner (someone involved in agriculture and a citizen) all of whom must live in the coastal zone.

5.2.5.2 Legislative Authorization

Chapter 11, Texas Parks and Wildlife Code establishes the Texas Parks and Wildlife Commission (TPWC) and provides for its make-up and appointment. Chapter 12 establishes the powers and duties of the TPWC, and Chapter 61 provides the commission with responsibility for marine fishery management and authority to promulgate regulations. Chapter 66 provides for the sale, purchase, and transportation of protected fish in Texas. All regulations adopted by the TPWC are included in the Texas Statewide Hunting and Fishing Proclamations.

5.2.5.3 Reciprocal Agreements and Limited Entry Provisions

5.2.5.3.1 Reciprocal Agreements

Texas statutory authority allows the TPWC to enter into reciprocal licensing agreements in waters that form a common boundary, i.e., the Sabine River area between Texas and Louisiana. Texas has no statutory authority to enter into reciprocal management agreements.

5.2.5.3.2 Limited Entry

Texas has no specific statutory provisions for limited entry in the spotted seatrout fishery.

5.2.5.4 Commercial Landings Data Reporting Requirements

There has been no commercial fishery for spotted seatrout in Texas since the Texas Legislature banned the sale of native spotted seatrout in 1981. Spotted seatrout legally caught or raised outside of Texas may be imported under guidelines of Chapter 66, Texas Parks and Wildlife Code.

5.2.5.5 Penalties for Violations

Penalties for violations of Texas' proclamations regarding spotted seatrout are provided in Chapter 61, Texas Parks and Wildlife Code, and most are Class C misdemeanors punishable by fines ranging from $25 to $500.

5.2.5.6 Annual License Fees

The following is a list of licenses and fees that are applicable to spotted seatrout harvest in Texas. They are current to the date of this publication and are subject to change at any time thereafter.

Recreational	
General Fishing License	
· resident	$19.00
· nonresident	30.00
Temporary Fishing License (three-day) Resident	10.00
Temporary Fishing License (14-day) Resident	12.00
Temporary Fishing License (five-day) Nonresident	20.00
Lifetime Fishing License	600.00
Saltwater Sportfishing Stamp*	7.00
Special Resident Fishing**	6.00
Combination Hunting and Fishing	32.00
“Super Combo” License Package Resident***	49.00
“The Texan” All-Purpose License Package Resident****	100.00
Lifetime Combination Hunting and Fishing License Resident	1,000.00

*Required in addition to recreational licenses when fishing in saltwater.
**Required of residents who reach 65 years of age after September 1, 1995, who are legally blind or are resident commercial fishermen fishing for sport.
***Package includes Resident Combination Hunting and Fishing License and seven state stamp fees (five hunting, two fishing) at a discount price ($82.00 value if items purchased separately).
****Package adds free park entry (Gold Texas Conservation Passport) to Super Combo above and may include preferred customer opportunities.

5.2.5.7 Laws and Regulations

Various statewide hunting and fishing proclamations affect the harvest of spotted seatrout in Texas. The following is a general summary of these laws and regulations. They are current to the date of this publication and are subject to change at any time thereafter. The TPWD should be contacted for specific and up-to-date information.

5.2.5.7.1 Size Limits

A minimum size limit of 15 inches TL has been established for spotted seatrout in Texas.

5.2.5.7.2 Gear Restrictions

Sail lines may be used to take spotted seatrout. Gill nets, trammel nets, seines, and any other type of net or fish trap are prohibited in the coastal waters of Texas. Purse seines may be used for taking menhaden only in the Gulf of Mexico outside of 0.5 mile offshore and beyond one mile of any barrier, jetty, island, or pass. Spotted seatrout caught on trotline may not be retained or possessed. Cast nets that do not exceed 14 ft in diameter, small mesh (0.5-inches square) seine not exceeding 20 ft in length, and individual bait-shrimp trawls may be used for taking non-game fish for bait purposes only. Gigs, lawful archery equipment, perch traps, spears, spear guns, and umbrella nets may be used for taking non-game fish only. Gaffs may only be used to aid in landing fish caught on other legal devices, means, or methods; fish landed may not be below the minimum or above the maximum or within a protected length limit. Dip nets may be used to aid in landing of fish caught on other legal devices; non-game fish may be taken for bait purposes only.

5.2.5.7.3 Closed Areas and Seasons

There are no closed areas or seasons for the taking of spotted seatrout in Texas.

5.2.5.7.4 Quotas and Bag/Possession Limits

A bag limit of ten fish per person per day and a possession limit of 20 fish has been established for recreational anglers in Texas.

5.2.5.7.5 Other Restrictions

Spotted seatrout must be kept with heads and tails attached until landed on a barrier island or the mainland; however, viscera and gills may be removed. It is unlawful to take or attempt to take fish with one or more hooks attached to a line or artificial lure used in a manner to foul-hook a fish (snagging or jerking).

5.2.5.7.6 Historical Changes to Regulations

In response to overfishing and to help spotted seatrout populations recover following catastrophic events, regulations were implemented beginning in 1978. In 1981, spotted seatrout were declared a gamefish. Sport bag and size limits were: no size or bag restrictions prior to December 1, 1978; 12-inch minimum size, bag limit 20 from December 1, 1978 through December 31, 1983; 14-inch minimum size, bag limit ten from January 1, 1984 through May 31, 1990; and 15-inch minimum, bag limit ten from June 1, 1990 to present.

5.3 Regional/Interstate

5.3.1 Gulf States Marine Fisheries Commission (P.L. 81-66)

The Gulf States Marine Fisheries Commission (GSMFC) was established by an act of Congress (P.L. 81-66) in 1949 as a compact of the five Gulf States. Its charge is

> "to promote better utilization of the fisheries, marine, shell and anadromous, of the seaboard of the Gulf of Mexico, by the development of a joint program for the promotion and protection of such fisheries and the prevention of the physical waste of the fisheries from any cause."

The GSMFC is composed of three members from each of the five Gulf States. The head of the marine resource agency of each state is an *ex-officio* member, the second is a member of the legislature, and the third, a citizen who shall have knowledge of and interest in marine fisheries, is appointed by the governor. The chairman, vice chairman, and second vice chairman of the GSMFC are rotated annually among the states.

The GSMFC is empowered to make recommendations to the governors and legislatures of the five Gulf States on action regarding programs helpful to the management of the fisheries. The states do not relinquish any of their rights or responsibilities in regulating their own fisheries by being members of the GSMFC.

Recommendations to the states are based on scientific studies made by experts employed by state and federal resource agencies and advice from law enforcement officials and the commercial and recreational fishing industries. The GSMFC is also authorized to consult with and advise the proper administrative agencies of the member states regarding fishery conservation problems. In addition, the GSMFC advises the U.S. Congress and may testify on legislation and marine policies that affect the Gulf States. One of the most important functions of the GSMFC is to serve as a forum for the discussion of various problems, issues, and programs concerning marine management.

5.3.2 Interjurisdictional Fisheries Act of 1986 (P.L. 99-659, Title III)

The IJF Act of 1986 established a program to promote and encourage state activities in the support of management plans and to promote and encourage management of IJF resources throughout their range. The enactment of this legislation repealed the Commercial Fisheries Research and Development Act (P.L. 88-309).

5.3.2.1 Development of Management Plans (Title III, Section 308(c))

Through P.L. 99-659, Congress authorized the Department of Commerce to appropriate funding in support of state research and management projects that were consistent with the intent of the IJF Act. Additional funds were authorized to support the development of interstate FMPs by the Gulf, Atlantic, and Pacific States Marine Fisheries Commissions.

6.0 DESCRIPTION OF FISHING ACTIVITIES AFFECTING THE STOCKS IN THE UNITED STATES GULF OF MEXICO

Spotted seatrout are an important recreational and commercial species in the Gulf. Highly prized by recreational and commercial fishermen, spotted seatrout is considered a delicacy by many. They are taken almost exclusively within state jurisdictions due to close association with marsh and estuarine habitats. For biological, social, and economic reasons, spotted seatrout have been declared gamefish in Texas and Alabama. However, limited commercial harvest occurs in Louisiana, Mississippi, and Florida. Spotted seatrout management and allocation issues have precipitated controversy over limits and harvest methodologies within and between fishing groups.

6.1 Recreational Fishery

6.1.1 History

Spotted seatrout have long been sought after for their flesh and their fight. The popularity of spotted seatrout with sport anglers may be due to their response to both natural and artificial baits and the ease of accessibility due to association with coastal bayous, marshes, and bays. Most spotted seatrout are taken within three miles of shore (USDOC 1996) usually near seagrass beds, near structures such as shell reef and dock pilings, or near drop offs in close proximity to beaches, banks, channels, and emergent vegetation. Hook and line and entanglement nets have been the preferred means of recreational and commercial harvest, respectively, of the spotted seatrout fishery since the turn of the century.

Since implementation of the Magnuson Act in 1976, there has been a heightened awareness and recognition of the economic importance and impact of recreational fishing in the marine environment. In addition, a shift in the demographics of the coastal areas resulted in an increase in the number of participants in marine fisheries. Both events led to a philosophical change in fisheries management in the late 1970s and early 1980s. In 1981, the Texas Legislature banned the sale of spotted seatrout, recognizing the fisheries decline and its economic importance, thus eliminating any commercial harvest in Texas waters (Matlock 1982, Ferguson 1986). Alabama passed similar gamefish legislation in 1986 eliminating their commercial fishery for spotted seatrout.

Little historic information exists regarding the recreational sector of the spotted seatrout fishery in the northern Gulf of Mexico. General information on the numbers of anglers participating and their catches has been unavailable other than as entries into local rodeos and tournaments which take place along the Gulf coast. Guest and Gunter (1958) indirectly addressed the lack of recreational data when they pointed out that the recreational or sport catch “undoubtedly exceeds the yearly commercial catch” referring to the almost 5.0 million lbs marketed commercially in 1954. Only recently have some states imposed regulations on the recreational sector to allow accurate assessment of recreational catch and participation. For example, saltwater fishing licenses were not required in the state of Mississippi until July 1993. The NMFS Marine Recreational Fisheries Statistics Survey (MRFSS) and the Texas survey are the most current Gulf-wide recreational fishing information. The Texas survey has been in place since 1974 and the MRFSS since 1979 and provide the best estimates of landings and effort by recreational anglers in each respective state. The trend toward additional economic add-ons are beginning to improve the available information on the recreational sector. In recent years, MRFSS and the Texas survey have increased sampling efforts leading to more reliable estimates of the recreational contribution to the spotted seatrout fishery. Recreational landings from 1981 to 1998 are summarized in Table 6.1 by weight (lbs) and Table 6.2 by total number. Recreational spotted seatrout records for each state are provided in Table 6.3.

Table 6.1. Annual recreational catch estimates of spotted seatrout in the Gulf of Mexico by total weight (lbs) from 1981-1998 (NMFS unpublished data, TPWD unpublished data) (NA = data not available). *Mississippi harvest estimates include fish captured in all waters (inland, state territorial sea, and EEZ). Due to sampling anomalies in the MRFSS survey, fish caught in Mississippi state waters were incorrectly classified as caught in the EEZ.

Year	West FL	AL	State MS*	LA	TX	Gulf Totals
1981	2,018,593	8,796	149,646	1,956,918	2,624,651	6,758,604
1982	3,316,602	327,013	390,968	6,486,290	2,447,853	12,968,726
1983	3,916,796	134,152	591,040	3,438,953	3,125,117	11,206,058
1984	6,078,329	52,670	60,305	851,467	834,059	7,876,830
1985	3,077,439	71,268	107,128	2,832,069	1,551,815	7,639,719
1986	7,024,321	146,200	626,852	7,755,251	1,969,952	17,522,576
1987	3,520,449	99,117	496,736	6,385,683	2,019,429	12,521,414
1988	5,519,278	145,296	377,253	4,866,904	2,081,588	12,990,319
1989	6,565,879	85,622	214,477	4,986,792	1,554,081	13,406,851
1990	1,887,744	41,010	183,504	2,455,578	671,643	5,239,479
1991	3,931,446	88,420	369,720	7,244,734	1,380,566	13,014,886
1992	2,762,897	67,212	272,921	5,835,715	2,418,100	11,356,845
1993	2,144,271	161,527	323,675	5,359,667	2,256,361	10,245,501
1994	2,373,737	24,753	203,687	6,510,043	2,255,365	11,367,585
1995	2,375,970	107,984	363523	7,449,300	2,185,368	12,482,145
1996	1,752,035	75,691	376,208	7,512,688	2,201,393	11,918,015
1997	1,835,632	62,381	473,645	6,900,266	2,659,625	11,931,549
1998	2,208,961	123,742	442,518	5,347,925	NA	NA

Table 6.2 Annual recreational catch estimates of spotted seatrout in the Gulf of Mexico by total number from 1981-1998 (NMFS unpublished data, TPWD unpublished data)(NA = data not available). *Mississippi harvest estimates include fish captured in all waters (inland, state territorial sea, and EEZ). Due to sampling anomalies in the MRFSS survey, fish caught in Mississippi state waters were incorrectly classified as caught in the EEZ.

	State					
Year	**West FL**	**AL**	**MS***	**LA**	**TX**	**Gulf Totals**
1981	1,817,544	8,946	178,826	1,757,893	2,289,073	6,052,282
1982	2,684,142	241,382	291,854	6,200,925	1,947,610	11,365,913
1983	4,356,699	73,557	506,601	3,044,675	2,084,245	10,065,777
1984	5,721,758	39,225	66,159	786,580	518,162	7,131,884
1985	2,858,364	48,696	165,055	3,233,401	977,460	7,282,976
1986	7,487,881	93,096	671,141	8,629,850	1,191,203	18,073,171
1987	3,210,926	66,690	517,588	6,551,965	1,174,155	11,521,324
1988	4,913,647	109,597	350,146	4,002,086	1,226,014	10,601,490
1989	4,124,561	48,252	245,072	3,683,416	915,323	9,016,624
1990	1,287,898	24,723	163,114	2,116,977	390,513	3,983,225
1991	2,663,058	50,833	345,093	6,620,102	782,634	10,461,720
1992	1,825,729	31,629	257,251	5,674,293	1,290,170	9,079,072
1993	1,529,971	92,387	222,244	5,299,431	1,203,874	8,347,907
1994	1,682,317	21,947	187,169	5,918,500	1,232,339	9,042,272
1995	1,799,154	92,297	266,054	6,837,314	1,179,877	10,174,696
1996	1,113,702	42,630	294,043	6,015,903	1,202,849	8,669,127
1997	1,180,728	40,254	314,337	6,531,903	1,453,228	9,520,450
1998	1,416,728	66,937	331,960	4,930,503	NA	NA

Table 6.3. State records for spotted seatrout.

State	Weight (lbs)	TL (inches)	Year	Location
Florida (statewide)	17.7	NA		Ft. Pierce
Florida (Gulf)	12.8	NA		Crystal River
Alabama	12.4	NA	1980	Orange Beach
Mississippi	10.37	NA	1973	Chandeleur Island
Louisiana	12.38	NA	1950	Lake Catherine
Texas	13.69	33.13	1996	Baffin Bay

6.1.2 State Fisheries

6.1.2.1 Florida

Spotted seatrout have long been a targeted recreational species for most Florida saltwater anglers and is considered one of the preferred recreational species on both the east and west coasts (Tabb 1960, Perret et al. 1980, Rutherford 1982). These prized fish are widely distributed along Florida's western coast from Everglades National Park and Florida Bay to the panhandle. Recreational anglers use a full range of techniques from jigs and artificial plugs to live bait with great success. It is estimated that in 1996, 2,251,000 residents participated in saltwater fishing in west Florida (USDOC 1997) and landed 1,113,702 spotted seatrout totaling 1,752,035 lbs (NMFS unpublished data) (Figure 6.1). Resident and nonresident license sales can be found in Table 6.4. West Florida's spotted seatrout landings in 1996 contributed 14.7% (by weight) of the total landings for the northern Gulf of Mexico. Florida anglers made approximately 11,766,000 fishing trips in 1996 with spotted seatrout contributing 3% by number and 9% by weight (lbs) of the total catch for all species off west Florida (NMFS unpublished data).

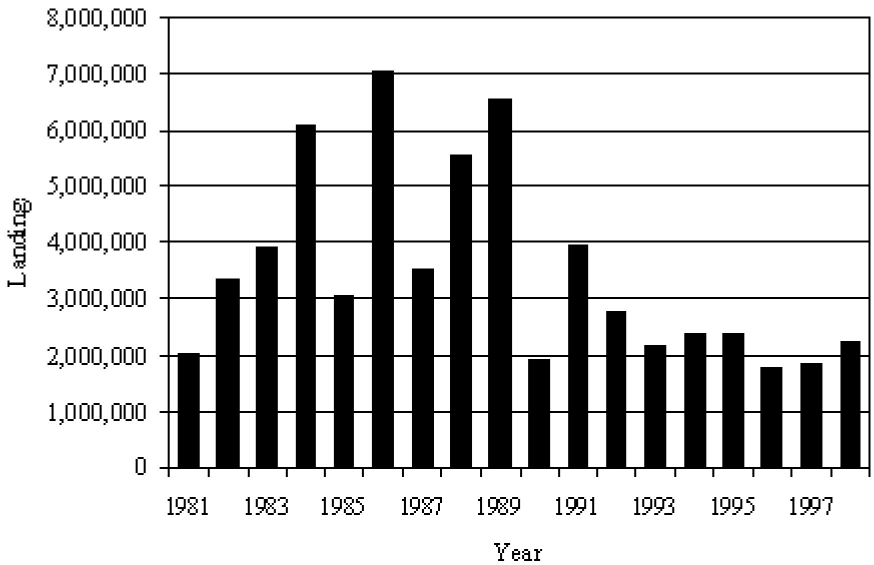

Figure 6.1. Florida (west coast) recreational landings (lbs) of spotted seatrout from 1981-1998 (NMFS unpublished data).

Table 6.4. Annual resident and nonresident Florida recreational saltwater fishing license sales from 1989-1997 (FDEP unpublished data).

Year	Annual Resident	Ten Day Resident	Annual Nonresident	Three Day Nonresident	Seven Day** Nonresident
89-90*	203,254	281	63,349	67,190	0
90-91	244,178	104	67,853	78,167	59,884
91-92	261,245	7	61,264	40,561	140,472
92-93	250,530	8	59,270	39,330	148,822
93-94	272,183	5	58,992	40,199	161,236
94-95	276,468	8	60,339	41,699	169,749
95-96	267,423	5	57,160	41,327	154,829
96-97	278,597	167	61,159	43,518	154,496

* License sales in 1989 did not begin until December 1989
**This license was unavailable the first year.

6.1.2.2 Alabama

Limited information is available prior to 1981 on recreational fishing effort and landings due to the absence of recreational data collection other than anecdotal information. Some information can be derived from state fishing events like the Speckled Trout Rodeo held annually in Baldwin County, Alabama. Catch data was historically sampled from this event by personnel from the MRD, and these records go back to 1964 (Tatum 1980). Even though these data do not provide any annual landings or effort, they can provide an abbreviated overview of the recreational fishing population that targeted spotted seatrout in Alabama. The best information on recreational fishing in Alabama exists in the MRFSS dataset which has only been collected since 1981.

Recreational landings of spotted seatrout in Alabama have varied greatly since 1981 and are summarized in Tables 6.1, Table 6.2, and Figure 6.2. In 1996, it was estimated that 258,000 residents participated in marine recreational fisheries in Alabama waters and that these anglers harvested 42,630 individual spotted seatrout weighing 75,691 lbs total (NMFS unpublished data). Alabama anglers made 870,000 fishing trips in 1996 (USDOC 1996). Spotted seatrout comprised approximately 3% by number and 5% by weight of the total catch for all species in Alabama for 1996 and 0.6% of the total spotted seatrout catch by weight for the Gulf of Mexico (NMFS unpublished data). All recreational license sales in Alabama from 1995-1996 through 1997-1998 are located in Table 6.5.

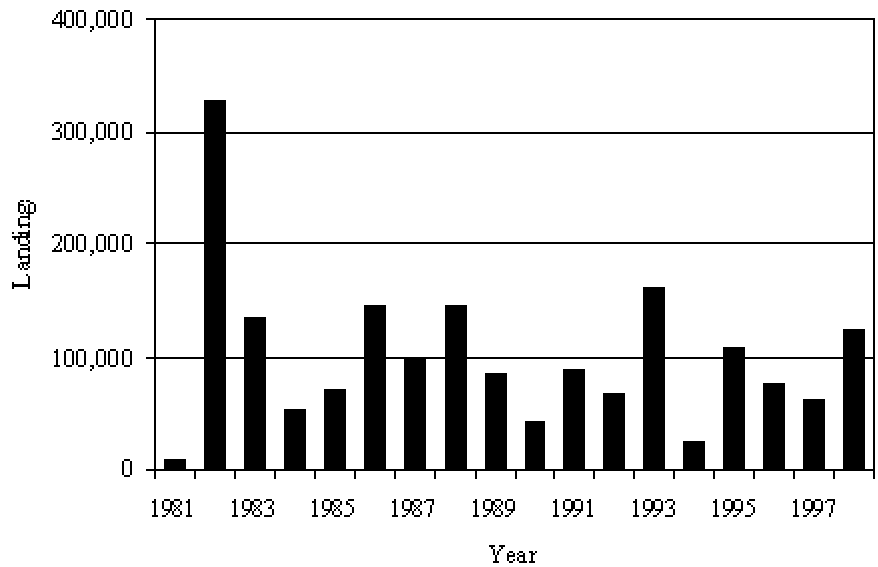

Figure 6.2. Alabama recreational landings (lbs) of spotted seatrout from 1981-1998 (NMFS unpublished data).

Table 6.5. Alabama resident recreational license sales from 1995/1997 to 1997/1998 (ADCNR unpublished data). Combination angler endorsement includes both fresh and saltwater privileges.

Year	Recreational Net	Recreational Shrimp	Saltwater Angler	Combination Angler	Seven Day Trip	Pier
1995/1996	615	1,744	18,429	16,841	5,949	950
1996/1997	664	1,433	17,523	17,408	7,736	798
1997/1998	699	1,700	17,761	19,753	7,275	867

6.1.2.3 Mississippi

Spotted seatrout are the preferred target species by recreational anglers in Mississippi with red drum and flounder being the second and third choice, respectively (Deegen 1990). Spotted seatrout are caught hook and line with a wide variety of artificial baits (i.e., jigs and plugs) and live baits (shrimp and bull minnows). Participation in the recreational fishery increased as Mississippi's coastal population grew. The evidence of increasing numbers of recreational anglers can be seen in the increasing saltwater recreational fishing license sales (Table 6.6). Since July 1993, when the recreational saltwater fishing license was instituted, total license sales have increased approximately 13%.

Table 6.6. Annual recreational saltwater licenses sales in Mississippi (MDMR unpublished data).

Year	Resident	Annual Nonresident	Three Day Nonresident	Total
1993-1994	44,529	2,125	6,375	53,029
1994-1995	46,815	1,746	6,445	55,006
1995-1996	54,295	1,712	7,444	63,451
1996-1997	58,004	1,978	8,452	68,434
1997-1998	58,099	1,986	8,529	68,614

During 1996, the total recreational take of spotted seatrout by anglers was 249,441 individuals estimated at 312,736 lbs (NMFS unpublished data, Table 6.1, Table 6.2, and Figure 6.3). Spotted seatrout made up 9% by number and 12% by weight of all species landed by recreational

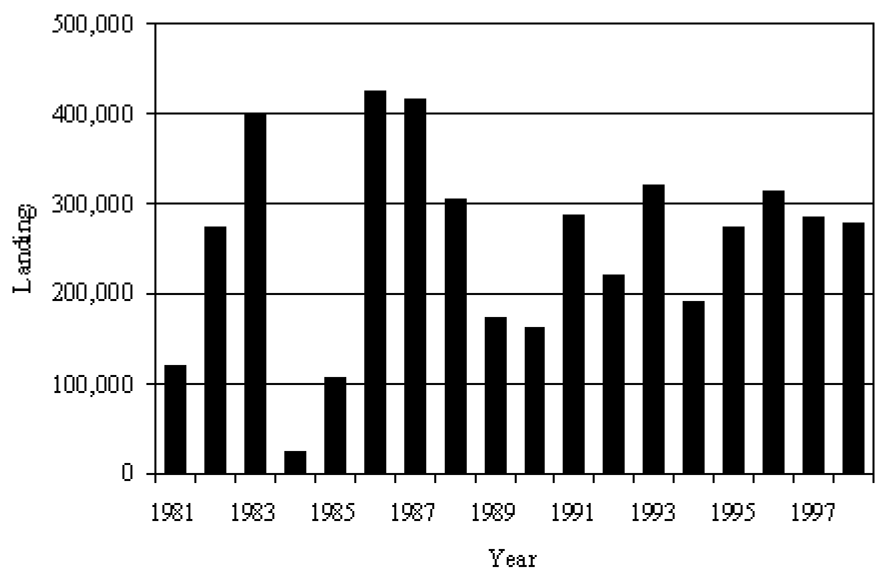

Figure 6.3. Mississippi recreational landings (lbs) of spotted seatrout from 1981-1998 (NMFS unpublished data).

anglers in Mississippi in 1996 (NMFS unpublished data). Mississippi landings for spotted seatrout accounted for 2.6% of the total landings by weight for the Gulf of Mexico in 1996 (NMFS unpublished data).

6.1.2.4 Louisiana

Spotted seatrout has consistently been reported as one of the primary target species by recreational anglers in Louisiana comprising 52% by number and 36% by weight of the total recreational catch in Louisiana for 1996 (NMFS unpublished data). Prior to 1976, the spotted seatrout fishery in Louisiana was unregulated, and estimates of recreational landings before 1981 do not exist other than anecdotal accounts and historical publications such as newspapers and magazines, or events such as rodeos. For example, the Grand Isle Tarpon Rodeo, founded in 1928, is the oldest. These sources provide very little insight into historical effort but may provide limited information on the makeup of the catch through annual awards lists and new state records.

In a survey by Adkins et al. (1990), 63.8% of interviewed Louisiana anglers were found to prefer spotted seatrout to all other species. It is estimated that 493,000 residents participated in marine recreational fishing and made an estimated 2,780,000 trips in 1996 (USDOC 1997). A total of 6,015,252 individual spotted seatrout weighing 7,512,688 lbs were taken in 1996 by recreational anglers in Louisiana waters (NMFS unpublished data, Table 6.2). This made up approximately 63% of the total landings by weight of spotted seatrout in the Gulf of Mexico (Table 6.1 and Figure 6.4). Recreational license sales from 1984-1985 through 1998-1999 are summarized in Table 6.7.

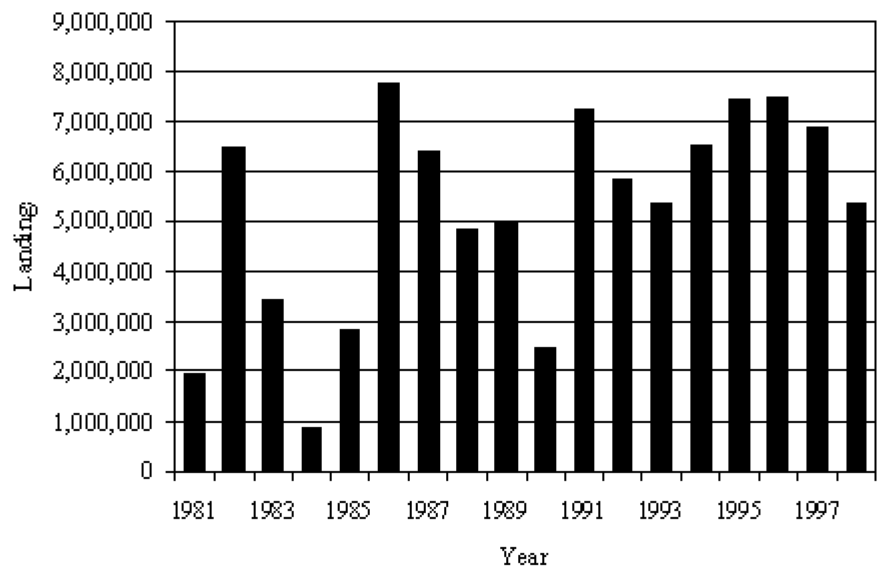

Figure 6.4. Louisiana recreational landings (lbs) of spotted seatrout from 1981-1998 (NMFS unpublished data).

Table 6.7. Louisiana resident and nonresident recreational saltwater angler licenses issued, 1984-1985 through 1998-1999 (LDWF unpublished data). NA indicates license not available.

Season	Annual Resident Saltwater	Nonresident						Total Nonresident Saltwater Anglers
		Saltwater Annual	Saltwater Trip	Two Day Fresh or Salt	Three Day Saltwater	Charter Trip	Lifetime Hunting/Fishing	
1984-1985	83,469	8,849	9,807	NA	NA	NA	NA	18,656
1985-1986	169,132	9,141	9,365	NA	NA	NA	NA	18,506
1986-1987	199,423	9,425	7,573	NA	NA	NA	NA	16,998
1987-1988	195,099	12,432	8,195	NA	NA	NA	NA	20,627
1988-1989	204,686	5,714	8,392	NA	NA	NA	NA	14,106
1989-1990	208,292	5,219	4,320	9,857	NA	NA	NA	19,396
1990-1991	206,088	4,699	1,941	21,118	NA	NA	NA	27,758
1991-1992	229,805	5,013	1,881	26,693	NA	NA	0	33,587
1992-1993	245,952	5,495	1,667	32,429	NA	NA	2	39,593
1993-1994	266,104	5,963	1,346	26,857	NA	NA	3	34,171
1994-1995	280,749	6,510	1,269	27,618	NA	NA	0	35,402
1995-1996	297,470	7,852	1,574	31,433	NA	5,374	1	46,239
1996-1997	271,597	7,428	1,604	19,295	NA	11,648	0	39,981
1997-1998	285,014	9,649	411	10,904	8,243	13,947	0	43,160
1998-1999	298,569	10,007	NA	NA	23,989	17,598	2	51,602

6.1.2.5 Texas

Most saltwater anglers in Texas preferred either red drum or spotted seatrout during the period of 1986-1988 (Ditton et al. 1990). While the first preference for red drum declined from 35.7% in 1986 to 33.7% in 1988 (Ditton et al. 1990) down to 32.6% in 1996 (Ditton and Hunt 1996), the first preference for spotted seatrout increased from 19.5% in 1986 to 23.1% in 1988 but declined again to 18.0% in 1996. Over 53% of private sport-boat anglers indicate they actively seek spotted seatrout (TPWD unpublished data). Green et al. (1991) found the same preference choices but noted that over 30% of anglers surveyed indicated no species preference.

A joint spotted seatrout angler survey conducted by Texas A&M University and the TPWD generated the following findings (Ditton 1993). Anglers spent an average of 18.9 days fishing in saltwater, with most of that time directed toward capture of spotted seatrout. On average, $132 was spent on a typical trip. Generally, trips lasted two days and involved one-way travel of 85 miles. About 265,000 licensed anglers in Texas targeted spotted seatrout in the 1992-1993 license year (Table 6.8). An estimated $340 million was spent in 1992 by anglers seeking spotted seatrout; this estimate included trip cost only, not equipment purchases (e.g., boats, rods, reels, etc.). Major expenditures on spotted seatrout trips were for transportation, lodging, boat operation cost, and food, drinks, and ice. About 16% of anglers participated in saltwater fishing tournaments in the previous 12 months; most fished in one (53%) or two (30%) tournaments. About 22% of the anglers reported having fished for spotted seatrout with a professional guide; anglers averaged three days of guided fishing per year.

Spotted seatrout are caught from private boats, charter boats, head boats, lighted piers, jetties, and from the shoreline. Because a comprehensive, all inclusive study of recreational fishery landings is cost prohibitive, the TPWD implemented an annual long-term monitoring program targeting private and party (guided charter) boat anglers. Shore based and other directed recreational fisheries are surveyed periodically. Landings are distributed along the coast with Galveston Bay generally reporting highest landings. Recreational landings are summarized in Table 6.1, Table 6.2, and Figure 6.5.

6.2 Commercial Fishery

6.2.1 History

Records of commercial catches of spotted seatrout date back as far as 1887 in Louisiana when an estimated 524,000 lbs were caught in a single year. Similar records exist for most of the Gulf States, although the markets for spotted seatrout are smaller than those for other species due to the delicate flavor which makes it preferred as a fresh-caught fish. The flesh tends to spoil more rapidly than other fish limiting its commercial harvest to inshore gill-nets, trammel nets, haul seines, and otter trawls which ensure a quick return to market. Other harvest techniques contributing historically to the commercial catch also include hand lines, trotlines, and splatter poles. Splatter pole fishing for spotted seatrout is still practiced in a few areas in Florida although it is primarily associated with the Atlantic coast and the Indian River Lagoon.

Table 6.8. Texas total number of recreational fishing licenses sales from 1978-1998 (L. Green personal communication). Recreational licenses included fresh and saltwater fishing privileges.

Fiscal Year	Resident Combo [1]	Resident Fishing	Nonresident Fishing	Resident Temporary	Nonresident Temporary	Special Resident Fishing [2]	Lifetime Combo [3]	Lifetime Resident Fishing [3]	Total Fishing	Saltwater Stamp Sales	Estimated Saltwater Anglers [4]
1978	447,740	857,978	30,492	62,236	40,366	1,208			1,440,020		816,728
1979	523,830	1,036,538	37,071	70,454	45,119	2,139			1,715,151		972,772
1980	572,149	1,019,481	32,753	76,443	41,949	2,693			1,745,468		989,967
1981	609,118	1,022,644	34,262	84,709	44,036	3,187			1,797,956		1,019,736
1982	673,212	1,069,370	29,582	74,141	76,378	3,424			1,926,107		1,092,419
1983	724,990	1,098,271	28,486	66,429	75,997	3,883			1,998,056		1,133,226
1984	690,937	981,870	31,123	51,770	56,125	3,950			1,815,775		1,029,843
1985	694,409	988,046	31,432	55,820	55,180	3,865			1,828,752		1,037,203
1986	663,660	1,056,587	34,234	46,898	52,602	4,084			1,858,065	390,545	1,053,828
1987	661,010	1,031,021	37,561	41,145	54,193	3,812	376	6	1,829,124	520,699	1,037,414
1988	681,349	1,067,584	39,647	39,282	56,172	6,445	521	18	1,891,018	569,648	1,072,518
1989	670,735	1,018,684	44,881	40,185	60,874	5,806	636	28	1,841,829	566,132	1,044,619
1990	668,895	1,058,814	48,621	39,984	65,192	5,914	750	34	1,858,204	585,391	1,070,922
1991	656,527	1,077,717	50,750	43,097	69,170	5,667	1,332	75	1,904,335	576,199	1,080,071
1992	527,669	1,002,095	45,740	89,004	72,426	6,195	1,677	95	1,744,901	561,412	989,645
1993	528,003	984,141	47,360	132,513	75,516	6,505	1,758	105	1,775,901	574,376	1,007,227
1994	510,524	1,012,031	49,802	152,184	81,185	6,737	1,942	130	1,814,535	615,713	1,029,139
1995	512,820	1,066,712	47,668	39,531	58,187	7,103	2,055	149	1,734,225	609,460	983,590
1996	500,375	1,018,192	47,673	37,884	57,536	13,765	2,365	202	1,677,992	608,401	951,697
1997	471,537	889,163	48,567	95,633	56,089	25,759	3,243	328	1,590,319	498,766	901,972
1998	485,778	885,136	48,336	98,999	55,048	32,588	3,535	357	1,609,777	490,862	913,008

[1] Includes hunting and fishing privileges.

[2] Available to any resident who was legally blind, a qualified disabled veteran, or a licensed commercial fisherman. Beginning FY 1996, persons becoming 65 on or after 15 September 1995 were required to obtain this license.

[3] Totals are cumulative.

[4] Estimated number of Saltwater fishermen based on Green et al. (1991), equals (Total/0.67) x 0.38) where 0.67 adjusts for those that fish without a license and 0.38 adjusts for those that fish in saltwater.

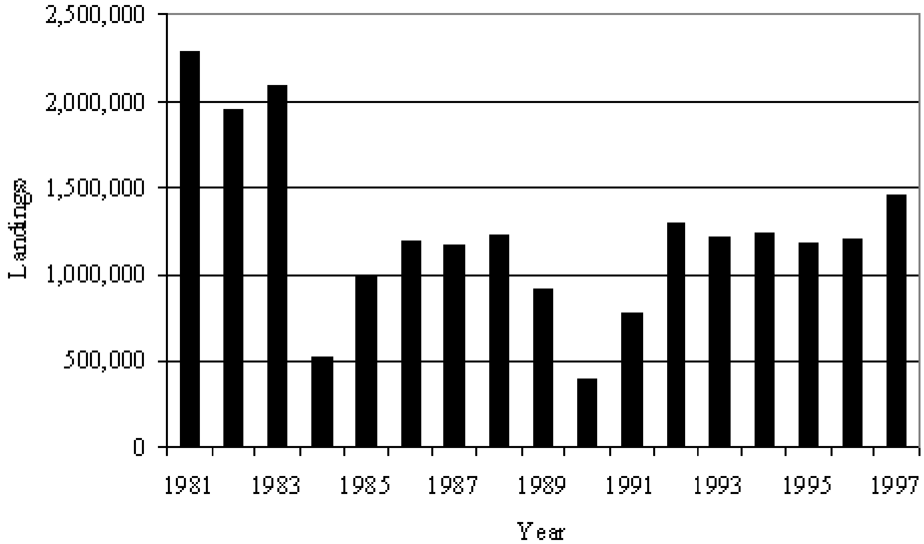

Figure 6.5. Texas recreational landings (lbs) of spotted seatrout from 1981-1997 (TPWD unpublished data).

Commercial catches of spotted seatrout in the northern Gulf of Mexico vary annually. Landings (lbs) of spotted seatrout by the Gulf States from 1963 to 1997 are presented in Table 6.9.

6.2.2 State Fisheries

6.2.2.1 Florida

Historically, spotted seatrout were frequently taken by commercial fishermen setting inshore gill nets, trammel nets, and beach seines. Typically, the inshore gill net fisheries consisted of mullet in the fall, red drum in the winter, sheepshead in the spring and fall, and flounder and spotted seatrout throughout the year. Two-thirds of the trips that landed spotted seatrout account for only one-third of the spotted seatrout landings (Muller et al. 1997). A smaller component of the commercial spotted seatrout fishery was fishermen using hook and line, many of whom were part time fishermen or recreational anglers who chose to sell their excess catch.

Prior to 1984, commercial fishermen were not required to obtain a license from the state in order to sell their catch. However, some counties, such as Manatee, required fishermen to possess a gill net license if they were going to use that gear. The rule that was implemented in 1984 not only required fishermen to have a Saltwater Products License in order to sell their catch, but they were also required to sell only to licensed wholesale dealers (see Section 5.2.1.4) (Chapter 370., Florida Statutes). Commercial license sales from 1986-1997 are presented in Table 6.10.

Table 6.9. Annual spotted seatrout commercial catch estimates in the Gulf of Mexico by total weight (lbs) from 1963 to 1998 (NMFS unpublished data). Dashes indicate no commercial take due to gamefish status and parenthesis ( ) indicate out-of-state fish brought in-state.

Year	West FL	AL	MS	LA	TX	Gulf Totals
1963	2,571,400	53,500	80,300	380,400	1,190,200	4,275,800
1964	2,799,300	64,600	148,100	290,500	977,700	4,280,200
1965	3,369,700	53,800	148,600	398,200	1,176,200	5,146,500
1966	3,173,800	47,500	144,600	646,600	1,508,300	5,520,800
1967	2,636,700	90,900	171,200	620,700	1,520,900	5,040,400
1968	3,065,200	100,800	268,500	619,000	1,871,300	5,924,800
1969	2,418,700	98,400	220,800	719,600	1,172,900	4,630,400
1970	2,642,900	84,500	254,800	786,300	1,156,800	4,925,300
1971	1,961,100	137,300	393,400	1,122,100	1,487,400	5,101,300
1972	2,140,200	220,000	254,600	1,699,500	1,499,400	5,813,700
1973	2,226,200	351,500	356,900	2,527,500	1,968,900	7,440,000
1974	2,259,900	363,600	294,700	2,125,000	1,996,100	7,039,300
1975	2,169,400	104,200	262,800	1,896,900	1,184,300	6,247,600
1976	2,282,300	42,900	177,500	1,611,200	1,768,600	5,882,500
1977	1,931,900	21,533	146,850	1,083,950	1,346,800	4,531,033
1978	2,015,700	31,722	105,420	682,016	1,162,018	3,996,876
1979	2,085,900	74,166	109,480	798,328	1,030,310	4,098,184
1980	1,955,735	26,021	27,245	377,024	977,920	3,591,176
1981	1,972,651	26,718	8,980	586,859	645,679	3,240,887
1982	2,009,364	62,579	16,820	727,606	------	2,816,369
1983	1,870,313	59,539	54,060	1,340,625	------	3,324,537
1984	1,550,898	20,506	55,006	973,250	------	2,599,660
1985	1,131,045	4,160	47,426	1,161,598	------	2,344,229
1986	1,258,296	3,325	38,035	1,978,038	------	3,277,694
1987	1,344,779	2,548	57,304	1,801,874	------	3,206,505
1988	1,349,644	814	65,584	1,433,408	------	2,849,450
1989	986,063	5,103	77,616	1,488,878	------	2,557,660
1990	761,278	------	30,442	648,645	------	1,440,365
1991	823,839	------	31,295	1,220,231	------	2,075,365
1992	653,296	------	31,564	971,481	------	1,656,341
1993	543,932	(721)	51,362	1,138,070	------	1,734,085
1994	641,271	------	73,034	1,023,665	------	1,737,970
1995	350,555	------	72,158	656,801	------	1,079,514
1996	22,732	------	43,589	774,375	------	840,696
1997	29,291	------	41,456	549,505	------	620,252
1998	40,704	------	42,562	111,979	------	195,245

Table 6.10. Commercial fishing license sales in Florida from 1986-1997 (FWC unpublished data).

Year	Saltwater Products	Restricted Species	Purse	Blue Crab	Stone Crab	Lobsters	Marine Life
1986	10407		60	1542	2819	2499	
1987	11321		82	1727	2874	2716	
1988	14556		88	2091	3335	2530	
1989	14702	1488	87	2295	3649	2606	
1990	15458	4533	97	2734	4197	2689	
1991	12778	5440	104	2721	4103	2593	128
1992	11958	5711	114	2833	4157	2317	228
1993	11451	5662	127	2962	4189	2107	273
1994	11800	5808	128	3480	4571	1888	339
1995	11391	6281	147	3777	5044	1504	418
1996	10362	6178	169	3486	4270	1569	488
1997	10163	6088	170	3612	3844	1715	510

Regulations have dramatically changed commercial fishing in Florida, especially inshore net fishing. Prior to the establishment of the FMFC in 1983, regulations on spotted seatrout consisted of a 12-inch minimum size, and some counties were exempt even from the size limit. A moratorium on red drum (*Sciaenops ocellatus*) fishing was put into effect in October 1986 and reduced spotted seatrout landings especially in the Southwest region where spotted seatrout were frequently captured in the trammel nets that were set for red drum. In November 1989, the FMFC instituted a November to October fishing year, a 14-inch minimum size statewide, required fishermen to have a Restricted Species Endorsement, and commercial quotas for the Southwest (538,000 lbs) and Northwest (407,000 lbs) regions. Actual landings were less than the quotas, because the quota for the Southwest region never filled. However, the quota in the Northwest was frequently filled by January or February. All of these measures reduced the number of commercial fishermen by 36% based on the average number of special products licenses landing spotted seatrout in the period of 1987-1989 (3,117) and the average of the period 1990-1994 (1,992) (Muller et al. 1997). In July 1995, a constitutional amendment eliminated entangling gears in state waters. In January 1996, the FMFC implemented a June through August commercial season, specified cast nets and hook and line gear as the only allowable gears, and raised the minimum size to 15 inches with a maximum size of 24 inches. The combined elimination of gill nets, trammel nets, and beach seines and the tighter size limits reduced the average landings of spotted seatrout in 1996-1997 to 26,000 lbs (Table 6.9 and Figure 6.6).

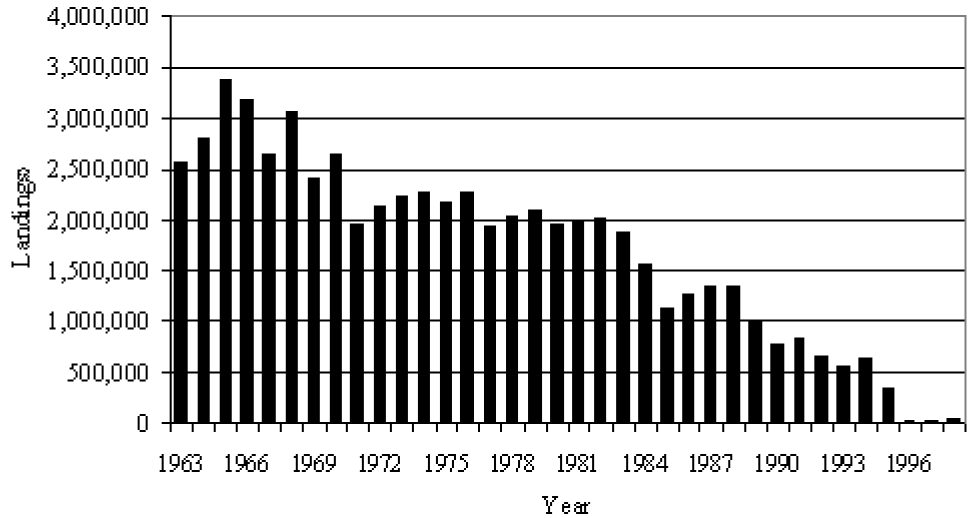

Figure 6.6. Florida (west coast) commercial landings (lbs) of spotted seatrout, 1963-1998 (NMFS unpublished data).

6.2.2.2 Alabama

A commercial fishery for spotted seatrout has not existed in Alabama since 1986 when spotted seatrout was declared a gamefish. Historically, the Alabama spotted seatrout fishery has been the smallest among the Gulf States with peak landings of only 363,600 lbs harvested in 1974 (Table 6.9 and Figure 6.7). The majority of the Alabama landings, however, were caught out-of-state, primarily from Louisiana and the Chandeleurs. Changes in Louisiana in 1974 contributed to the reduction in the overall landings for Alabama by prohibiting the use of trammel nets, seines, gill nets, or webbing from the waters of Breton and Chandeleur islands.

Although commercial harvest of spotted seatrout in Alabama waters is no longer legal, importation of spotted seatrout is permitted by licensed seafood dealers. As a result, a few landings have been recorded in Alabama, but these fish were caught in other states which still had a legal commercial harvest. Prior to 1986, spotted seatrout were occasionally caught in run-around gill nets and entangling gill nets. Currently, any spotted seatrout caught incidentally with nets, trawls, or seines of any kind must be immediately returned to the water.

6.2.2.3 Mississippi

Commercial landings from 1963 to 1998 are shown in Table 6.9 and Figure 6.8. The landings have varied annually due to reporting efficiency, fish availability, and/or management regulations. Mississippi's landings peaked in 1971 with 393,400 lbs and declined to a low of 8,980 in 1981. Since 1981, landings values have fluctuated between 30,000-80,000 lbs, a mean of about 40,000 lbs. Current management regulations have set the commercial quota at 40,000 lbs.

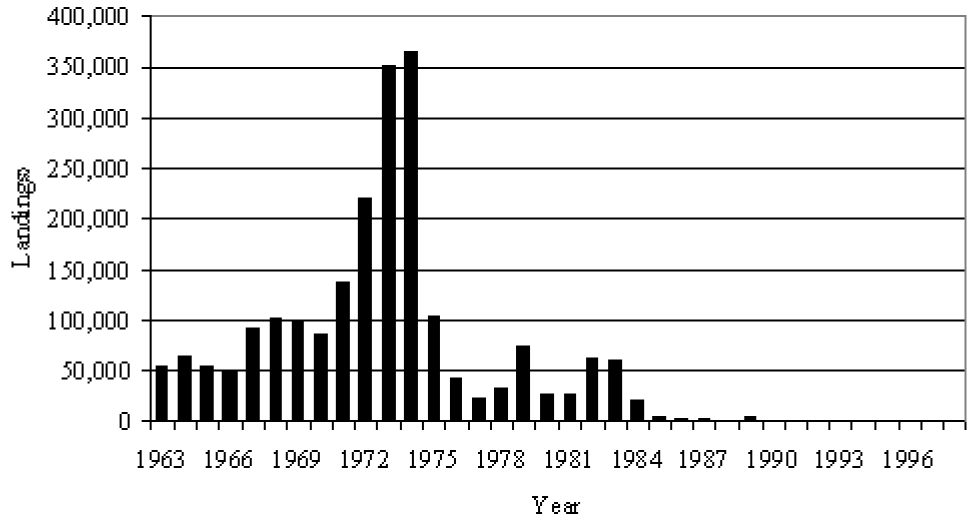

Figure 6.7. Alabama commercial landings (lbs) of spotted seatrout, 1963-1998 (NMFS unpublished data).

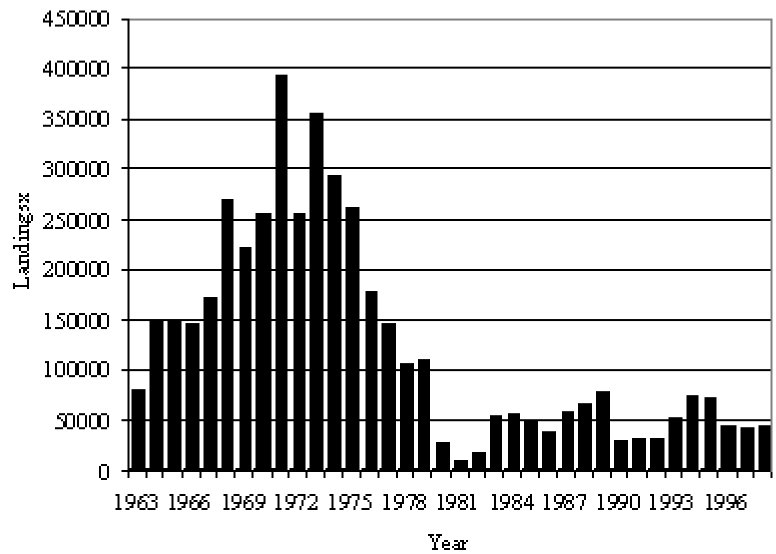

Figure 6.8. Mississippi commercial landings (lbs) of spotted seatrout, 1963-1998 (NMFS unpublished data).

Over the years, the bulk of commercial catches of spotted seatrout have been with some type of entanglement gear. Trammel nets produced the major percentage of the catch in the 1960s through the middle 1970s. Gill nets began dominating the catches in the late 1970s through 1996. Within these years, a small percentage of the catch is attributed to trawl and hook-and-line (Table 6.11). However, with the recent adoption of a degradable webbing requirement for gill and trammel nets in Mississippi, most of the spotted seatrout landings after 1996 are attributed to hook and line gear. Commercial license sales from 1987-1997 are summarized in Table 6.12.

Table 6.11. Mississippi commercial spotted seatrout landings by gear from 1987 to 1997 (NMFS unpublished data). Blanks indicate no landings reported.

Year	Gear					
	Otter Trawl	Gill Nets (Other)	Gill Nets (Drift and Runaround)	Trammel Nets	Hand Lines	Rod & Reel
1987	430	10,564	30,920	6,172	9,218	
1988	553	32,320	13,619	5,878	13,214	
1989	284	21,808	15,869		29,833	
1990	1,997	13,861	2,506		6,016	
1991	810	16,818	1,990		5,833	
1992	676	20,829	4,548	1,354	4,157	
1993	99	32,369	11,634		7,260	
1994	79	22,856	41,717		4,572	
1995	89	24,315	32,493		11,556	
1996		7,726	17,451		18,412	
1997			12,073		24,917	539

Table 6.12. Number of resident commercial licenses issued, by gear, 1987-1998 in Mississippi (MDMR unpublished data). Mississippi commercial fishing license year is May 1 through April 30 of the following year. NA indicates the license was not available.

Year	Shrimp Vessel <30 ft	Shrimp Vessel 30-45 ft	Shrimp Vessel >45 ft	Gill/Trammel Net	Commercial Hook & Line
1986/1987	836	509	332	153	NA
1987/1988	942	555	356	194	NA
1988/1989	940	622	531	213	NA
1989/1990	950	569	495	222	NA
1990/1991	726	564	520	185	51
1991/1992	494	536	490	182	89
1992/1993	457	428	464	190	64
1993/1994	428	447	459	233	73
1994/1995	347	389	449	220	86
1995/1996	324	380	473	167	86
1996/1997	339	370	457	168	75
1997/1998	327	361	410	58	85

6.2.2.4 Louisiana

The commercial spotted seatrout fishery within Louisiana was initially a bycatch fishery. In the 1880s and early 1900s, the fishery was based largely on shrimp-seine bycatch or on a secondary hook-and-line effort. The adoption of the shrimp trawl around 1920 and the resulting decrease in use of shrimp seines led to the introduction of trammel nets and the evolution of the fishery into a directed winter fishery conducted between shrimp seasons (i.e., between December and April/ May). The spotted seatrout fishery developed into a year-round fishery when gillnets were introduced in the 1960s. While many commercial fishermen still preferred the hook-and-line method in the early 1970s (Pesson 1974), by the mid 1970s gill nets were the primary method of harvest followed by seines and trammel nets (Bowman et al. 1977). Monofilament gill nets, an improvement over the older twine nets, were introduced in 1971 (Bowman et al. 1977). After the monofilament gill net ban in 1977, the use of webbing composed of three or more twisted strands of monofilament became widespread. Gill nets remained the primary method of harvest, and trammel nets displaced seines as the second most popular gear type through the 1980s and early 1990s (Table 6.13). Since March 1, 1997, only a commercial rod and reel may be used to commercially harvest spotted seatrout. Commercial license sales are included in Table 6.14.

Table 6.13. Louisiana commercial spotted seatrout landings (lbs) by gear type from 1980 to 1989. Other category includes handlines, purse seines, and butterfly nets (NMFS unpublished data).

Year	Gill Net	Trammel	Haul Seine	Shrimp	Other
1980	224,600	377,000	0	200	2,300
1981	424,000	157,800	0	13,300	3,200
1982	471,800	218,800	9,600	2,400	26,400
1983	842,000	440,300	21,200	600	36,500
1984	454,600	496,300	0	300	22,000
1985	577,700	539,000	400	5,200	39,300
1986	1,189,300	680,000	24,400	6,200	77,000
1987	1,209,800	496,000	8,500	22,300	65,300
1988	1,196,500	170,000	2,000	61,100	13,600
1989	1,376,000	93,300	1,700	17,800	<100

Table 6.14. Commercial license sales in Louisiana from 1987 to 1997 (LDWF unpublished data). Total gill net license includes both resident and nonresident fresh and saltwater gill nets until 1992. As of 1997 the only legal commercial method to harvest spotted seatrout was by rod and reel. NA indicates license was not available.

Year	Resident Saltwater Gill Net	Nonresident Saltwater Gill Net	Fish Seine	Trammel Net	Total Gill Net	Spotted Seatrout Permits	Commercial Rod & Reel
1987	NA	NA	291	847	3,491	NA	NA
1988	NA	NA	243	619	2,638	NA	NA
1989	NA	NA	272	628	2,888	NA	NA
1990	NA	NA	263	599	2,748	NA	NA
1991	NA	NA	252	541	2,816	NA	NA
1992	831	76	220	502	NA	NA	NA
1993	900	85	185	496	NA	NA	NA
1994	1,017	127	196	502	NA	NA	NA
1995	1,572	154	163	484	NA	73	3
1996	984	81	177	0	NA	186	24
1997	794	58	136	0	NA	138	25

Louisiana landings increased from less than one million lbs in the late 1800s to a high of 2.5 million lbs in 1973 (Table 6.9 and Figure 6.9). Reported annual landings in Louisiana have averaged approximately 0.85 million lbs since 1887 and seldom exceeded one million lbs prior to 1971. Landings increased steadily through the early 1970s, and peaked at 2.5 million lbs in 1973. Landings averaged 1.37 million lbs from 1971 to 1987. After 1988, landings ranged from 0.65 million to 1.49 million lbs, an average of 1.15 million lbs. Commercial harvest quotas were established in 1987, and a season between September 15-May 1 in 1992. Since the fishing year does not coincide with the calendar year, there is more variation in harvest by calendar year than by fishing year. In 1995, the harvest season was modified to operate between the third Monday in November until May 1.

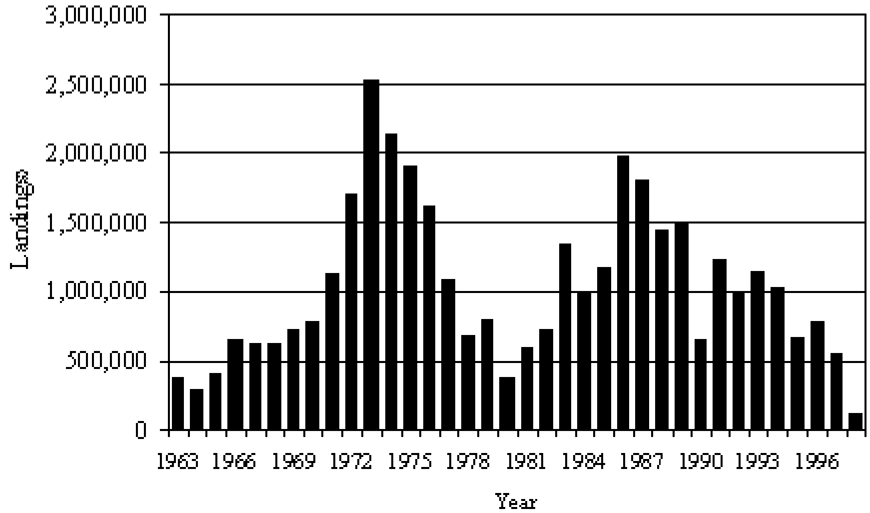

Figure 6.9. Louisiana commercial landings (lbs) of spotted seatrout, 1963-1998 (NMFS unpublished data).

6.2.2.5 Texas

The Texas commercial spotted seatrout fishery rivaled the east coast of Florida and Louisiana in annual weight landed, around 1.7-2.0 million lbs from the late 1960s to the 1973-1975 period (Table 6.9 and Figure 6.10). In 1981, the Texas legislature banned the sale of native spotted seatrout, eliminating any commercial harvest in Texas waters. Commercial license sales in Texas from 1978-1997 are summarized in Table 6.15.

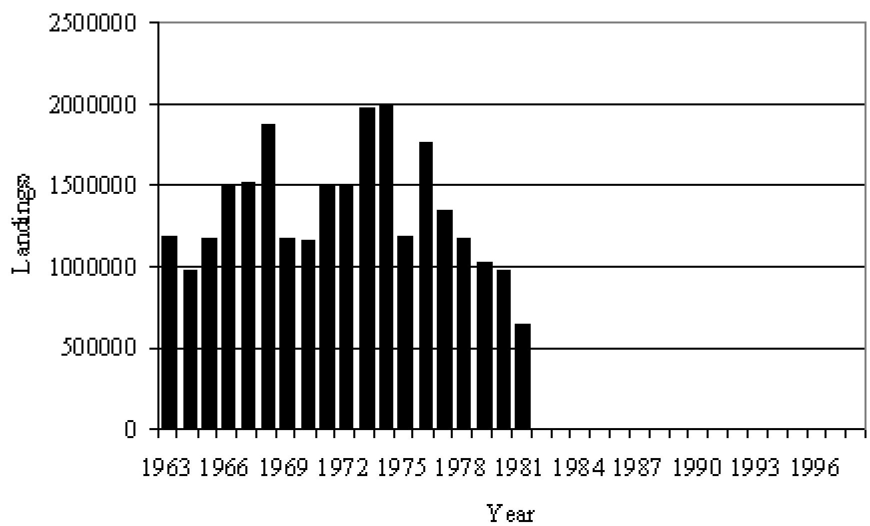

Figure 6.10. Texas commercial landings (lbs) of spotted seatrout, 1963-1988 (TPWD unpublished data).

Table 6.15. Number of Texas resident (R) and nonresident (N) commercial license sales from 1978-1997. Blanks indicate license was unavailable. All commercial netting was prohibited September 1988. Total annual sales are not additive because of the unknown number of multiple license holders. No division was made in the "General" license prior to 1980. Seine tags include both fresh and saltwater privileges.

Year	General (R)	General (N)	Finfish (R)	Finfish (N)	Saltwater Trotline Tags	Seine Tags	Fishing Boat (R)	Fishing Boat (N)	Bay Shrimp (R)	Bay Shrimp (N)	Bait Shrimp (R)	Bait Shrimp (N)
1978	28,425				14,488	14,738	1,379		3,765		1,521	
1979	4,379				16,371	17,312	1,755		4,444		1,751	
1980	19,660	2,291	1,989	46	16,866	13,971	1,504		4,467		2,026	
1981	14,205	3,581	1,678	444	17,947	9,510	1,254		5,215		2,218	
1982	13,427	3,870	632	16	16,702	8,096	787		4,477		2,277	
1983	13,591	4,775	670	31	15,943	8,498	1,095		4,771		2,724	
1984	12,357	5,503	452	11	9,323	6,325	1,100		4,724		2,837	
1985	11,244	5,352	466	28	7,818	7,164	917		4,456		2,713	
1986	10,803	1,742	486	46	8,318	7,184	947		3,660		2,445	
1987	10,885	1,725	479	24	8,849	6,528	1,042		3,340		2,454	
1988	10,429	1,348	596	20	9,841	7,264	1,233	68	3,037	6	2,376	2
1989	9,036	1,309	506	54	9,538	2,859	1,181	71	2,779	7	2,135	4
1990	8,018	1,008	619	67	10,587	2,545	994	7	2,503	4	1,882	5
1991	7,446	309	637	7	9,930	2,060	879	2	2,338	5	1,707	2
1992	6,410	316	825	2	9,692		1,252	92	1,960	7	1,551	2
1993	5,829	124	803	3	9,170		1,242	12	1,800	4	1,512	1
1994	4,733	43	1282	6	9,796		1,459	27	1,589	0	1,475	0
1995	4,564	45	1525	11	10,795		1,561	35	1,841	0	1,787	0
1996	3,201	61	986	4	12,575		1,681	59	1,643	2	1,588	1
1997	2,582	31	865	6	12,586		1,466	37	1,539	1	1,472	1

During the period when commercial fishing for spotted seatrout was legal, regulations were implemented at various times along the coast. For instance, netting was illegal in the Laguna Madre. Commercial fishermen could not set their nets between 1:00 p.m. Friday and 1:00 p.m. Sunday, but there were variations in times between coastal zones. Certain areas were restricted where commercial netting was illegal, including parts of Corpus Christi, Aransas, Matagorda, East Matagorda, Galveston, and Trinity bays. There were also mesh-size restrictions and net length restrictions, etc. Commercial fishermen could keep all spotted seatrout over 12-inches long. A monthly report for commercial landings was filed with the TPWD by the 10th of each month by all buyers of commercial fish.

6.3 Incidental Catch

6.3.1 Recreational Fishery

The MRFSS has been in operation since 1979; therefore, little or no prior data exist regarding recreational harvesting other than occasional anecdotal reports in the literature. Bycatch of spotted seatrout in the recreational fishery exists as primarily undersized fish which are released. Generally, most recreational anglers who catch spotted seatrout while targeting another species generally do not discard or release them unless they are undersized. However, hooking mortality must be considered when discussing the release of undersized spotted seatrout by recreational anglers.

Mortality estimates of released spotted seatrout caught by hook-and-line vary greatly under some circumstances (Muoneke and Childress 1994). Bycatch of Texas private sport-boat anglers was determined during May-November 1993; estimates of released spotted seatrout ranged from 803,000-902,000 fish (Campbell and Choucair 1995). About two spotted seatrout were released for every one landed. Generally, mortalities average <25% (Hegen et al. 1984, Jordan 1991). Even though high water temperatures should increase stress and reduce survival, Hegen et al. (1984) reported no difference in hooking mortality between summer and winter. Matlock et al. (1993) estimated combined hooking mortalities of around 7% for treble and single-hook caught spotted seatrout, suggesting that releases of spotted seatrout have little effect on total fishing mortality in Texas. Matlock et al. (1993) also reported no significant differences in hooking mortality between hook type (treble versus single barb) and bait type (natural versus artificial). A hook-and-release mortality study in Louisiana (unpublished data) indicates that spotted seatrout smaller than the 14-inch size limit were more likely to survive (87%) than were legal fish (81%, P = 0.010).

6.3.2 Commercial Food Shrimp Fishery

Historically, it was believed that the shrimp trawl fishery negatively impacted spotted seatrout populations around the Gulf; however, studies have not necessarily shown this to be true. Mississippi's fishery-independent sampling program indicates that very few spotted seatrout have been collected as bycatch in their monthly samples (MDMR unpublished data, J. Warren personal communication). Generally, most areas frequented by juvenile and adult seatrout are not areas in which trawl fishing is legal or practical.

In Texas, however, a trawl fishery did exist for spotted seatrout during winter months in deeper bay areas when commercial fishing for spotted seatrout was legal (TPWD unpublished data;

L. McEachron personal communication). The TPWD's routine monitoring trawl samples (Table 6.16) catch YOY spotted seatrout in deeper bay water more often in winter-early spring months than in other months (TPWD unpublished data, B. Fuls personal communication). Commercial shrimping activity is relatively low during these cooler months but would still result in mortality of YOY spotted seatrout, because fish are concentrated in deeper areas of the bays (L. McEachron personal communication).

During 1992-1995, the TPWD conducted bycatch characterization studies aboard commercial bay-shrimp vessels during the spring (May 15-July 15) and fall (August 15-December 15) commercial bay-shrimp seasons (Fuls 1995, 1996a, 1996b). A total of 2,136 samples were collected and processed to determine bycatch composition (Table 6.16) Spotted seatrout catches were relatively low compared to other fish caught as bycatch. Most spotted seatrout caught in these studies were age-0 with highest catches (number/hr) recorded in the fall. Total number of spotted seatrout caught by the bay-shrimp industry was estimated using catch rates (number/hr and g/hr) and total commercial landings during each season for each bay. Bycatch estimates were greatest in fall, and Matagorda and Aransas bays had the highest total estimated bycatch. Mortality of fish caught as bycatch is probably high because of the extended time on deck before the catch is culled and placed back in the water. The estimated bycatch exceeds the sport-boat recreational spotted seatrout landings in Matagorda and San Antonio bays in 1994, and Aransas and Corpus Christi bays in 1995 (TPWD unpublished data).

As part of a study of the impact of roller frame trawling over seagrass beds in Tampa Bay, Meyer et al. (1991) investigated the numbers of fish caught in that gear and the survival of the bycatch in pens. Fifteen, five-minute tows were conducted in August 1990 (one net examined) and November 1990 (both nets examined). A total of 142 spotted seatrout were caught. In August, 25 fish or 0.33 fish per net-minute were caught, and in November, 117 fish or 0.78 fish per net-minute were caught. Survival of spotted seatrout after being caught was 28% in August; survival was 59% in November.

Another study (Coleman et al. 1992) placed observers onboard commercial shrimp boats to identify the total catch in otter trawls, otter trawls with bycatch reduction devices, and with roller frame trawls. On Florida's Gulf coast, observers monitored 1,220 tows that captured a total of 653,385 fish of which only 601 were spotted seatrout (0.092%). Otter trawls caught fewer spotted seatrout (68 fish in 700 tows) than did roller frames which operate on seagrass flats (533 fish in 520 tows). Regionally, 360 otter trawl tows from the Northwest region (Gulf to Escambia counties) caught all of the spotted seatrout that were recorded in otter trawls. Observers did not accompany any roller frame trips in the Northwest, but the 420 tows from the Big Bend region (Pasco through Franklin counties) caught 379 spotted seatrout; the 100 observed tows from the Southwest region (Monroe through Pinellas counties) caught 154 spotted seatrout. Spotted seatrout were more commonly caught during October through December. About 600,000 spotted seatrout are caught as bycatch on Florida's Gulf coast using the number of commercial bait and food shrimping trips by area from the Florida's Marine Fisheries Information System. If none of the bycatch survives, then the 600,000 fish is equivalent to the number of age-0 spotted seatrout typically caught in the Northwest region prior to establishment of the 14-inch minimum size in 1989.

Table 6.16. Mean catch rate (SE) in number and weight, percent of bycatch, and mean size (SE) of spotted seatrout caught in shrimp trawls during the 1993-1995 spring (May 15-July 15) and fall (August 15-December 15) commercial bay-shrimp seasons, by bay system. CPUE standardized to a 9.5 m trawl in spring and 16.5 m trawl in fall (Fuls 1995, 1996a 1996b).

Estimated number derived using the following equation: $\frac{\text{(no/h in bycatch) (g of commercial shrimp landings)}}{\text{(g/h of shrimp in bycatch)}}$

SEASON Bay System	Year	Number of Samples	No/h/net (SE)	Percent of Bycatch	g/h/net (SE)	Percent of Bycatch	Mean Length (SE)	Minimum Length	Maximum Length	Estimated Total Commercial Bycatch
SPRING										
Sabine	1994	69	3.96 (3.96)	0.30	227.13 (227.13)	0.52	187 (6)	161	222	76
Galveston	1995	79	0	0	0					0
Matagorda	1995	79	0	0	0					0
	1994	69	0	0	0					0
San Antonio	1995	79	0.69 (0.44)	0.02	126.69 (86.04)	0.24	265 (5)	246	281	9,660
	1994	69	2.37 (2.06)	0.07	345.29 (337.27)	1.00	230 (7)	143	289	39,716
Aransas	1994	69	0.22 (0.22)	0.01	19.04 (19.04)	0.04	209	209	209	11,753
	1993	74	0.19 (0.19)	<0.01	24.68 (24.68)	0.05	240	240	240	9,339
Corpus Christi	1995	79	0.52 (0.33)	0.02	75.49 (54.79)	0.20	248 (11)	208	293	15,199
	1993	74	0	0	0	0				0
FALL										
Sabine	1994	142	8.87 (4.14)	0.27	571.48 (195.85)	1.19	187 (4)	126	351	3,346
Galveston	1995	137	0.04 (0.04)	<0.01	2.63 (2.63)	0.01	189	189	189	3,180
Matagorda	1995	137	1.20 (1.02)	0.12	20.06 (16.65)	0.09	128 (1)	115	162	153,124
	1994	142	1.41 (0.89)	0.11	46.46 (38.60)	0.18	160 (5)	107	186	166,252
San Antonio	1995	137	3.22 (1.51)	0.09	140.18 (74.35)	0.21	164 (7)	94	242	16,726
	1994	142	7.51 (1.74)	0.33	430.15 (149.70)	1.24	172 (2)	115	315	92,419
Aransas	1994	142	2.10 (0.79)	0.13	67.46 (31.42)	0.22	147 (4)	87	227	161,405
	1993	140	4.03 (2.15)	0.17	104.62 (52.23)	0.32	138 (4)	87	364	284,297
Corpus Christi	1995	137	2.12 (1.12)	0.20	65.24 (36.74)	0.29	154 (1)	118	188	71,382
	1993	140	0.72 (0.50)	0.04	20.18 (14.30)	0.08	155 (1)	135	160	18,031

6.3.3 Commercial Bait Shrimp Fishery

McIlwain (1991) reported only two spotted seatrout were captured in 350 trawl samples taken in Biloxi Bay during 1990. The trawl sampling was designed to investigate differences in the catch of trawls optimized for the local bait shrimp industry and those generally used in the commercial industry. The trawl samples were performed in areas opened to the bait shrimp industry but closed to commercial harvest. McIlwain stated:

> "Bycatch mortality in the bait shrimp industry does not appear to have an adverse affect on the overall population of fish and shellfish in Mississippi."

Conversely, a recent study by Meyer et al. (1991) indicates that very small spotted seatrout (25.0-55.0 mm SL) encountered in the bait shrimp fishery in Florida made up a small portion of the catch (0.8-4.4%) but suffered mortalities between 28.0% to 59.0%. These studies suggest that in areas where trawling over seagrass beds is practiced, the mortality on juvenile spotted seatrout from shrimp nets might be higher.

6.3.4 Commercial Finfish Fishery

Occasional incidental catches of spotted seatrout occur, but most of the individuals are young fish that are susceptible to certain fishing gear. Since the 1960s, gill and trammel net fisheries have been directed at species like red drum and spotted seatrout; additional regulations regarding net lengths, materials, and mesh opening size have greatly reduced the catch of undersized individuals thereby reducing bycatch. Mortality is high for spotted seatrout caught in gill nets with about 74% of all fish caught in TPWD overnight sample gill nets being recovered dead (Chai et al. 1992). Mortality was generally inversely related to mesh size and was higher in spring than in fall. In Texas, entangling nets were impeding management efforts to protect spotted seatrout. In 1988, entangling nets were banned in all marine waters. Extensive regulations restricting entanglement nets have been put in place in the Gulf States. Entangling nets are no longer legal gear in Texas, Florida, and parts of Mississippi.

A study of the gill net fishery in Tampa Bay funded by the state of Florida in 1992 showed that gill nets caught few undersized spotted seatrout (Motta 1993). In 80 commercial run-around gill net sets, the total number of spotted seatrout caught was 227; of those, 222 were of legal size. All of the undersized fish were captured in the first two quarters of the year, and of the five fish that were not landed, only two fish were released in a moribund state. In the Florida run-around gill net fishery, the typical time between deployment and beginning retrieval was 15 mins. This may explain the low mortality of gilled fish.

Another gear which produces incidental catch of spotted seatrout is the trotline, a type of longline which is used to catch black drum in Texas. Spotted seatrout was the third most common species harvested by trotlines in the Texas black drum fishery (McEachron et al. 1987). This bycatch was a concern for both fishermen and fishery managers. It was determined that using circle hooks reduced mortality of fish significantly; placing trotlines on the bottom reduced bycatch further without affecting targeted black drum catches.

6.3.5 Nonfishing Human-Induced Bycatch

Impingement or entrainment by power plant cooling water intake screens can cause mortality of spotted seatrout. During an eight-year study (1973-1980) in Galveston Bay, an estimated 175,105 spotted seatrout weighing 3,421 kg were impinged at the Houston Light & Power Cedar Bayou Station, or about 21,888 fish/year (Palafox 1993). Impingement varied among months and years, but most fish were impinged during November-April with a peak in January. Lengths of spotted seatrout impinged ranged from 30 to 285 mm TL. In Galveston Bay, five power plants are in operation; therefore, an estimated 109,440 spotted seatrout may be impinged and die annually. Total annual mortalities in the Gulf of Mexico may be high due to numerous power plants and other entities using estuarine bay water for cooling. Research in the Gulf of Mexico is needed to estimate the magnitude of this impingement/entrainment mortality.

6.4 Foreign Activity

No foreign fishing activity for spotted seatrout occurs in the Gulf States.

7.0 ECONOMIC CHARACTERISTICS OF THE COMMERCIAL AND RECREATIONAL FISHERIES

There are a number of underlying economic characteristics of the commercial and recreational spotted seatrout fisheries in the Gulf of Mexico. Commercial dockside value represents the total amount paid by the first handler to the harvester during the initial off-loading of the fish. Markups that might occur in subsequent market levels are not included. Annual and monthly nominal (not adjusted for inflationary changes) dockside values will be discussed for each state and the Gulf, in general. Annual and monthly nominal exvessel prices (i.e., the price per pound received by the harvester for whole fish) will be discussed by region, state (where appropriate), and gear type. Information on prices and dockside value provides basic insight into the economic importance and performance of the commercial spotted seatrout harvest sector. Information on trends in Gulf landings (lbs) is found in Section 6.1.1, Tables 6.2 and 6.9.

The sources and uses of spotted seatrout by finfish wholesale distributors and processors in the Gulf provide insight into the importance of the stocks to seatrout purveyors in the region, as compared to seatrout obtained from other domestic sources and foreign suppliers. Unfortunately, volume and value of spotted seatrout sold by wholesale distributors, as well as wholesale markups, are not readily available. Limited data on consumption estimates will be discussed to provide some insight into the importance of spotted seatrout to retail consumers in the region.

Spotted seatrout are targeted by anglers in all Gulf States. A limited number of studies provides a partial assessment of the economic importance of this species to recreational fishing activities in the Gulf. Measurements of trip expenditures and recreational anglers' willingness to pay (i.e., contingent valuation) for access to spotted seatrout are discussed and provide insight into the economic value that anglers place on spotted seatrout. Although not directly reflected in the marketplace, as are commercial dockside value and exvessel prices, contingent valuation estimates are no less important in providing an understanding of the total economic value derived from the utilization of spotted seatrout stocks.

Replacement costs associated with spotted seatrout provide fishery managers and law enforcement agencies with the existing values placed on replacing fish potentially lost through natural phenomena, habitat destruction, pollution events, and regulatory violations.

7.1 Commercial Sector

7.1.1 Annual Commercial Dockside Value

7.1.1.1 Gulfwide Dockside Value

The dockside value for spotted seatrout in the Gulf exhibited an increasing trend from the 1970s until the mid 1980s but has mirrored the declining trend seen for commercial landings during the mid 1980s until the present (see Section 6.2 and Table 6.4). Nominal dockside value (e.g., not adjusted for changes in inflation) increased in a steady trend from 1970 ($1.375 million) through 1988 ($2.976 million) (Table 7.1). A downward trend in value began in 1989 that continued through 1995, when dockside value had fallen to $1.175 million. This latter value was less than the Gulfwide

Table 7.1. Annual spotted seatrout dockside value (nominal, not adjusted for inflation) for the Gulf States, 1970-1997 (units of 1,000). Dashes (-) indicate no commercial sales (NMFS unpublished data).

Year	State					Total Gulf
	TX	LA	MS	AL	West FL	
1970	257	217	63	26	812	1,375
1971	357	297	98	40	615	1,408
1972	420	447	68	65	718	1,718
1973	646	775	114	111	854	2,501
1974	645	635	91	110	884	2,366
1975	701	696	97	32	921	2,447
1976	797	714	77	15	1,055	2,658
1977	723	528	70	10	987	2,318
1978	769	392	56	18	1,166	2,402
1979	883	566	79	45	1,329	2,902
1980	961	474	21	20	1,307	2,785
1981	738	568	8	23	1,550	2,887
1982	-	653	16	55	1,796	2,519
1983	-	1,220	50	56	1,715	3,040
1984	-	1,062	54	21	1,409	2,546
1985	-	1,256	55	4	1,045	2,360
1986	-	1,676	38	3	1,191	2,908
1987	-	1,605	60	3	1,306	2,974
1988	-	1,498	76	1	1,401	2,976
1989	-	1,390	96	4	1,004	2,494
1990	-	997	46	-	928	1,971
1991	-	1,512	52	-	988	2,551
1992	-	1,075	45	-	781	1,901
1993	-	1,274	84	-	675	2,033
1994	-	1,068	123	-	792	1,984
1995	-	593	120	-	462	1,175
1996	-	713	74	-	39	826
1997	-	553	80	-	62	695

dockside value reported for 1970. Dockside values for the Gulf continued falling to $826,000 in 1996 and $695,000 in 1997. These declining total commercial values are directly related to policy and regulatory changes which have limited availability to the resource by the commercial sector throughout the Gulf.

7.1.1.2 Dockside Values by State

The Texas Legislature banned the sale of Texas-caught spotted seatrout in 1981. Landings of spotted seatrout in Texas averaged 1.4 million lbs during 1970-1981 with an average annual dockside value of $658,000 (Table 7.1). During 1970-1980, nominal dockside value increased steadily from $257,000 in 1970 to $961,000 in 1980. Dockside value decreased to $738,000 in 1981, the last year commercial sales were allowed.

Annual dockside value for spotted seatrout in Louisiana during 1970-1982 averaged $536,000 (Table 7.1). Both landings and dockside value increased dramatically in 1983, with dockside values reported at $1.2 million. Annual dockside value increased to a record of $1.7 million in 1986, then began declining through 1990 ($997,000). Dockside value increased dramatically to $1.5 million in 1991, then began a general declining trend in 1992 which continued until a value of $0.55 million was observed in 1997.

Commercial spotted seatrout landings and dockside value in Mississippi declined steadily from the early 1970s until the early 1980s (Table 7.1). Landings decreased from 393,000 lbs in 1971 to 9,000 lbs in 1981. Dockside value decreased from $114,000 in 1973 to $8,000 in 1981. Landings fluctuated between about 30,000 and 70,000 lbs from the early 1980s until 1995. In contrast, nominal dockside value increased from $16,000 in 1982 to approximately $120,000 in 1994 and 1995. Dockside value decreased again to $74,000 and $80,000 in 1996 and 1997, respectively.

Dockside value for spotted seatrout in Alabama increased dramatically between 1971 and 1974, then decreased to significantly lower levels (Table 7.1). Landings and dockside value exhibited average annual amounts of 312,000 lbs and $95,000 between 1972 and 1974, respectively. During 1975-1984, landings and dockside value averaged 47,000 lbs and $30,000, respectively. Commercial landings and dockside value decreased even further between 1985 and 1989 with average annual values of 3,000 lbs and $3,000, respectively. Commercial harvest of spotted seatrout was disallowed in Alabama beginning in 1986.

Although commercial landings of spotted seatrout in Florida have declined steadily since 1970, dockside value increased until the early 1980s (Table 7.1). Commercial landings in Florida declined from 2.6 million lbs in 1970 to 1.1 million lbs in 1985. Landings then increased slightly to 1.3 million lbs in 1988, then decreased steadily to 348,000 lbs in 1995. Beginning in 1995, commercial landings of spotted seatrout in Florida were severely limited due to an amendment to the Florida constitution which disallows the use of entangling nets in state waters, the primary gear by which spotted seatrout were commercially harvested in Florida. In contrast, nominal dockside value increased from $812,000 in 1970 to $1.8 million in 1982. Dockside value then decreased to $462,000 in 1995. The dramatic decline in value mirrored a drop in landings during the 1990s. Total dockside value for spotted seatrout decreased from $988,000 in 1991 to $462,000 in 1995. The implementation of the net ban in Florida waters reduced commercial effort on the spotted seatrout, resulting in further decreases in landings and dockside value. The dockside value of spotted seatrout fell to $39,000 and $62,000 in 1996 and 1997, respectively.

7.1.2 Monthly Commercial Nominal Dockside Value

Nominal monthly dockside value is examined for 1993-1997 (Table 7.2). The five-year average was estimated for each month, by state. Data are not available for Texas during this period, due to the lack of a commercial fishery after 1981. Also, the limited data available for Alabama do not allow monthly estimates for reasons of confidentiality. Average monthly landings by state can be found in Section 6.1.1. Monthly dockside value for spotted seatrout landed in Louisiana typically peaks in the winter months and reach the lowest levels during the spring and fall months. The season is closed for commercial harvest during May through August. A similar pattern is seen for the west coast of Florida, with values peaking in the winter months. In contrast, monthly dockside values for Mississippi peak in the spring.

Table 7.2. Average nominal monthly dockside value (units of 1,000; not adjusted for inflation) for spotted seatrout in the Gulf States, 1993-1997 (NMFS unpublished data). Dashes (-) indicate no landings.

	State		
Month	**LA**	**MS**	**West FL**
January	241.1	4.1	70.3
February	175.7	3.7	47.4
March	64.8	5.6	31.1
April	24.0	19.9	23.2
May	-	24.7	20.9
June	-	7.7	25.6
July	-	6.9	23.4
August	-	6.6	19.0
September	3.3	2.7	13.7
October	54.5	4.9	16.4
November	79.4	5.3	35.9
December	152.0	4.0	81.5

7.1.3 Annual Exvessel Prices for Spotted Seatrout

7.1.3.1 Gulfwide Exvessel Prices

Nominal exvessel price/lb for spotted seatrout increased steadily from 1970 until 1985, when the upward trend was disturbed by fluctuations which occurred between 1986 and 1989 (Table 7.3). The Gulfwide exvessel price fell 12% from 1985 to 1986, partly in response to record landings that occurred in 1986. Higher landings kept downward pressure on nominal prices through 1989. However, when landings fell 44% between 1989 and 1990, exvessel prices responded by increasing to record levels. Interestingly, as landings fell 50% between 1991 and 1995, nominal exvessel prices also declined 8% during the same period. Nominal price continued to decline to $0.98 in 1996 but then increased to $1.11 in 1997.

Real prices (adjusted by using the producer price index for all foods-1983 base year) for spotted seatrout [United States Bureau of Labor Statistics (USBLS) 1997] have exhibited both upward and downward trends since 1970. Real prices increased in an erratic manner from $0.78 in 1970 to $1.21 in 1990. Real prices fell steadily through 1996. Real prices also declined at a greater total percent than nominal prices since 1990. For example, nominal prices declined 28% between 1990 and 1996, while real prices declined 35% during the same period. Similar to nominal prices, real prices increased during 1997 (to $0.90).

7.1.3.2 Exvessel Price by State

Although variability in exvessel prices are likely found on a regional or offloading site basis, existing data do not allow disaggregation beyond the state level. Exvessel prices for spotted seatrout landed in most states exhibited an increasing trend during the 1970 to mid 1980s (prices for Texas are available only through 1981) (Table 7.3). Prices for Louisiana initially peaked in 1984 and became somewhat variable until another peak was reached in 1990; then a declining trend occurred and continued until 1997. Prices for Florida spotted seatrout reached a peak in 1990 and remained steady until increasing from $1.32 in 1995 to $1.91 in 1997. This dramatic increase in exvessel price may be the result of reduced volumes due to the net ban implemented in 1995. Thunberg and Adams (1992) found an inverse relationship between exvessel price and landings for commercially landed spotted seatrout in Florida during 1981-1990. During the 1980s, prices across states were variable with the highest relative prices being received for spotted seatrout landed in Mississippi. During the 1990s, the exvessel price received for spotted seatrout in Mississippi exceeded those for Louisiana and Florida. Prices for Alabama are available only through 1989. The nature of the trends in real prices among states is unknown since state-specific producer price indices are not available. Therefore, real price trends would likely mirror the nominal price trend previously discussed for the Gulf in general, since harvesting and processing methods are quite similar within the region.

7.1.4 Monthly Commercial Exvessel Prices for Spotted Seatrout

Nominal exvessel prices for spotted seatrout are lowest in the late fall and winter months, and peaks are exhibited during the summer (Table 7.4). During 1993-1997, average monthly nominal prices were greater for Mississippi than Florida and Louisiana. Prices for Louisiana exhibited the most variability and were typically lower than prices for Florida. Since commercial

Table 7.3. Nominal (not adjusted for inflation) annual exvessel prices, values are dollars/lb whole weight for spotted seatrout in the Gulf States, 1970-1997. Real price adjusted by the Producer Price Index (PPI) for all foods, base year = 1985 (USBLS 1997). Dashes (-) indicate no commercial sales (NMFS unpublished data).

	Gulfwide						
Year	Nominal	Real	TX	LA	MS	AL	West FL
1970	0.28	0.78	0.22	0.28	0.25	0.31	0.31
1971	0.28	0.75	0.24	0.24	0.25	0.29	0.31
1972	0.30	0.77	0.28	0.27	0.27	0.30	0.34
1973	0.34	0.77	0.33	0.31	0.31	0.32	0.38
1974	0.34	0.65	0.32	0.30	0.31	0.30	0.39
1975	0.39	0.69	0.39	0.37	0.37	0.31	0.42
1976	0.45	0.76	0.45	0.44	0.43	0.36	0.46
1977	0.51	0.81	0.54	0.49	0.48	0.44	0.51
1978	0.60	0.89	0.66	0.58	0.53	0.58	0.58
1979	0.71	0.93	0.86	0.71	0.72	0.61	0.64
1980	0.78	0.89	0.98	0.79	0.78	0.78	0.67
1981	0.89	0.94	1.14	0.97	0.90	0.86	0.77
1982	0.89	0.92	-	0.90	0.94	0.88	0.89
1983	0.91	0.93	-	0.91	0.92	0.93	0.92
1984	0.98	0.98	-	1.09	0.99	1.00	0.91
1985	1.01	1.01	-	1.08	1.15	0.90	0.92
1986	0.89	0.91	-	0.85	1.01	1.05	0.95
1987	0.93	0.93	-	0.89	1.06	0.99	0.97
1988	1.05	1.01	-	1.05	1.16	1.05	1.04
1989	0.98	0.90	-	0.93	1.24	0.87	1.02
1990	1.37	1.21	-	1.54	1.53	-	1.22
1991	1.23	1.09	-	1.24	1.65	-	1.20
1992	1.15	1.01	-	1.11	1.44	-	1.20
1993	1.17	1.02	-	1.12	.163	-	1.24
1994	1.14	0.98	-	1.04	1.69	-	1.24
1995	1.13	0.93	-	0.95	1.67	-	1.33
1996	0.98	0.79	-	0.92	1.70	-	1.72
1997	1.11	0.90	-	1.01	1.93	-	1.91

Table 7.4. Average monthly nominal, not adjusted for inflation, exvessel prices (values are dollars/lb whole weight) for spotted seatrout in the Gulf States, 1993-1997 (NMFS unpublished data). Dashes (-) indicate no landings.

	State		
Month	**LA**	**MS**	**West FL**
January	0.94	1.30	1.14
February	1.06	1.37	1.22
March	1.32	1.68	1.30
April	1.45	1.78	1.35
May	-	1.81	1.45
June	-	1.88	1.56
July	-	1.94	1.54
August	-	1.88	1.53
September	1.46	1.79	1.46
October	1.14	1.71	1.37
November	0.92	1.48	1.36
December	0.91	1.33	1.15

harvest is no longer allowed in Texas and Alabama, monthly exvessel price data are not available for those states.

7.1.5 Exvessel Prices by Type of Harvest Gear

Factors such as seasonal shifts in landings and demand, supply of closely substitutable species, and region of harvest may affect the per pound exvessel price for spotted seatrout in general or on a species-specific basis. In addition, the harvest gear used may have some influence on the exvessel price received. For example, a gear which allows the individually harvested fish to be handled more gently (less damage through crushing, tearing, etc.) may result in a perceived higher quality product. If buyers recognize these quality attributes and a market for those attributes exist, a higher per unit price may result. Thus, a fish caught in an entangling net (which may be bruised and missing scales) may bring a lower price than a fish caught on hook and line.

Real exvessel prices were computed for landings of spotted seatrout by gear type (Table 7.5). These prices represent exvessel prices for spotted seatrout landed across all states in the Gulf of Mexico. The prices were computed by dividing total nominal exvessel value for each gear type by the respective landings for each gear type. The resulting nominal prices were then adjusted for inflation with the PPI for all food items. The gear types selected for comparison included those that accounted for the majority of landings reported on a gear type basis. The gear types selected included trawls, various gill nets, trammel nets, and hand/troll lines. The cumulative reported landings for these gear types represented approximately 75% of the total landings of spotted seatrout reported by gear type in the Gulf of Mexico during 1988-1997.

Table 7.5. Real exvessel spotted seatrout prices (dollars/lb) by gear type (gear code) for the Gulf of Mexico, 1988-1997 (NMFS unpublished data). Dashes (-) indicate no commercial sales. Prices are adjusted by the Producer Price Index (PPI) for all foods, base year = 1985 (USBLS 1997).

Year	Otter Trawl (215)	Entangling Nets (400)	Gill Nets Other (425)	Gill Nets Drift (470)	Gill Nets Runaround (475)	Trammel Nets (530)	Hand Lines (610)	Troll Lines (660)
1988	1.09	0.98	1.02	0.94	1.01	0.98	1.03	1.04
1989	0.96	0.97	0.89	1.01	0.85	0.91	0.95	1.00
1990	1.02	1.27	1.49	1.48	1.04	1.11	1.09	1.23
1991	1.37	1.17	1.51	1.00	1.07	1.00	1.13	1.33
1992	1.30	1.04	1.26	0.97	1.04	1.05	1.19	1.26
1993	0.88	-	1.44	-	1.11	1.07	1.09	1.27
1994	1.33	-	1.43	-	1.45	-	1.39	-
1995	1.39	-	1.36	-	1.40	-	1.37	-
1996	-	-	1.41	-	1.40	-	1.33	-
1997	-	-	1.53	-	1.65	-	1.52	-

Relative magnitudes of prices varied considerably during 1988 to 1992 with no clear pattern evident among gear types. Following 1993, higher prices were generally associated with net, rather than with hand and troll lines as might have been expected a priori (Table 7.5). Recall that these prices are for spotted seatrout landed within the Gulf on an annual basis. Prices by gear type may change across states or by month. These prices may also be influenced by local market conditions that may mask the impact of harvest method on price.

7.1.6 Processing and Marketing

7.1.6.1 Market Channels

Few studies have been conducted to describe the processing and marketing of spotted seatrout in the Gulf of Mexico. In particular, no studies have attempted to describe the marketing channels associated with spotted seatrout in the region. Degner et al. (1989) examined the marketing channels for mullet in Florida. However, the variety of products derived from mullet (i.e., fillets, smoked, roe, split carcasses for bait, and gizzards) provided for a much more complex market channel system than would be anticipated for spotted seatrout.

To better understand the market system for spotted seatrout in the Gulf, a brief market survey was designed and conducted by the GSMFC in 1996. This survey solicited information on sources of spotted seatrout supply, product forms, and disposition of spotted seatrout products in and out of the region. The relative importance of various product forms demanded by wholesalers, retailers, restaurants, and retail consumers was also solicited. Information of this nature will allow a better understanding of the economic values associated with the spotted seatrout resource as its products moves from vessel to final consumer. A brief mail-out survey instrument was designed, field tested, and mailed to 538 seafood wholesale distributors in the Gulf. Each of these firms reported some sales of flounder and/or spotted seatrout during 1995. Of the total number of surveys sent out, 348 went to Florida firms, 32 to Texas firms, 99 to Louisiana firms, 18 to Mississippi firms, and 41 to Alabama firms. A cover letter and questionnaire were initially sent out and followed up three weeks later with a reminder letter and another copy of the questionnaire. A total of 79 responses was obtained, of which 67 usable responses were returned providing for a 12.5% overall return rate. The returns by state were 31 from Florida, nine from Texas, 16 from Louisiana, five from Mississippi, and six from Alabama. A copy of the survey instrument is located in Appendix 14.2.

Respondents were initially asked about the source of their supply during 1996. Approximately two-thirds of the spotted seatrout purchased by wholesalers in the Gulf was obtained directly from local fishermen (Table 7.6a). Another 26% were obtained from other wholesalers. Less than 10% were obtained from other domestic sources and foreign imports. Of the supply obtained directly from local anglers and wholesalers, respondents indicated that most was obtained in fresh, round/whole form. For example, of the total amount of spotted seatrout purchased from fishermen and wholesalers, 99% and 92% were purchased in round form, respectively. The same percentages apply to purchases of fresh product. Of the product purchased from other domestic sources, approximately two-thirds was purchased as round/whole trout, while one-third was purchased as fillets. Only for imports were fillets (62%) or frozen (50%) spotted seatrout relatively important product forms.

Table 7.6a. Sources of spotted seatrout supply and product form for spotted seatrout wholesalers in the Gulf States, 1996 (GSMFC unpublished data).

Supply Source and Form					
Source of Supply	Percentage	Product Form Purchased (%)[1]			
		Round/Whole	Fillets	Fresh	Frozen
Fishermen	64	99	< 1	99	<1
Other Wholesalers	26	92	8	92	8
Other Domestic Sources	4	67	33	100	0
Importers	6	75	25	67	33
Total	100				

Table 7.6b. Sales by product form for wholesalers in the Gulf States, 1996 (GSMFC unpublished data).

Sales by Sector and Product Forms								
	Percentage			Product Form Sold (%)[1]				
Market Sector	In-State	Out-of-State	Total	Whole	Fillets	Other	Fresh	Frozen
Wholesalers	23	8	31	90	8	2	96	4
Retailers	13	1	14	69	31	0	81	19
Restaurants	25	1	26	39	60	1	86	14
Retail Consumers	29	-	29	59	40	1	93	7
Foreign Buyers	0	-	0	0	0	0	0	0
Total	90	10	100					

[1] These values represent indices of importance relative to each product form for the respective market sector. Percentages given by respondents (see survey instrument in Appendix 14.2) are summed and divided by the total number of responses, including zero (0) responses. Missing values (-) are excluded. Percentages are computed only for those market channels utilized by respondents.

Respondents were then asked to describe the product forms into which the initial supplies were converted. The majority of spotted seatrout sold by wholesalers (61%) remained in round/whole form; virtually all was fresh. Approximately 34% of the spotted seatrout sold by wholesalers was processed into fillets (approximately 75% fresh), and almost none was sold in any other fresh or frozen product form (i.e., steaked, stuffed, etc.)

Respondents were asked to describe how their sales were distributed across buyers (both in and out of state) and what product forms were demanded by these buyers. The distribution of sales across types of domestic buyers was somewhat uniform (Table 7.6b). For example, sales to other wholesale distributors/processors represented 31% of total sales. Sales to retailers accounted for 14% of total sales, and sales to restaurants and retail consumers accounted for 25% and 29% of total sales, respectively. For all types of buyers, in-state sales represented the majority of volumes sold. For sales to other wholesale distributors/processors, out-of-state sales accounted for approximately 25% of the total. Respondents indicated that there were no sales of spotted seatrout to foreign buyers in 1996.

Whole product represented the most important product form for wholesale and retail buyers. Of sales to wholesale buyers, 90% was in whole form, and only 8% was sold as fillets to wholesale buyers. However, fillets were more important for sales to retailers (31%), restaurants (60%), and retail consumers (40%). In addition, all types of buyers apparently preferred fresh product, while frozen product was relatively more important to retail (19%) and restaurant (14%) buyers. Although sales among states within the Gulf are an important component of the regional market, only 6% of total spotted seatrout sales went to buyers outside the Gulf States.

7.1.6.2 Other Sources of Spotted Seatrout Supply

The market channel analysis indicates that the most important source of spotted seatrout is from domestic fishermen; however, other sources of spotted seatrout exist. As suggested by the market channel analysis, approximately 6% of the total supply is obtained from foreign sources. It is uncertain how much of the supply obtained from other wholesalers may have been originally obtained from foreign sources or from states outside the region. Spotted seatrout imports into Texas are recorded by the TPWD via the Finfish Tracking System (TPWD 1997a). During February 1992 to September 1997, about 109,800 lbs of whole, gutted spotted seatrout and 15,500 lbs of spotted seatrout fillets were imported into the state.

Considerable domestic production of various seatrout species occurs along the southeast Atlantic coast of the United States. For example, in 1996 a total of 282,000 lbs of spotted seatrout was landed in North Carolina and the Florida east coast (NMFS unpublished data). The final market destination of this product is not known. In addition, significant volumes of several other species of seatrout (i.e., weakfish, sand seatrout, silver seatrout, etc.) are commercially harvested in the Gulf and South Atlantic. Although these landings are not discussed in detail here, these supplies may serve as direct substitutes in the marketplace for spotted seatrout caught in the Gulf. This substitutability may result in downward pressure on prices for regionally caught spotted seatrout.

7.1.6.3 Consumption Estimates

Few studies exist that indicate the importance of spotted seatrout to consumers. Published average, annual per-capita seafood consumption estimates do not provide estimates for most specific fresh finfish products (NMFS unpublished data). In addition, the NMFS estimates are not provided on a regional basis. A study by Degner et al. (1994) estimated weekly and annual per capita consumption (edible meat weight) by Florida residents for 34 saltwater and freshwater finfish species and 11 shellfish species. In addition, per capita consumption estimates for a number of processed products were also derived. Among all finfish species consumed in fresh or frozen form, the annual per capita consumption estimate for seatrout was found to be minor when compared to the consumption of other species of finfish. The study found that resident adult Floridians consume, on average, approximately 0.6 lbs of seatrout each year (approximately 40% was obtained recreationally, while the remainder came from commercial sources). This represented less than 2% of all finfish consumed, including canned and further processed products. The consumption estimate for seatrout was not disaggregated into species of seatrout or source (i.e., domestic and imported). A recent study of seafood consumption in Louisiana found that 12.5% of that state's residents prefer to consume "trout" (Research Strategies, Inc. 1996).

7.2 Recreational Sector

7.2.1 Angler Expenditures in the Gulf of Mexico

Saltwater recreational fishing represents an important industry to the Gulf States. For example, in 1996, saltwater recreational fishing for all species results in angler expenditures of $888 million in Texas, $205 million in Louisiana, $155 million in Mississippi, $124 million in Alabama, and $2.21 billion in Florida (both coasts) (Maharaj and Carpenter 1997).

7.2.2 Spotted Seatrout Angler Expenditures and Preferences in the Gulf

Spotted seatrout represent an important species for the nearshore saltwater sportfishing industry in the Gulf of Mexico. In fact, the 1995 MRFSS indicates that more spotted seatrout were caught by Gulf anglers than any other single species. Spotted seatrout comprised 15% of the total number of individual fish caught by anglers in the Gulf.

Although there are no studies measuring expenditures associated with the recreational harvest of spotted seatrout in the Gulf, several studies have attempted to measure angler expenditures, preferences, or amount of targeted effort associated with recreational fishing for spotted seatrout at local or state levels. These studies provide some insight into the popularity and economic importance associated with spotted seatrout in the Gulf.

Ditton and Hunt (1996) found that 18% of the marine recreational anglers in Texas preferred to target spotted seatrout. An earlier survey of spotted seatrout anglers in Texas found that 265,000 anglers targeted spotted seatrout and spent $132 while on a typical spotted seatrout fishing trip (Ditton 1993). An earlier study (Ditton et al. 1990) found similar levels of spotted seatrout targeting preference by Texas marine recreational anglers. That this species is of relatively high preference among recreational anglers is manifested by spotted seatrout comprising the largest percentage volume of all species caught recreationally within the coast wide bay and pass regions of Texas (Warren et al. 1994).

Spotted seatrout has also been shown to be an important recreationally sought species in Louisiana (Bourgeois et al. 1996). For example, Adkins et al. (1990) reported that spotted seatrout was the preferred species of approximately 64% of Louisiana saltwater anglers in a 1984 survey. In addition, Adkins found that this preference is somewhat seasonal with greatest preference being expressed by beach, pass, lake, and bay anglers. Wieting (1989) found up to 25% of the saltwater recreational catch in Louisiana is comprised of spotted seatrout. Kelso et al. (1991) estimated that 56% of Louisiana saltwater anglers consider spotted seatrout as their species of highest preference. Holloway and Lavergne (1997) report almost 40% of the recreational saltwater anglers in Louisiana target spotted seatrout. Bertrand (1984) found Louisiana anglers averaged almost $30 in expenditures on a saltwater fishing trip, and the majority of these anglers targeted spotted seatrout. Similar information about species preference is also available for saltwater anglers in Mississippi. For example, Deegen (1990) reported that spotted seatrout was the species most preferred by saltwater recreational angers in that state. Milon et al. (1993) found in a joint MRFSS-University of Florida marine recreational fishing participation study that “trout” was the most popular species in terms of number of targeted saltwater fishing trips in Florida. This category, however, was general enough to have contained other species of trout.

7.2.3 Economic Activities Associated with Spotted Seatrout Angler Expenditures in the Gulf

The economic activities associated with saltwater angler expenditures in the Gulf of Mexico have been estimated by Maharaj and Carpenter (1997). Initial expenditures by anglers set in motion a series of spending in local economies that results in the provision of economic output and products, secondary purchases of goods and services by associated businesses, generation of wages and salaries, and the creation of jobs. True economic "impact" occurs when these economic consequences are associated with the expenditures by nonresident anglers. Maharaj and Carpenter (1997) found that the economic activities associated with saltwater angling in the Gulf States was substantial. The economic output associated with saltwater angling expenditures in the Gulf (excluding Florida) was estimated to be $2.9 billion. This economic activity results in annual wages and salaries of $750 million and generates 38,501 jobs. Saltwater angling occurring on the Gulf and Atlantic coasts combined generates $4.1 billion in economic output, $1.2 billion in wages and salaries, and 56,278 jobs. No estimates are currently available, however, for a Gulfwide or state-specific perspective on the total expenditures, economic output, wages and salaries, and jobs related to recreational fishing specifically for spotted seatrout.

7.2.4 Economic Valuation of Recreational Spotted Seatrout Fishing in the Gulf

Despite the popularity of recreational fishing for spotted seatrout, there are no comprehensive studies that measure the economic "value" of the spotted seatrout fishery for the Gulf. Several studies have sought to measure the economic value associated with angling for spotted seatrout at local or state levels. These studies provide some insight into angler willingness to pay above the actual expenditures incurred when fishing for spotted seatrout. In a study of Florida saltwater anglers' willingness to pay for changes in current regulations, Milon et al. (1994) found that, on average, anglers were willing to pay $1.36 for an increase from 10-15 in the daily bag limit. This resulted in an implicit average value of $0.27 per fish for the five-fish marginal change in the then current bag limit in Florida. In addition, anglers in Florida were willing to pay $1.36 for the ability to retain an additional "trophy" seatrout (i.e., greater than 24 inches). Irwin (1994) found that a one-fish increase in the catch rate of trout by anglers in the Indian River Lagoon region of Florida was valued at approximately $3.60 on an annual basis. This amount exceeded similar values estimated for both snook and red drum. Although not associated specifically with spotted seatrout, estimates of willingness to pay above trip costs for saltwater fishing trips ranged from $85 to $152 per year per trip for three major bay systems in Texas, with an average variable trip cost of $126 (Wellman and Noble 1997).

7.3 Civil Restitution Values and Replacement Costs

Values exist by which a state can assess damages for events in which negligence or illegal activities result in loss of fish. These values are determined in a variety of ways for both recreationally and commercially important species. Cost of replacement may be assessed based on the costs associated with hatchery production, willingness to pay by users and nonusers, and travel cost estimation by recreational users. The individual states may utilize additional methods for estimating the value associated with an individual fish for the purpose of damage assessment, such as utilizing existing market prices for commercially important species and estimated hourly valuations for recreationally important species. The American Fisheries Society (1982, 1992) has estimated replacement values for certain species (primarily freshwater) and provides the methods for determining these values. State civil restitution values may be linked directly with these published estimates and methods.

The restitution values vary considerably by state. The values for spotted seatrout in Texas and Louisiana are a function of size (Table 7.7). For example, values for spotted seatrout in Louisiana range from $0.42, $14.99, to $94.63 each for a 1-inch, 16-inch, and a 32-inch fish, respectively (LDWF 1989). Values for the same sizes of spotted seatrout in Texas are $0.12, $50.51, and $144.41, respectively (TPWD 1997b). In Florida, a fixed value ($23.50) is assessed for all sizes of spotted seatrout (FDEP 1995). These values provide at least some means for assessing the damage to stocks of spotted seatrout.

Table 7.7. Civil restitution values for spotted seatrout by size of fish (TPWD 1997b, LDWF 1989). NA indicates values not available.

Size (inches)	Texas	Louisiana
1	$ 0.12	$0.42
2	0.27	0.74
3	0.42	1.13
4	0.55	1.64
5	0.69	1.88
6	5.24	2.20
7	9.74	2.93
8	14.23	3.66
9	18.73	4.38
10	23.23	5.11
11	27.73	5.84
12	32.23	6.67
13	36.05	7.30

Size (inches)	Texas	Louisiana
14	40.80	9.28
15	45.62	11.80
16	50.51	14.99
17	55.50	19.03
18	60.57	24.14
19	65.74	30.63
20	71.02	38.86
21	76.40	49.30
22	81.90	52.54
23	87.51	55.59
24	93.25	68.68
25	99.13	71.80
26	105.14	74.96
27	111.29	78.13
28	117.59	81.36
29	124.05	84.61
30	130.67	87.91
31	137.45	91.25
32	144.41	94.63
33	151.54	NA
34	158.86	NA
35	166.37	NA
36	174.08	NA

8.0 SOCIAL AND CULTURAL FRAMEWORK OF DOMESTIC FISHERMEN AND AND THEIR COMMUNITIES

8.1 Social and Cultural Framework for Spotted Seatrout Commercial Fisheries

8.1.1 Gill Net Harvesters

The gill net sector contributed much less to the overall spotted seatrout landings in the Gulf over the last five years due to sweeping regulations on gill nets Gulf-wide. Entanglement nets are still used in Alabama and Mississippi, but gamefish status in Alabama and material requirements have further reduced their contribution to the Gulf spotted seatrout landings. In 1986, entanglement nets (various gillnets, trammel nets, and unclassified entangling nets) contributed 2.9 million lbs of spotted seatrout, about 88% of the total Gulf commercial landings (NMFS unpublished data). Much of the commercial harvest in Louisiana prior to March 1997 was from gill (strike) net landings. That gear was outlawed at that time, and legal harvest since then has been confined to commercial rod and reel gear. Although this entanglement net sector has been greatly reduced in the Gulf, it has historically been a significant contributor to the total commercial harvest, thereby justifying its characterization.

A report by Wagner et al. (1990) provides insight into the Texas commercial net fishery as it existed prior to the ban of all entanglement nets in 1988. Their study surveyed all commercial saltwater finfish fisherman in Texas and estimated 160 of the roughly 400 license holders in 1985 and 1986 were gill net/trammel net fishermen (43% of respondents). Texas net fishermen averaged 74 fishing days per year and fished five nets per fisherman. Of these 160 net fishermen, about 62% indicated they participated in other fisheries in 1985 and 1986. It was estimated 71% of the net fishermen also participated in shrimping, whereas 19% participated in crabbing and 13% participated in oyster fishing.

In Louisiana, Mississippi, and Alabama, limited net fisheries still exist. The Louisiana net fishery is seasonally permitted exclusively for Florida pompano and striped mullet; the Mississippi net fishery has been greatly reduced due to 1997 restrictions on the use of monofilament nets. Never-the-less, gill net fishermen in the central Gulf of Mexico still contribute substantial numbers to the total landings for spotted seatrout, other drums, mullet, and flounder.

Considering the species spectrum which net fishermen target, it can be assumed that many individuals participating in the mullet fishery are the same individuals contributing to commercial landings of spotted seatrout in the northern Gulf (Degner et al. 1989). Therefore, a few broad generalizations can be made regarding the net fishermen in the Gulf based on information compiled in the striped mullet FMP (Leard et al. 1995) and other literature characterizing the mullet fishery. For example, in a study characterizing mullet fishermen in Florida, Thunberg et al. (1994) found most of those in the commercial mullet industry are family based and multi-generational. Based on seasons and availability, most net fishermen targeted multiple species. In Florida, most of the net fishermen surveyed never completed a high school education, and at the time of the study, most were approaching middle age. The combination of these two factors made the net fishermen surveyed reluctant to consider entering non-fishing occupations prior to the Florida net referendum (Leard et al. 1995).

8.1.2 Hook and Line Harvesters

Little or no information exists on the makeup of the commercial harvesters in the Gulf. Most of the work related to hook and line fishing lies within the recreational sector. The portion that contributes to the Gulf's overall spotted seatrout landings is limited to Florida, Mississippi, and Louisiana due to the ban on commercial sale of spotted seatrout in Alabama. In Texas, the commercial sale of native spotted seatrout is banned, although individuals can sell fish caught in areas where legal and imported under Texas import rules.

8.1.3 Dealers and Processors

Dealers and processors for spotted seatrout in the Gulf are not species specific; therefore, as before, we can briefly describe this group using information from the FMP for black drum as an informed proxy (Leard et al. 1993). It should be noted these generalizations do not address the Florida dealers and processors, because no viable market exists for black drum. Generally dealers and processors were an ethnically, monocultural group. Dyer (C. Dyer personal communication) found them to be white, middle class males between the ages of 25-55 years old who owned their businesses. Work in Texas by Osburn et al. (1990) indicates that individuals of Vietnamese, Cambodian, and Laotian descent comprised less than 9% of all licensed seafood dealers in 1985 and were concentrated adjacent to the Galveston Bay system.

8.2 Ethnic Characteristics

Ethnic profiles of the commercial spotted seatrout fishermen in the Gulf do not exist; however, some information can be gleaned from the literature on ethnicity from other fisheries such as the commercial gill net fisheries.

Vietnamese-American fishermen make up a large portion of the commercial fishing sector in the northern Gulf (Starr 1981, Osburn et al. 1990, Moberg and Thomas 1993, Durrenberger 1994). In a description of the shrimp trawl fishery in the Gulf, Starr (1981) noted several groups have been lumped into the Vietnamese category for simplicity but include individuals of Laotian and Cambodian descent. A few, broad characterizations have been made regarding Vietnamese-American fishermen in the Gulf, describing them as industrious, frugal, and hard working. As a result, they have gained an unspoken respect from many for their energy and ingenuity, although as Durrenburger (1994) points out, admiration is not always the case. Many less-successful American fishermen continue to unfairly blame the Vietnamese-American fishermen for everything from poor fishing to bad weather. Clashes occurred frequently between the two groups during the resettlement of the first Vietnamese to the coast in the mid 1970s. Most of these conflicts were due to cultural differences, language deficiencies, and misunderstanding of unwritten local fishing rules and customs (Starr 1981, Osburn et al. 1990).

Typically, southeast Asian fishermen rely on kinship ties for success. Vietnamese-American gill net fishermen, as well as crab and shrimp fishermen off the coast of Mississippi operate using family or neighbors as crew. Often, several family members will share ownership and responsibility for a vessel. Loans of money and equipment are commonly made between neighbors. Likewise, the profits resulting from these relationships are shared as well (Durrenberger 1994). In many cases, catch which is considered to have little or no value is consumed by family (Starr 1981) allowing the Vietnamese-American fishermen to operate at a lower bottom line. These close ties have contributed greatly to the work ethic so often attributed to their fishing communities; nothing goes to waste so nothing is lost.

Other regions of the Gulf are made up of various ethnic groups and are frequently localized such that ethnic stratification can occur. For example, prior to the net ban and the ban on the sale of native spotted seatrout in Texas waters which eliminated the commercial fishery, the ethnic makeup of the fishing communities varied regionally. Overall, commercial fishing in the upper Laguna Madre was dominated by Anglo fishermen and a few Hispanics; lower Laguna Madre was dominated by Hispanic fishermen at nearly 90%. In Galveston Bay (upper coast) and in the middle coast, transgenerational Anglos and Asians still occupy the black drum trotline fishery (P. Campbell and L. Robinson personal communication).

Many of the Vietnamese fishermen who settled in the panhandle of Florida first entered the Gulf fishery as gill net fishermen (Starr 1981). In 1978, recently immigrated Vietnamese net boats made up ⅛ of the gill net fleet in Pensacola Bay. Concern was raised, however, by the American net fishermen over the use of nontraditional lengths of net, failure to properly mark nets, and longer duration of net sets practiced by new Vietnamese fishermen. Through legislation and regulations, the immigrants were forced to comply with local standards (Starr 1981). The new constraints and regulations directed at the Vietnamese immigrants eventually forced them into the shrimp fishery where they remain today.

8.3 Social and Cultural Framework for Spotted Seatrout Recreational Fisheries

Unlike commercial harvesters who usually live and work in coastal communities, most marine anglers usually live in urban or metropolitan statistical areas adjacent to or near the coast (USFWS 1996, Ditton and Hunt 1996). They travel to coastal communities to make use of the fishing-related infrastructure provided by government and private sector services available to them. These include facilities and services provided by state fisheries management agencies such as piers, launch ramps, and access areas as well as those provided by the private sector: guides, boat rentals, marinas, private launch facilities, retail stores, restaurants, hotels, motels, campgrounds, and the rest of the tourism support system. Many of the aforementioned elements have important interconnections at the interpersonal level, in that individuals work together at the local area to make their fishing destination more desirable than others in the region. Thus, there are communities of individuals that serve recreational anglers, just as there are commercial fishing communities that can be impacted deleteriously by certain rule-making actions. They are also an important part of spotted seatrout fishing in that little recreational fishing probably would occur without their services regardless of high quality fish stocks. They are all a part of the spotted seatrout fishery when this term is used to denote a social system that includes the fish as well as harvesters and the entire support industry whose long-term success rests with sustainable fish populations.

In addition to coastal communities of individuals working in support of recreational fisheries, anglers are a part of their own social world of recreational angling. A contemporary definition of a social world is "an internally recognizable constellation of actors, organizations, events, and practices which have coalesced into a perceived sphere of interest and involvement for participants"

(Unruh 1979). This definition would include anglers, groups of anglers or groups that represent anglers, tournaments and their participants, and various fishing practices used by different anglers. Clearly, the social world of saltwater angling goes beyond licensed anglers.

Within the recreational fishing social world, there are various subworlds. One of these subworlds would include saltwater anglers who target or catch spotted seatrout. Social worlds and their subworlds are not defined by formal boundaries or membership lists and generally lack a powerful, centralized authority structure. Participants do so voluntarily, and many are involved in other social worlds (angling or otherwise). They are not exclusively spotted seatrout anglers. Individuals can identify with multiple social worlds and get their information about spotted seatrout fishing from various media including magazines, television, and radio.

Likewise, there are various subworlds within the spotted seatrout subworld. For example, there are spotted seatrout anglers who focus their activity in different ways. For example, some anglers use artificial lures while others use live bait. Likewise, there are spotted seatrout anglers that make use of emerging technologies to fish in particular locations using particular gear such as fly rods. There are spotted seatrout subworlds based on ideology as well where anglers practice catch and release and have the requisite skills while others keep all legal fish caught. What is important here is the diversity of anglers and their experiences within the spotted seatrout fishing social world (Ditton et al. 1992). Hopefully, this will put survey results regarding fishing practices used in better perspective. Anglers are in constant flux within the social world and involving themselves with various other subgroups of anglers based on where they fish, what they fish for, how they fish, the importance of technology to them, and their orientation toward fishing and conservation issues. Not every angler moves at the same pace within the spotted seatrout fishing subworld; there is no average spotted seatrout angler (Schafer 1969).

Anglers vary in terms of their social proximity to knowledge about the social world and the activities therein. Unruh (1979) described four subworlds (strangers, tourists, regulars, and insiders) along a theoretical dimension having four characteristics (orientation, experience, relationships, and commitment). For example, strangers are naive in orientation; most of their fishing experiences are disoriented, their relationships within their fishing groups are rather superficial, and they are detached in terms of their commitment toward fishing. Insiders, on the other hand, identify with their fishing activity, find ways to create new fishing experiences, maintain close and intimate relationships with their fishing groups, and are so committed that they recruit new people to recreational fishing. There is no evidence to suggest that this process is linear or inevitable; in other words, not all strangers will become insiders.

8.4 Basic Understandings and Information Needs

To understand potential impacts of fisheries management and related rule making, it becomes necessary for fisheries managers to have a basic understanding of these systems in order to involve all relevant parties in fisheries decision making, as well as understand potential social impacts associated with new or changing rules. Most Gulf States are able to identify recreational fishing guides who operate in state waters through licensing records. Lists of guides by state need to be maintained on a regular basis so they can be queried as to their interests in particular decisions. Other elements of the private sector support-structure are more general in their support of coastal tourism and are more difficult to monitor on a regular basis. Managers should understand these businesses have a legitimate stake in fisheries management decisions – their livelihoods are impacted by implemented rules.

The limited extent of angler surveys currently available that focus on spotted seatrout anglers specifically provide little insight into this recreational fishery and the various subworlds within. There is an important social and cultural framework for understanding the spotted seatrout fishery and the diversity of anglers and experiences found therein, but current studies focus only on documenting the extent of spotted seatrout anglers and their activity as well as their catch and effort. Elements of the social and cultural framework need to be viewed as high priority items for data collection and important to management efforts as a means of understanding and dealing with the diversity found in spotted seatrout angling.

8.5 Organizations Associated with the Fishery

8.5.1 National

National Coalition for Marine Conservation
Ken Hinman
3 West Market Street
Leesburg, VA 22075

National Fisheries Institute
Lee J. Weddig
1525 Wilson Boulevard, Suite 500
Arlington, VA 22209

American Sportfishing Association
Mike Hayden
1033 North Fairfax Street
Suite 200
Alexandria, VA 22314

Coastal Conservation Association (CCA)
Walter Fondren, Chairman
4801 Woodway, Suite 220W
Houston, TX 77056

8.5.2 Regional

Gulf and South Atlantic Fishery Development Foundation
Judy L. Jamison
Lincoln Center, Suite 997
5401 West Kennedy Boulevard
Tampa, FL 33609

Southeastern Fisheries Association
Robert Jones
312 East Georgia Street
Tallahassee, FL 32301

8.5.3 Local (State)

The following organizations are concerned with finfish-related legislation and regulations, and they are consequently interested in their effects on spotted seatrout.

8.5.3.1 Florida

Coastal Conservation Association
Dave Lear
905 East Park Avenue
Tallahassee, FL 32301-2646

Florida Department of Agriculture and Consumer Services
Bureau of Seafood and Aquaculture
Charles Thomas
2051 East Dirac
Tallahassee, FL 32310

Florida League of Anglers
534 North Yachtsman
Sanibel, FL 33957

Organized Fishermen of Florida
Jerry Sansom, Executive Director
P.O. Box 740
Melbourne, FL 32901

Seafood Consumers and Producers Association, Inc.
Tom Murray
P.O. Box 25954
Tampa, FL 33622-5954

8.5.3.2 Alabama

Coastal Conservation Association
David Dexter
P.O. Box 16987
Mobile, AL 36616

Alabama Seafood Association
Pete Barber
P.O. Box 357
Bayou La Batre, AL 36509

8.5.3.3 Mississippi

Coastal Conservation Association
Ray Lenaz
P.O. Box 4434
Biloxi, MS 39535-4434

Gulf Coast Seafood Producers and Consumers Association
Tommy Bordage
11 Chantilly Terrace
Bay St. Louis, MS 39520

Mississippi Charterboat Association
Jim Twigg
3209 Magnolia Lane
Ocean Springs, MS 39564

Mississippi Gulf Coast Fishermen's Association
Eley Ross
176 Rosetti Street
Biloxi, MS 39530

Mississippi Gulf Fishing Banks
Paul Kensler
P.O. Box 223
Biloxi, MS 39533

Pass Christian Commercial Fishermen's Association
P.O. Box 324
Pass Christian, MS 39571-0324

Save America's Seafood Industry Coalition
Jean Williams
P.O. Box 2275
Pascagoula, MS 39569-2275

United Fisheries Cooperative
Earl Fayard
400 Front Beach Drive
Ocean Springs, MS 39564

8.5.3.4 Louisiana

Concerned Citizens and Fishermen's Association
Mr. Tyrone Edwards
P.O. Box 63
Davant, LA 70046

Concerned Finfishermen of Louisiana and Louisiana Fishermen for Fair Laws
Henry Truelove
P.O. Box 292
Charenton, LA 70523

Coastal Conservation Association - Louisiana
Jeff Angers, Executive Director
P.O. Box 373
Baton Rouge, LA 70821-0373

Louisiana Association of Coastal Anglers
Susan Vuillemot
P.O. Box 80371
Baton Rouge, LA 70818

Louisiana Coastal Fishermen's Association
Terry Pizani
P.O. Box 420
Grand Isle, LA 70354

Louisiana League of Anglers
Will Scheffler, President
P.O. Box 1848
Marrero, LA 70073

Louisiana Seafood Processors Council
Mike Voisin
P.O. Box 3916
Houma, LA 70361-3916

Louisiana Seafood Promotion and Marketing Board
Catherine Blades
P.O. Box 70648
New Orleans, LA 70172

Louisiana Wildlife Federation
Randy Lanctot, Executive Director
P.O. Box 65239
Baton Rouge, LA 70896-5239

Organization of Louisiana Fishermen
L.J. Brunet
P.O. Box 220
Galliano, LA 70354

8.5.3.5 Texas

Coastal Conservation Association
Kevin Daniels, Director
4801 Woodway, Suite 220W
Houston, TX 77056-1805

Tournament Directors Foundation of Texas (TDF of TX)
Pam Basco
P.O. Box 75231
Houston, TX 77034

Sportsmen Conservationists of Texas
Alan Allen, Director
807 Brazos Street
Suite 311
Austin, TX 78701

9.0 MANAGEMENT CONSIDERATIONS

9.1 Definition of the Fishery

The fishery includes harvesting activities for spotted seatrout in the United States Gulf of Mexico.

9.2 Management Unit

Although early genetic studies demonstrated that spotted seatrout in the United States Gulf of Mexico were a single stock with some degree of population substructuring (Ramsey and Wakeman 1987, King and Pate 1992), recent analysis of mitochondrial DNA haplotypes (Gold and Richardson 1998, Gold et al. 1999) confirm the presence of significant population substructuring across Gulf spotted seatrout populations. This most recent study states that:

> "current management of spotted seatrout as a single stock within the borders of most Gulf coast states may not be warranted,"

suggesting that varied local or regional management may effectively provide regulations that fit local needs or desires within acceptable biological parameters without impacting all subpopulations. This statement is qualified, however. It indicates that the greatest genetic differences in spotted seatrout populations coincide with the greatest geographic separation of those populations (J. Gold personal communication). At this time, boundaries for the genetic divergence of spotted seatrout populations have not been determined, but a conservative estimate may be as much as 1,000 km (J. Gold personal communication). Therefore, regulations designed for specific sub-populations are not likely to directly affect distant subpopulations.

9.3 Stock Assessment and Status of the Stock

Stock assessments conducted by member states have estimated recent transitional SPR (Gulf of Mexico SPR Management Strategy Committee 1996) higher than 20% in the Gulf States, except Mississippi. However, evaluating the status of the spotted seatrout stock Gulf-wide is problematic, because different states have different conservation standards. For example, Louisiana has adopted a SPR value of 18% as their conservation standard. Their SPR in 1996 was 21.6%, therefore, they do not consider their population to be overfished; however, Florida's management objective is a transitional SPR value of 35%, and they consider their spotted seatrout overfished (transitional SPR values of 22% in the Northwest region and 25% in the Southwest region). Individual state agencies (Section 5.2) should be contacted for copies of the most current stock assessment information.

9.3.1 Texas

The basis of this summary was Fisher (1996). The status of spotted seatrout in Texas was evaluated with sequential population analyses of catch-at-age data from 1984 through 1994 on a May-April fishing year basis. The assessment focused on this period because Texas prohibited the sale of spotted seatrout in 1981, and managers raised the minimum size to 14 inches and lowered the recreational bag limit to ten fish in 1984. Assessments were developed for males and females separately because of the sexual dimorphic growth.

Fishery-dependent personnel conduct creel surveys of boat anglers annually to estimate recreational landings and to measure anglers' catches. Sexes were assigned to the landings using logistic regressions of the proportion of females by total length.

Numbers of fish by sex, total length, and year were assigned ages using sex specific age-length keys that were applied to all years. The numbers of fish harvested did not include release mortality. The numbers of fish were aggregated by region, sex, and year into catch-at-age tables for sequential population analyses. The ages considered in the analyses were 0-9. As with the other assessments, the natural mortality rate was 0.30 per year based upon longevity and earlier work on spotted seatrout. Population sizes and instantaneous fishing mortality rates were calculated with the ADAPT framework (Gavaris 1988). Catch rates of age-1+ fish from fishery independent gill net sets were used to tune the analyses. The status of the stock was determined by comparing the observed fishing mortality rates to benchmarks such as F_{MAX} and $F_{0.1}$. Transitional SPR values were calculated from the estimated total mortality rates (natural + fishing), proportion mature as a function of age from a logistic equation, and observed average weights by age.

In Texas, total landings of females ranged from a high of 956,000 fish landed in 1987-1988 to 268,000 fish in 1990-1991, and males ranged from 480,000 fish in 1986-1987 to 125,000 fish in 1990-1991. In 1994-1995, the landings were comprised of 700,000 females and 303,000 males. Of the fish harvested in 1994-1995, 70% were female. Low landings in 1990-1991 were attributed to mortalities associated with a severe cold spell in December 1989-January 1990. The average, instantaneous fishing mortality rate for female fish in 1994-1995 for all ages weighted by catch was 0.29 per year which is less than F_{MAX} (0.35 per year) but higher than $F_{0.1}$ (0.22 per year). Fishing mortality rates for male seatrout were lower at 0.12 per year. The transitional SPR for females was 37% in 1994-1995 which, if sustained until all age classes were rebuilt, is expected to rise to 41% (static SPR).

9.3.2. Louisiana

The basis of this summary came from Louisiana's draft, 1996 stock assessment and the 1997 update (LDWF 1996). The status of spotted seatrout in Louisiana also was evaluated with sequential population analyses of catch-at-age from 1980 through 1996 on a calendar year basis. A recreational minimum size was implemented in 1987, and the daily bag limit was lowered from 50 to 25 fish in 1988. The commercial minimum size was increased in 1984 from ten inches to 12 inches and again in 1987 to 14 inches.

The MRFSS estimates annual recreational catch and harvest, and samplers measure fish during interviews. After the commercial minimum size was increased in 1987 to 14 inches, Louisiana's recreational harvest remained stable and ranged from six to eight million lbs annually. Low landings in 1990 were attributed to mortalities experienced during a severe cold spell in December 1989. Commercial landings were extracted from NMFS's general canvass, and sizes of fish landed commercially came from Louisiana's commercial fishery survey. After 1987, Louisiana's commercial landings declined from 1.8 million lbs to 0.5 million lbs in 1997. Annual commercial landings recorded in lbs were converted to numbers of fish by size, and these were assigned sexes using a logistic regression. Age-length keys were unavailable, and von Bertalanffy growth equations for spotted seatrout by sex developed by Weiting (1989) were used to assign ages to the sex-specific catches-at-length.

Pauly's (1980) equation produced natural mortality estimates of 0.36 per year for males and 0.42 per year for females; however, the analyses used a value of 0.30 per year so as to not underestimate the effects of fishing. Fishing mortality rates and population sizes were derived from sequential population analyses that were not tuned. Spotted seatrout in Louisiana were found not to be over fished, because the transitional SPR was 21.6% in 1996 and the static SPR was 21.7%; both values exceed Louisiana's conservation standard of 18% SPR.

9.3.3. Mississippi

Available information for stock assessment of spotted seatrout in Mississippi includes commercial landings up to 1996, commercial landings length frequencies from 1984 through 1992, recreational landings from 1981 through 1996, recreational length frequencies from 1981 through 1996 although only a few fish were measured in some years, ageing using otoliths, size-specific sex ratios, and length-weight relationships. There is no commercial effort information such as catch per set, catch per day, etc.

Recreational landings have ranged from an estimated 36,000 fish in 1984 to 468,000 fish in 1986. Similarly, commercial landings have ranged from 30,000 lbs in 1990 to 78,000 lbs in 1989, these landings are equivalent to 20,000 fish and 47,000 fish. Commercial landings in pounds were converted to numbers of fish by length category (inch) using the length frequencies and average weight per length category.

Sexes were assigned to the numbers of fish with the size-specific sex ratios from fishery-independent sampling. Fork lengths were converted to total lengths with equations developed for the Florida Panhandle. The numbers of fish by length category and sex were assigned ages with the appropriate age-length key. As with the analyses from Texas, there was only a single age-length key available per sex at this time. Ages considered in the analyses were 0-5+ for females and 0-7+ for males. Fishing mortalities and population sizes by sex were estimated with a tunable, separable virtual population analyses (Integrated Catch at Age Analysis, version 1.4). The analyses used a natural mortality rate of 0.3 per year and was tuned with the recreational total number of fish per trip adjusted for geographic location, month, number of anglers, and hours fished with a general linear model. Fishing mortality rates for females have declined from a peak of 2.28 per year in 1989 to 1.28 per year in 1996. Males experienced lower fishing mortality rates with a value of 0.67 per year in 1996. Although fishing mortality rates have declined, the transitional SPR in 1996 was only 9%, but if this lower fishing mortality rate is maintained, the stock would be expected to attain a SPR of 16% (static SPR). Managers in Mississippi have not specified a core objective for spotted seatrout, but the 1996 fishing mortality rate was still higher than traditional fisheries benchmarks such as $F_{0.1}$ (0.30 per year with a static SPR 33%) or $F_{20\%}$ (0.92 per year).

9.3.4. Alabama

The ADCNR/MRD conducted a recreational creel survey from October 1995 through September 1997 and used those data to develop a baseline assessment. A von Bertalanffy growth equation for females was developed from sectioned otoliths and used to assign ages to the lengths. They used a catch curve (a semi-logarithmic regression of the number of fish by age on age) with age-2 through age-6 being fully recruited to estimate the instantaneous total mortality rate as 1.0 (95% confidence interval 0.61 to 1.39) per year. While they calculated a natural mortality rate from Pauly's equation of 0.32 per year, they used the same 0.30 per year in their analyses that was used by the other states. Thus, the fishing mortality rate for females was 0.70 per year. The static SPR associated with the 95% confidence interval of total mortality were 21% to 40%. They concluded from this method of assessment and uncertainties in the data that no changes in fishing regulations were necessary at this time and that Alabama's spotted seatrout fishery should continue to be monitored for any indication of increased effort or increased mortality on younger fish. The current minimum size in Alabama is 14 inches (356 mm) TL and the regulation allows for two undersized fish.

9.3.5 Florida West Coast

The basis for this summary was Muller et al. (1997). The status of spotted seatrout on Florida's West Coast was evaluated with sequential population analyses of catch-at-age data from 1986 through 1996 on a calendar year basis. The fishery for spotted seatrout in Florida is divided into four regions: Northwest (Escambia through Pasco counties), Southwest (Pinellas through Monroe counties), Southeast (Dade through Volusia counties), and Northeast (Flagler through Nassau counties). Separate stock assessments are developed for each region and for the purposes of the GSMFC, the subsequent discussion will focus on the Northwest and Southwest regions only. Separate assessments are developed for males and females because of sexual dimorphic growth (Section 3.2.2).

Catch-at-length tables were developed for the recreational and commercial sectors of the fishery. Commercial landings information was extracted from Florida's Marine Fisheries Information System commonly referred to as the trip ticket program and recreational catch and landings came from MRFSS. Recreational estimates were post-stratified into the two regions on the west coast using a program, PSTRAT, developed by MRFSS. Biostatistical samplers interview commercial fishermen, measure fish, and identify sexes of fish at fish houses and enter these data into the Trip Interview Program (TIP). The TIP data were used to convert commercial landings in pounds to numbers of fish by total length and sex. Recreational landings in numbers of fish were partitioned into total lengths using the MRFSS length measurements from the appropriate region that were converted to total length from fork length. Sex was assigned using logistic regressions of the proportion of females by total length. A release mortality rate of 8% was applied to fish that were caught by recreational anglers and released alive. Fish that were released dead were included in the landings.

Numbers of fish by sex, total length, and year were assigned ages using age-length keys. There were insufficient seatrout collected each year to develop annual age-length keys so some years were grouped producing age-length keys for 1986-1991, 1992-1994, and 1995-1996 by sex and region for a total of 12 age-length keys. The numbers of fish were aggregated by region, sex, and year into catch-at-age tables for sequential population analyses.

Natural mortality was 0.30 per year based upon longevity and earlier work on spotted seatrout. Age-specific selectivities were obtained with separable virtual population analyses assuming a terminal fishing mortality rate determined with Robson-Chapman catch curves on the 1995 numbers of fish with ages-3 or older and the assumption that selectivity on the oldest age class (age-6+) was 1.0. The elimination of entangling nets in July 1995 throughout Florida's waters and the implementation of narrower slot limits for spotted seatrout in 1996 necessitated conducting the sequential population analyses only through 1995 and then using the Baranov equation (Ricker 1975) to estimate fishing mortality rates for 1996. As with Texas's stock assessment, population sizes and instantaneous fishing mortality rates were calculated with the ADAPT framework (Gavaris 1988). The tuning indices included commercial and recreational, standardized catch rates, and a young-of-the-year fishery independent index.

The status of the stock was determined by comparing the observed fishing mortality rates to benchmarks such as $F_{MAX,}$ $F_{0.1}$ and $F_{35\%}$. Unweighted, transitional SPR were calculated from the estimated total mortality rates (natural+fishing), a logistic equation for proportion mature as a function of age, and the observed average weights by age. As per the recommendation of an outside stock assessment review panel that met in November 1994, the maximum age in the SPR calculations was 15 years.

9.3.5.1 Northwest Florida

In the Northwest region, total landings of females ranged from a high of 3,105,000 fish landed in 1988 to 735,000 fish in 1996, and males ranged from 1,730,000 fish to 241,000 fish in the same years. These reductions in harvest were in response to stricter regulations. Seventy-five percent of the 1996 harvest were female. The average, instantaneous fishing mortality rate for ages 2+ fish was 0.44 per year which is less than F_{MAX} (0.68 per year) and but higher than $F_{0.1}$ (0.27 per year). Fishing mortality rates for male seatrout were much lower at 0.05 per year. The transitional SPR was 22% in 1996 which is less than the management objective of 35%, and if the current fishing mortality rate could be sustained, the management objective would not be expected to be achieved because the static SPR value for a fishing mortality rate of 0.44 per year is projected to be only 29%.

9.3.5.2 Southwest Florida

In the Southwest region, total landings of females ranged from a high of 1,337,000 fish in 1989 to 393,000 fish in 1996, and males ranged from 885,000 fish to 143,000 fish in the same years. These reductions in harvest were in response to regulations. Of the 1996 harvest, 73% were female. The average, instantaneous fishing mortality rate for ages 2+ female fish in 1996 was 0.40 per year which is less than F_{MAX} (0.85 per year) but higher than $F_{0.1}$ (0.32 per year). Fishing mortality rates for male seatrout were lower at 0.20 per year. The transitional spawning potential ratio for females was 25% in 1996 which is less than the management objective of 35%; however, if the current fishing mortality rate could be sustained until all of the age classes had rebuilt, the management objective could be achieved because the static SPR value for a fishing mortality rate of 0.40 per year is projected to be 40%.

9.4 Problems and Perceived Problems in the Fishery

Spotted seatrout occur throughout the nearshore waters of the Gulf of Mexico; therefore, fisheries for spotted seatrout are largely conducted within state jurisdictions. Problems in spotted seatrout fisheries vary state to state. The following is a general discussion of problems, real and perceived, in Gulf spotted seatrout fisheries. State-specific problems are discussed where appropriate.

9.4.1 Inadequate Supply for all Potential User Groups and Increased Participation

Fish stocks are finite, and stocks of spotted seatrout are no exception. Unlimited take of spotted seatrout by all potential user groups would be no more possible than with other exploitable fish species. Based upon the stock assessments conducted by the member states, spotted seatrout were determined to be fully utilized or over utilized in each state, with the exception of Alabama. Recent regulations have eliminated the commercial harvest of spotted seatrout in many states; however, this reduction in catch is minor from the population perspective because recreational anglers harvest more seatrout than commercial fishermen (Tables 6.1 and 6.9).

An inadequate supply of a fish resource, whether real or perceived, may lead to political decisions that are not scientifically based to limit the take of fish. For example, recreational fishermen in Mississippi were strongly vocal in their beliefs that gill netting operations in Mississippi's coastal waters were reducing the population of spotted seatrout. This belief contributed to the severe restriction of gill netting activity in Mississippi. This is an example of the perception there was an inadequate supply for all user groups, and the resource was reallocated through management measures. The same sentiments have led to similar actions in the Gulf States.

All states report increased recreational effort toward inshore fish species, particularly spotted seatrout. For example, Louisiana recreational license sales between 1991 and 1995 increased an average of 4% per year over the last eight years. In addition to the direct result of potential increased harvest rates for spotted seatrout, increased fishing effort may have fewer obvious, indirect impacts. Launching areas and fishing grounds may become crowded with anglers, and competition for other limited resources (e.g., space, quality of experience, etc.) may intensify. The various user groups' requirements may create conflicts over access to marine fishing areas. Some recreationalists may be attempting to seek solitude; this solitude can be interfered by boat cruises, jet skis, recreational or commercial harvesters, or other user groups.

Changes in demographics suggest the potential for increased fishing pressure along the coastal areas. The majority of the population in the United States lives near the coast, and recent studies have shown that coastal populations are growing faster than other populations (Culliton et al. 1990, Cohen et al. 1997). Coastal population growth coupled with increased numbers of tourists and vacationers have increased demands on aquatic habitats and fishery resources. Over the period of 1990-2025, the projected rates of growth in the number of saltwater anglers (60%) will trail population growth (66%) but will far exceed the rate of growth among freshwater anglers (42%). Most of the change in the rate of participation in saltwater fishing in Texas from 2000 to 2025 will result from changes in population characteristics such as ageing of the population and not from population growth (Murdock et al. 1992). The increase in saltwater anglers will put additional pressure on saltwater fisheries including spotted seatrout. The proportion of minority group members participating in saltwater fishing is also expected in increase in Texas (Murdock et al. 1992). Minorities could increase to 56% of all saltwater participants by the year 2025; this is significant because previous anglers' studies have yielded results primarily for Anglo anglers. Species and management preferences, fishing motivations, and determinants of satisfaction for minority group members have not been studied previously to any great extent by any state bordering the United States Gulf of Mexico.

Different segments within the harvesting community have varied expectations of resource availability and abundance so that their perceptions of stock adequacy will also vary. Commercial harvesters typically require a higher harvest rate than recreational harvesters to achieve satisfaction. There are also a variety of expectations among recreational user groups. Nonusers of the resource also have expectations of management, including the "value of existence" of a "healthy" resource.

9.4.2 Recreational Expectations (i.e., Trophy Versus Food Fishing)

As recreational effort increases on a prized resource such as spotted seatrout, some anglers are shifting toward more conservation responsible philosophies, such as fly fishing, trophy fishing, and catch-and-release. In some cases the recreational fishery may impact other species as their effort increases. A few Texas anglers believe the recent increase in use of Atlantic croaker as a highly effective bait for large spotted seatrout may have adverse effects on spawning and recruitment in Texas. However, there is no biological evidence of adverse impacts to date.

9.4.3 Ineffective Bag and Possession Limits

Bag and possession limits are a typical method of distributing the catch between anglers and in some cases may not be entirely successful in the allocation. Texas managers report increases in guided fishing trip effort and harvest. Guides typically attempt to provide clients with limits of large individual fish and are so experienced that they often succeed. Generally, anglers fishing with guides have CPUE and landings much greater than the average angler. If many guided anglers land limits of large spotted seatrout, it is conceivable that current bag limits could be set too high. Guided fishing trips and associated high spotted seatrout landings are also causing conflicts among user groups.

9.4.4 Ineffective Size Limits

From a stock assessment perspective, states that have size provisions for undersized spotted seatrout are concerned that the regulation is being used to land fish as a regular component of the bag limit, not due to concern over release mortality. For example, Alabama allows recreational anglers to creel two undersized spotted seatrout per daily limit of ten. They report 20% of all fish seen during roving and access point angler surveys during 1995-1996 were smaller than the state's 14 inch TL minimum legal size. Mississippi had similar experience in allowing undersized harvest (Section 5.2.3.7.6). The take of small fish can have a more dramatic effect on the spawning potential of spotted seatrout than does the take of larger, older individuals. As a result, provisions allowing the legal harvest of undersized fish may undermine management efforts toward conservative harvest.

9.4.5 Restricted Public Access to Fishing Areas

In Louisiana, predominantly, conversion of wetland areas into open waters has resulted in large expanses of spotted seatrout habitat that offer limited access to fishermen. Some of these open water areas, as well as oil field access canals, have been posted and/or gated by private landowners who may legally deny access to these areas.

Other fishing areas including beach areas may have restricted access due to various concerns including private property issues, resting or nesting areas for bird colonies, endangered species concerns (e.g., manatees), etc. As these restrictions increase, crowding of the remaining available areas will be exacerbated.

9.4.6 Limited Database for Management

Data needs for improved spotted seatrout management fall into two broad categories; biological and user-oriented. More data are needed regarding age structure and harvest of spotted seatrout stocks. Because of rapid and variable growth and the large difference in growth rates between sexes of spotted seatrout, managers can be led to invalid assumptions and inappropriate regulatory actions without detailed stock and catch structure information. Additionally, it is widely agreed that year-class strength of discrete spotted seatrout populations is environment and habitat related if there are adequate numbers of spawners. In many cases, however, little site-specific data have been collected that allow managers to relate annual indices of juvenile abundance to subsequent recruitment. Improved understanding of habitat limitations and influences could allow for better management. In addition, genetic variability may influence managers' decisions. Gulf-wide identification of discrete spotted seatrout subpopulations could have far-reaching management implications.

On the user side, detailed social and economic data would help managers better understand the desires, expectations, management preferences and opinions, costs and earnings, trip expenditures, and willingness to pay by various commercial and recreational users. These data can be used to tailor the management of discrete populations of spotted seatrout. Because fishery management relies on people management, qualitative and quantitative data regarding the makeup of various user groups is as fundamental to successful management as is basic biological information for the target fish species.

For example, since resident seniors (aged 65+) and youngsters (>16 or 17) are typically exempt from licensing, managers may have difficulty quantifying fishing participation rates and maintaining contact with particular constituencies. Texas' regulation that requires persons 65 years of age or older after September 1, 1995 to purchase a license to fish; this allows managers to monitor this user group along with other licensed anglers. In Florida, pier or shore-based recreational fishing is exempt from licensing. Other exempt groups throughout the Gulf States present the same type of problem.

9.4.7 Habitat Reduction and Degradation

Gulf States report concern over loss and degradation of fishery habitats. Freshwater/saltwater balance and timing of freshwater releases top the list of habitat variables of major concern to spotted seatrout managers. Channelization and stabilization of rivers and creeks drastically alter the salinity regimes and turbidity profiles of receiving estuaries and potentially have detrimental effects on spotted seatrout spawning success and year-class strength. In addition to direct influences on spotted seatrout populations, habitat variations can alter or redistribute principal prey resources of spotted seatrout with potentially deleterious effects on spotted seatrout stocks and dependent fisheries.

For example, in states with limited coastal areas such as Alabama and Mississippi, variances in stability or loss of habitat can cripple management efforts. Alabama's managers indicate concern over the cumulative impacts of incremental human encroachment into the coastal area with concomitantly incremental (and largely unmitigated) stresses on the coastal ecosystem (Section 4.8).

9.4.8 Inconsistent Interstate Management

Inconsistent spotted seatrout regulations between neighboring states can lead to enforcement and management problems. For example, a Mississippi angler possessing both Mississippi and Louisiana licenses can file a float plan with the state of Mississippi indicating the trip will exceed 24 hours. The angler is then allowed to harvest and retain the current Louisiana bag and possession limits which is more lenient than Mississippi's. The angler can legally return to Mississippi and land fillets but cannot land fillets in Louisiana. Filleted fish cannot easily be identified, and biological data cannot be collected in the field. This scenario presents problems for all the Gulf States. Accurate estimates of harvest cannot be obtained by the states. In addition, state managers are concerned that local anglers may be exploiting seatrout at adjacent states' limits.

Texas and Louisiana have a slightly different but related problem. While fishing Sabine Lake, Sabine Pass, and the Sabine River on the Texas/Louisiana border, Texas anglers can creel a Louisiana limit (12-inch minimum TL, 25 fish per day), and land those fish in Texas, provided they do not stop to fish in Texas waters. Louisiana anglers are restricted, however, to Texas limits (15-inch minimum TL, ten fish per day) if they choose to fish in Texas waters. This inequity poses a serious enforcement problem for Texas. Consistent bag and creel limits for waters fishable by the anglers of adjacent states would alleviate both problems.

9.5 Fishery Information Network (FIN) Activities

The Gulf of Mexico coastal states and Caribbean territories (Texas, Louisiana, Mississippi, Alabama, Florida, Puerto Rico and United States Virgin Islands), the NMFS, the USFWS, the NPS, the Gulf of Mexico and Caribbean Fishery Management Councils, and the GSMFC have initiated a state-federal cooperative program to collect, manage, and disseminate statistical data and information on the marine commercial and recreational fisheries of the Southeast Region called the Fisheries Information Network (FIN). The goals of the program are to plan, manage, and evaluate commercial and recreational fishery data collection activities; to implement a marine commercial and recreational fishery data collection program; to establish and maintain a commercial and recreational fishery data management system; and to support the establishment of a national data collection and management program.

Currently, through this program, the GSMFC, the Gulf States, and the NMFS have begun and will continue to conduct activities to improve the quantity and quality data available for fisheries management. The data collection and management activities conducted under the FIN are designed to collect data for the various modules outlined in Figures 9.1a and 9.1b.

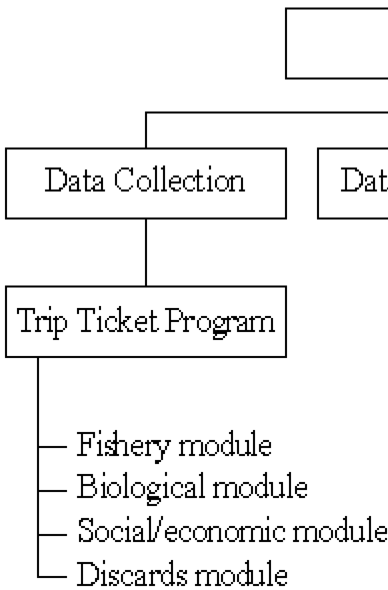

Figure 9.1a. Commercial Fishery Information Network (ComFIN) structure and modules.

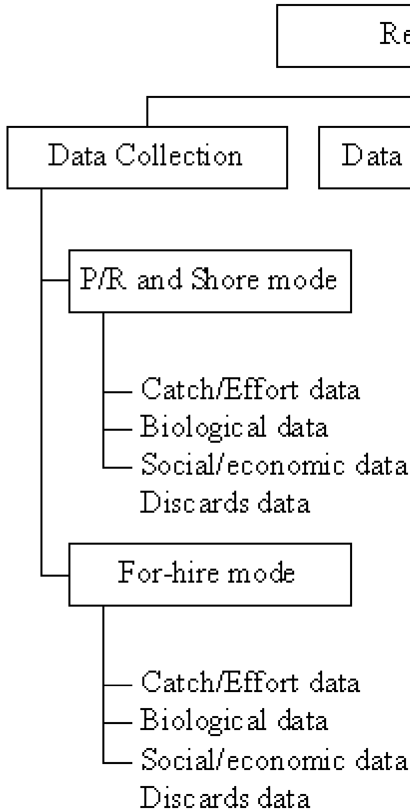

Figure 9.1b. Recreational Fishery Information Network (RecFIN) structure and modules.

10.0 MANAGEMENT RECOMMENDATIONS

The ultimate goal of any FMP is to achieve sustainability through consistent management of a species across its entire range. While this goal is worthy, consistent regulations or management strategies are not always feasible or practical for a species. The biology, distribution, and behavior of spotted seatrout throughout the Gulf suggest that distinct differences exist regionally when one examines localized population. Genetics studies have provided further evidence to confirm population substructuring on a large geographic scale (Section 3.2.3.1). Early genetic studies suggested that spotted seatrout in the Gulf of Mexico were a single stock (Ramsey and Wakeman 1987, King and Pate 1992). Recent advances using mitochondrial DNA challenge those studies (Gold and Richardson 1998, Gold et al. 1999). Gold et al. (1999) suggest that a Gulf-wide, single stock perspective may not be appropriate for the management of spotted seatrout. Instead, varied local and/or regional management may effectively provide regulations that fit sub-regional needs or desires within acceptable biological parameters to meet established conservation standards. Even though the results of these studies preclude standardized, Gulf-wide regulations for spotted seatrout, there are still opportunities for increased cooperation and uniformity in management among the states.

Conservation standards are intended to protect the viability of a fish stock for future generations. These standards have historically been based on a number of biological measures of the dynamics of fish stocks, depending on the availability and adequacy of data. Conservation standards should be separated into two types: a *conservation threshold* which is entirely biologically based and a *conservation target* which considers biological measures modified by relevant social, economic, and ecological factors. A conservation threshold is a biological baseline for the harvest of a fish stock that should not be exceeded. It is the highest level of fishing mortality that will ensure that recruitment overfishing will not occur. Beyond the conservation threshold, a conservation target may be set which provides for other management goals in the fishery. Such goals may include maximizing yield in weight or numbers of fish, economic benefits or profit, employment, or some other measurable goal. These targets should be set at a fishing mortality rate below that of the conservation threshold in order to ensure that the biological integrity of the stock is not damaged by fishing.

Due to inadequacies of data used in stock assessments for spotted seatrout as previously described (Section 9.4.6), caution should be used when applying conclusions from the assessments for management recommendations on a Gulf-wide basis. Individual stock assessments have estimated recent transitional SPR higher than 20% in the Gulf States except Mississippi (Section 9.3). However, evaluating the status of the spotted seatrout stock Gulf-wide is problematic because different states have different conservation standards. For example, Louisiana has adopted a SPR value of 18% as their conservation standard and consider their subpopulation not over fished, because Louisiana's spawning potential ratio (SPR) in 1996 was 21.6%. Florida, on the other hand, considers their spotted seatrout subpopulations to be over fished (transitional SPR values of 22% in the Northwest region and 25% in the Southwest region), according to the most recent stock assessment available, because their management objective is a transitional SPR value of 35%. Florida's conservation standard was chosen in an effort to increase both the number of large, older fish in the spawning stock and angler satisfaction. To achieve these ends, Florida is successfully rebuilding its stocks through a minimum and maximum allowable size limit and a five fish per day bag limit.

Texas does not use a "conservation threshold" associated with any one stock measure to guide management of the spotted seatrout fishery. Rather, a broad-based, more holistic approach is used. Management objectives are: 1) to allow fish to spawn at least once before entering the fishery, 2) to prevent growth overfishing, and 3) to provide for a quality and/or trophy fishery. Long-term fishery and fishery independent programs are in place to monitor the fishery to meet these objectives. Harvest estimates, relative abundance indices, and recruitment indices are all maintained. These indices are coupled with stock assessments, and other relevant population dynamics information such as age, growth, and genetic characteristics. Information regarding fishery participants is also included in any decision making relative to the management regime of the fishery. Incorporation of all these factors in management assessments allows the TPWD to identify options that meet the three management objectives.

It is recommended that the states review existing regulations and assess their ability to maintain an acceptable conservation standard appropriate for spotted seatrout. Any state that has not established a quantifiable conservation standard should do so. In the event that data are insufficient to establish a conservation standard and/or monitor the standard, states should enhance data collection through existing programs or implement new programs to acquire necessary data. In addition, states should not use inadequacies of the data to delay implementing more stringent regulations, if necessary. Current stock assessments show that spotted seatrout stocks are rebuilding (Section 9.3); however, from a Gulf-wide perspective, they are marginally healthy. In most states, fishing mortality rates are above F_{MAX}. In keeping with the growing evidence of substructuring in spotted seatrout populations, localized differences in fishing effort by recreational and commercial fishermen should not affect adjacent subpopulations. Therefore, states should consider modifications to regulations including but not limited to size limits, bag limits, and quotas to effectively manage the fishery for the greatest benefit to the users. The following additional management recommendations are made:

10.1 Fishing Year

Individual states could establish compatible/uniform fishing years to facilitate data collection, quota management, and for other purposes. Fishing years should be consistent among states to the greatest extent possible.

10.2 Harvest Limitations

It is recommended that the states continue to monitor stocks and revise stock assessments when appropriate to address any future problems or potential problems from fishing effort. Should a state's conservation standard not be met, harvest limitations could be established based on relevant biological, social, and economic factors. These limitations could include quotas, daily bag and possession limits, size limits, trip limits, etc. Quota systems, however, are only effective when reporting systems are in place to accurately track catch. Communication among the states is vital to monitor quotas.

States should evaluate the need for managing effort (i.e., limited access or entry) to the spotted seatrout fisheries and review the various forms of effort management and the procedures for their implementation.

10.2.1 Commercial Limitations

10.2.1.1 Allowable Biological Catch and Total Allowable Catch

Based on the current Gulf-wide knowledge of spotted seatrout stocks, neither an allowable biological catch (ABC) nor a TAC is recommended at this time for the spotted seatrout fishery of the United States Gulf of Mexico.

10.2.1.2 Size Restrictions

The states should review all regulations related to the legal harvest of undersized fish. Although the Gulf States have established minimum and/or maximum size limits for spotted seatrout, not all have implemented a zero tolerance for undersized fish. As discussed in Section 9.4.4, provisions for the legal harvest of undersized fish may undermine management efforts toward conservation harvest.

In addition, a uniform size criteria within and among states would increase the enforceability of such regulations, especially with regard to interstate transport of catch. States should work cooperatively to implement consistent commercial size restrictions where appropriate.

10.2.2 Recreational Limitations

10.2.2.1 Bag and Possession Limits

States should assess the present level of fishing pressure on spotted seatrout stocks to determine what bag or possession limits are appropriate. The states should continue to monitor this fishery. If future stock assessments indicate the need for more restricted harvests, the recreational fishery should be restricted to a per-person bag and/or possession limit while on the water or at any point of landing or dockage. Such bag and possession limit systems attempt to extend fishing over an entire fishing year and to provide more equitable fishing opportunities for more fishermen and anglers while maintaining adequate spawning stock.

10.2.2.2 Size Restrictions

Presently all states have recreational size limits for spotted seatrout (Section 5). States should continue to evaluate the level of fishing pressure on spotted seatrout stocks to determine if current size restrictions are appropriate. As discussed in Section 9.4.4, provisions for the legal harvest of undersized fish may undermine management efforts toward conservation harvest.

In addition, a uniform size limit within and among states would increase the enforceability of such regulations especially with regard to interstate transport of catch. States should work cooperatively to implement consistent recreational size restrictions where appropriate.

10.2.3 Sale and Landing

It is recommended that recreationally-caught fish not be sold. It is further recommended that both commercially and recreationally caught spotted seatrout be maintained whole (heads, tails, and flesh attached) during all fishing activities up to and including the point of landing. These provisions are recommended to enhance enforcement of size and bag restrictions, species identification, and data collection purposes.

10.3 Gear Regulations

All states currently have regulations regarding directed gear used to harvest spotted seatrout (Section 5.2). In addition, states should evaluate the impacts including, but not limited to, bycatch of other species and enact appropriate regulations to prevent unacceptable mortalities, and develop more uniform gear-use regulations to aid interstate enforcement. Bycatch reduction methods should be further studied to determine the value of these devices in protecting juvenile and sub-adult spotted seatrout (Section 6.3).

10.4 Area and Seasonal Closures

States should consider area or seasonal closures if stock assessments or life history information indicate a need for such measures. Prohibiting harvest of spotted seatrout from certain areas and during certain seasons as well as certain times (i.e., at night) could help regulate harvest and maintain adequate spawning stocks.

10.5 Monitoring Programs

States should continue to monitor the commercial and recreational spotted seatrout fisheries through fishery-dependent sampling and reporting as well as fishery-independent sampling of the spotted seatrout population. States should evaluate the adequacy of existing programs to meet management needs and expand those programs to meet additional data needs.

10.5.1 Fishery-Independent Monitoring

States should evaluate and compare existing programs to investigate the feasibility of standardization of sampling protocols among states where feasible. Most of the state fishery-independent monitoring programs utilize a variety of gear types at sampling sites or stations. As a result of this diversity, stock assessors must spend considerable time and effort reformatting each state's data to account for differences in gear type and size, gear tow time and/or soak time, number of samples, number of stations, etc. Standardization of these programs would facilitate comparison of data among states resulting in a more regional approach to fishery-independent monitoring.

10.5.2 Fishery-Dependent Monitoring

10.5.2.1 Catch Data

States should increase efforts to collect data on catch of spotted seatrout. The Cooperative Statistics Program, the FIN programs, and the Texas survey have been the primary programs used by states to gather data on harvest of spotted seatrout. States should work in conjunction with these programs to expand data collection efforts and establish uniform collection programs to specifically identify spotted seatrout as a target species. States should review existing requirements for reporting of data by harvesters, dealers, processors, and others. Where such reporting is determined to be inadequate, modifications to laws, regulations, and policies could be sought to improve the quantity and quality of data received. States should review the effectiveness of reporting and reporting forms. This should be done to ensure more accurate and precise data while not being too cumbersome.

10.5.2.2 Effort Data

States should increase efforts to gather information on the effort expended by both commercial and recreational fishermen toward catching spotted seatrout. Commercial fishermen targeting spotted seatrout could be more specifically identified to monitor their effort. This could be accomplished by increased monitoring of individual effort through an expanded statistics collection program that would include more individual trip information such as Florida has been collecting since 1986 or by special spotted seatrout permits such as those required in Louisiana. Recreational effort could also be more accurately determined through complete recreational licensing and by expanded creel surveys. States should review existing programs and procedures for collecting recreational effort data and implement changes where needed.

10.5.2.3 Socio-Economic Data

States should enhance efforts to collect recreational expenditure and commercial exvessel/wholesale price data. This information is needed to evaluate the economic costs and benefits of alternative allocation schemes and access limitation. This information could be generated through ongoing data collection programs such as the MRFSS, the FIN program (Sections 9.5 and 10.7), the Texas Survey, the Gulf-wide Trip Ticket Program, or additional fishermen surveys. Periodic collection of production cost data would allow for an assessment of harvest sector rents. This information would better allow the determination of changes in economic costs and benefits resulting from changes in harvest quotas, bag limits, size restrictions, etc.

In addition, states should quantify the volume and value of imports and exports of spotted seatrout. Data should describe monthly trade by product form (i.e., whole, fillets, fresh, frozen), country of origin (and destination), volume, and value.

10.5.3 Habitat Monitoring

States should develop more specific programs to monitor changes to estuarine and marine fisheries habitat through review of coastal development proposals. Appropriate action could then be taken to support projects that would restore, create, or enhance critical habitat and stop those that would further degrade estuarine habitats.

In addition, states could pursue development of a habitat management program including habitat that is critical for spotted seatrout. This program might include multi-agency involvement at the state and federal level. Many habitat protection efforts are ongoing; however, a more focused and coordinated effort directed at marine fisheries habitat could provide increased protection and production in a shorter period of time.

10.6 Management Programs

States should review management programs to determine if they are accomplishing specific objectives or addressing identified problems. They should also attempt to utilize management measures that address such needs with the least adverse impacts to users.

10.7 Fishery Information Network

The states should pursue full implementation of the FIN (Section 9.5) which will meet the monitoring and reporting requirements of this FMP. A transition or phased-in approach should be adopted to allow for full implementation of the FIN. Until such time as the FIN is implemented, the states should initiate implementation of specific FIN modules, and/or pursue pilot and evaluation studies to assist in development of reporting programs to meet the FIN standards. The complete FIN Program Design document is available through the GSMFC office.

10.8 Stock Enhancement

Each state could evaluate whether enhancement through stocking efforts following catastrophic events or heavy fishing mortality is appropriate and/or cost effective for their state.

10.9 Habitat Loss, Degradation, and Alteration

States should support those programs that identify, conserve, preserve, and/or restore essential spotted seatrout habitat and assess and discourage projects which negatively alter spotted seatrout habitat or impede access by spotted seatrout to essential habitats. States could close areas where harvest practices damage habitat. States should determine if habitat quality, quantity, or availability is a limiting factor for spotted seatrout survival and recruitment. The establishment of reserves could be used to preserve critical habitat for the various life history stages of spotted seatrout.

States should evaluate methods and opportunities to restore, create, or enhance critical spotted seatrout habitat. In circumstances where the creation or enhancement of existing habitat may be a mitigation option, managers should consider ways to create or enhance seatrout habitat, as in creating wetlands and nursery area. States should continue to investigate the effects of in- and near-shore, low profile artificial reefs on spotted seatrout populations.

States should support efforts to examine and reduce the impacts of pollution from urban and agricultural runoff and industrial discharges in coastal areas which remains largely unquantified.

10.10 Educational Measures to Support Management

States should increase educational programs to help harvesters and nonconsumptive users understand their individual and collective impacts on fishery resources. Previous work by Kelso et al. (1991) indicates there is strong support by anglers for additional programs and materials dealing with fish identification, catch and release skills, and angler based tagging programs. Increased effort should be directed toward educating anglers in the importance of participating in voluntary intercept and telephone surveys.

Suggested educational programs should emphasize conservation ethics, fishing ethics, and an awareness of the importance of habitat and water quality. In addition, programs could be established to educate home and property owners new to coastal areas to avoid excessive nutrient runoff (i.e., lawn services) and to appreciate the value of maintaining the natural state of coastal property, especially in wetland areas.

10.11 Fiscal Measures to Support Management

States should review the current level of management effort in conjunction with the level of funding support being received for management of spotted seatrout to determine if support is adequate to meet the needs of resource management. If funding support is determined to be inadequate, states could pursue increased license fees, inspection fees, or other support from users (legislative funding). Additionally, states could also seek support from state and federal funding sources while reviewing management needs and priorities of other species and fisheries.

11.0 RESEARCH AND DATA NEEDS

Research and data needs of the spotted seatrout fishery encompass a wide range of biological, social, economic, and environmental studies. Additional research and data collection programs are needed, and the following is a partial list of some of the more important needs.

11.1 Biological

- Collect additional age frequency data to better understand the age structure of stocks.

- Improve estimates of natural mortality and predation especially on early life stages. Ecosystem dynamics and their relation to spotted seatrout stocks should be investigated.

- Continue and expand mark/recapture studies where appropriate.

- Increase intercept studies to determine the nature and size of catches as well as effort on a state or areal basis.

- Quantify the impacts of habitat change including the effects of varying salinities (freshwater inflow and seasonality), marsh degradation, loss of seagrass beds, etc. on all spotted seatrout life history stages.

- Continue and expand genetic studies on variability of spotted seatrout across the Gulf and relate the results of those studies to the effectiveness of management actions.

11.2 Environmental

- Determine optimum environmental requirements especially on early life stages.

- Assess the effects of flooding and periods of high salinity on reproduction and survival.

- Determine how the loss of vegetated wetlands and the increase in shallow water, bottom habitat have affected spotted seatrout populations.

11.3 Industrial/Technological

- Identify existing processing and marketing activities for spotted seatrout and evaluate alternative methods.

11.4 Social and Economic

- Qualitative and quantitative information are needed to characterize user groups with particular attention to understanding their diversity, wants and needs, motivations, levels of satisfaction, and management preferences.
- Quantitative data are needed on the economic values of the commercial and recreational fisheries in support of allocation decision making.

11.5 <u>Resource Management</u>

- Evaluate existing management programs to determine their effectiveness in meeting management goals and objectives.

12.0 REVIEW AND MONITORING OF THE PLAN

12.1 Review

As needed, status of the stock, condition of the fishery and habitat, the effectiveness of management regulations, and research efforts will be reviewed. Results of this review will be presented to the S-FFMC for approval and recommendation to the GSMFC and the appropriate management authorities in the Gulf States.

12.2 Monitoring

The GSMFC, the NMFS, states, and universities should document their efforts at plan implementation and review these with the S-FFMC. The S-FFMC will also monitor each state's progress with regard to implementing recommendations in Section 10.0 on an annual basis.

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14.0 APPENDIX

14.1 Glossary

14.2 Market Channel Survey Instrument

14.1 GLOSSARY

(Modified from Roberts, K.J., J.W. Horst, J.E. Roussel, and J.A. Shepard. 1991. Defining Fisheries: A User's Glossary. Louisiana Sea Grant College Program. Louisiana State University. *as amended in* Wallace, R.K., W. Hosking, and S.T. Sxedlmayer. 1994. Fisheries Management for Fishermen: A manual for helping fishermen understand the federal management process. Auburn University Marine Extension & Research Center. Sea Grant Extension.)

*Added by Wallace et al. 1994.

A

A - See annual mortality.

ABC - See allowable biological catch.

Absolute Abundance - The total number of kind of fish in the population. This is rarely known, but usually estimated from relative abundance, although other methods may be used.

Abundance - See relative abundance and absolute abundance.

Age Frequency or Age Structure - A breakdown of the different age groups or individuals.

Allocation - Distribution of the opportunity to fish among user groups or individuals. The share a user group gets is sometimes based on historic harvest amounts.

Allowable Biological Catch (ABC) - A term used by a management agency which refers to the range of allowable catch for a species or species group. It is set each year by a scientific group created by the management agency. The agency then takes the ABC estimate and sets the annual total allowable catch (TAC).

Anadromous - Fish that migrate from saltwater to fresh water to spawn.

Angler - A person catching fish or shellfish with no intent to sell and typically represents the recreational fishermen. This includes people releasing the catch.

Annual Mortality (A) - The percentage of fish dying in one year due to both fishing and natural causes.

Aquaculture - The raising of fish or shellfish under some controls. Ponds, pens, tanks, or other containers may be used. Feed is often used. A hatchery is also aquaculture, but the fish are released before harvest size is reached.

Artisanal Fishery - Commercial fishing using traditional or small scale gear and boats.

Availability - Describes whether a certain kind of fish of a certain size can be caught by a type of gear in an area.

B

Bag Limit - The number and/or size of a species that a person can legally take in a day or trip. This may or may not be the same as a possession limit.

Benthic - Refers to animals and fish that live on or in the water bottom.

Biomass - The total weight or volume of a species in a given area.

Bycatch - The harvest of fish or shellfish other than the species for which the fishing gear was set. Examples are blue crabs caught in shrimp trawls or sharks caught on a tuna longline. Bycatch is also often called incidental catch. Some bycatch is kept for sale.

C

CPUE - See catch per unit of effort.

Catch - The total number or poundage of fish captured from an area over some period of time. This includes fish that are caught but released or discarded instead of being landed. The catch may take place in an area different from where the fish are landed. Note: Catch, harvest, and landings are different terms with different definitions.

Catch Curve - A breakdown of different age groups of fish, showing the decrease in numbers of fish caught as the fish become older and less numerous or less available. Catch curves are often used to estimate total mortality.

Catch Per Unit of Effort (CPUE) - The number of fish caught by an amount of effort. Typically, effort is a combination of gear type, gear size, and length of time gear is used. Catch per unit of effort is often used as a measurement of relative abundance for a particular fish.

Charter Boat - A boat available for hire, normally by a group of people for a short period of time. A charter boat is usually hired by anglers.

Cohort - A group of fish spawned during a given period, usually within a year.

Cohort Analysis - See virtual population analysis.

Commercial Fishery - A term related to the whole process of catching and marketing fish and shellfish for sale. *It refers to and includes fisheries resources, fishermen, and related businesses directly or indirectly involved in harvesting, processing, or sales.

Common Property Resource - A term that indicates a resource owned by the public. It can be fish in public waters, trees on public land, and the air. The government regulates the use of a common property resource to ensure its future benefits.

Compensatory Growth - An increase in growth rate shown by fish when their populations fall below certain levels. This may be caused by less competition for food and living space.

Compensatory Survival - A decrease in the rate of natural mortality (natural deaths) that some fish show when their populations fall below a certain level. This may be caused by less competition for food and living space.

Condition - A mathematical measurement of the degree of plumpness or general health of a fish or group of fish.

Confidence Interval - The probability, based on statistics, that a number will be between an upper and lower limit.

***Controlled Access** - See limited entry.

Cumulative Frequency Distribution - A chart showing the number of animals that fall into certain categories, for example, the number of fish caught that are less than one pound, less that three pounds, and more than three pounds. A cumulative frequency distribution shows the number in a category, plus the number in previous categories.

D

Demersal - Describes fish and animals that live near water bottoms. Examples are flounder and croaker.

Directed Fishery - Fishing that is directed at a certain species or group of species. This applies to both sport fishing and commercial fishing.

Disappearance (Z) - Measures the rate of decline in numbers of fish caught as fish become less numerous or less available. Disappearance is most often calculated from catch curves.

E

EEZ - See exclusive economic zone.

EIS - See environmental impact statement.

ESO - See economics and statistics office.

Economic Efficiency - In commercial fishing, the point at which the added cost of producing a unit of fish is equal to what buyers pay. Producing fewer fish bring the cost lower than what buyers are paying. Producing more fish would raise the cost higher than what buyers are paying. Harvesting at the point of economic efficiency produces the maximum economic yield. See maximum economic rent.

Economic Overfishing - A level of fish harvesting that is higher than that of economic efficiency, harvesting more fish than necessary to have maximum profits for the fishery.

Economic Rent - The total amount of profit that could be earned from a fishery owned by an individual. Individual ownership maximizes profit, but an open entry policy usually results in so many fishermen that profit higher than opportunity cost is zero. See maximum economic yield.

Economics and Statistics Office (ESO) - A unit of the National Marine Fisheries Service (NMFS) found in the regional director's office. This unit does some of the analysis required for developing fishery policy and management plans.

Effort - The amount of time and fishing power used to harvest fish. Fishing power includes gear size, boat size, and horsepower.

Electrophoresis - A method of determining the genetic differences or similarities between individual fish or groups of fish by using tissue samples.

Environmental Impact Statement (EIS) - An analysis of the expected impacts of a fisheries management plan (or some other proposed action) on the environment.

Escapement - The percentage of fish in a particular fishery that escape from an inshore habitat and move offshore, where they eventually spawn.

Euryhaline - Fish that live in a wide range of salinities.

Exvessel - Refers to activities that occur when a commercial fishing boat land or unloads a catch. For example, the price received by a captain for the catch is an exvessel price.

Exclusive Economic Zone (EEZ) - All waters from the seaward boundary of coastal states out to 200 natural miles. This was formerly called the Fishery Conservation Zone.

F

F - See fishing mortality

Fmax - The level of fishing mortality (rate of removal by fishing) that produces the greatest yield from the fishery.

FMP - See fishery management plan.

Fecundity - A measurement of the egg-producing ability of a fish. Fecundity may change with the age and size of the fish.

Fishery - All the activities involved in catching a species of fish or group of species.

Fishery Dependent Data - Data collected on a fish or fishery from sport fishermen, commercial fishermen, and seafood dealers.

Fishery Independent Data - Data collected on a fish by scientists who catch the fish themselves, rather than depending on fishermen and seafood dealers.

Fishery Management Plan (FMP) - A plan to achieve specified management goals for a fishery. It includes data, analyses, and management measures for a fishery.

Fishing Effort - See effort.

Fishing Mortality (F) - A measurement of the rate of removal of fish from a population by fishing. Fishing mortality can be reported as either annual or instantaneous. Annual mortality is the percentage of fish dying in one year. Instantaneous is the percentage of fish dying at any one time. The acceptable rates of fishing mortality may vary from species to species.

Fork Length (FL) - The length of a fish as measured from the tip of its snout to the fork in the tail.

G

GSI - See gonosomatic index.

Gonosomatic Index (GSI) - The ratio of the weight of a fish's eggs or sperm to its body weight. This is used to determine the spawning time of species of fish.

Ground fish - A species or group of fish that lives most of its life on or near the sea bottom.

Growth - Usually an individual fish's increase in length or weight with time. Also may refer to the increase in numbers of fish in a population with time.

Growth Model - A mathematical formula that describes the increase in length or weight of an individual fish with time.

Growth Overfishing - When fishing pressure on smaller fish is too heavy to allow the fishery to produce its maximum poundage. Growth overfishing, by itself, does not affect the ability of a fish population to replace itself.

H

Harvest - The total number or poundage of fish caught and kept from an area over a period of time. Note that landings, catch, and harvest are different.

Head Boat - A fishing boat that takes recreational fishermen out for a fee per person. Different from a charter boat in that people on a head boat pay individual fees as opposed to renting the boat.

I

ITQ - See individual transferable quota.

Incidental Catch - See bycatch.

Individual Transferable Quota (ITQ) - A form of limited entry that gives private property rights to fishermen by assigning a fixed share of the catch to each fishermen.

Instantaneous Mortality - See fishing mortality, natural mortality, and total mortality.

Intrinsic Rate of Increase (z) - The change in the amount of harvestable stock. It is estimated by recruitment increases plus growth minus natural mortality.

Isopleth - A method of showing data on a graph which is commonly used in determining yield-per-recruit.

J

Juvenile - A young fish or animal that has not reached sexual maturity.

L

Landings - The number or poundage of fish unloaded at a dock by commercial fishermen or brought to shore by recreational fishermen for personal use. Landings are reported at the points at which fish are brought to shore. Note that landings, catch, and harvest define different things.

Latent Species - A species of fish that has the potential to support a directed fishery.

Length Frequency - A breakdown of the different lengths of a kind of fish in a population or sample.

Length-Weight Relationship - Mathematical formula for the weight of a fish in terms of its length. When only one is known, the scientist can use this formula to determine the other.

Limited Entry - A program that changes a common property resource like fish into private property for individual fishermen. License limitation and the ITQ are two forms of limited entry.

M

M - See natural mortality.

MSY - See maximum sustainable yield.

Mariculture - The raising of marine finfish or shellfish under some controls. Ponds, pens, tanks, or other containers may be used, and feed is often used. A hatchery is also mariculture but the fish are released before harvest size is reached.

Mark-Recapture - The tagging and releasing of fish to be recaptured later in their life cycles. These studies are used to study fish movement, migration, mortality, growth, and to estimate population size.

Maximum Sustainable Yield (MSY) - The largest average catch that can be taken continuously (sustained) from a stock under average environmental conditions. This is often used as a management goal.

Mean - Another word for the average of a set of numbers. Simply add up the individual numbers and then divide by the number of items.

Meristics - A series of measurements on a fish, such as scale counts, spine counts, or fin ray counts which are used to separate different populations or races of fish.

Model - In fisheries science, a description of something that cannot be directly observed. Often a set of equations and data used to make estimates.

Morphometrics - The physical features of fish, for example, coloration. Morphometric differences are sometimes used to identify separate fish populations.

Multiplier - A number used to multiply a dollar amount to get an estimate of economic impact. It is a way of identifying impacts beyond the original expenditure. It can also be used with respect to income and employment.

N

National Standards - The Fishery Conservation and Management Act requires that a fishery management plan and its regulations meet seven standards. The seven standards were developed to identify the nation's interest in fish management.

Natural Mortality (M) - A measurement of the rate of removal of fish from a population from natural causes. Natural mortality can be reported as either annual or instantaneous. Annual mortality is the percentage of fish dying in one year. Instantaneous is the percentage of fish dying at any one time. The rates of natural mortality may vary from species to species.

O

Open Access Fishery - A fishery in which any person can participate at any time. Almost all fisheries in federal waters are open to anyone with a fishing boat.

Opportunity Cost - An amount a fisherman could earn for his time and investment in another business or occupation.

Optimum Yield (OY) - The harvest level for a species that achieves the greatest overall benefits, including economic, social, and biological considerations. Optimum yield is different from maximum sustainable yield in that MSY considers only the biology of the species. The term includes both commercial and sport yields.

Overfishing - Harvesting at a rate greater than which will meet the management goal.

P

Pelagic - Refers to fish and animals that live in the open sea, away from the sea bottom.

Population - Fish of the same species inhabiting a specified area.

Population Dynamics - The study of fish populations and how fishing mortality, growth, recruitment, and natural mortality affect them.

Possession Limit - The number and/or size of a species that a person can legally have at any one time. Refers to commercial and recreational fishermen. A possession limit generally does not apply to the wholesale market level and beyond.

Predator - A species that feeds on another species. The species being eaten is the prey.

Predator-Prey Relationship - The interaction between a species (predator) that eats another species (prey). The stage of each species' life cycle and the degree of interaction are important factors.

Prey - A species being fed upon by other species. The species eating the other is the predator.

Primary Productivity - A measurement of plant production that is the start of the food chain. Much primary productivity in marine or aquatic systems is made up of phytoplankton which are tiny one-celled algae that float freely in the water.

Pulse Fishing - Harvesting a stock of fish, then moving on to other stocks or waiting until the original stock recovers.

Q

q - See catchability coefficient.

Quota - The maximum number of fish that can be legally landed in a time period. It can apply to the total fishery or an individual fisherman's share under an ITQ system. Could also include reference to size of fish.

R

Recreational Fishery - Harvesting fish for personal use, fun, and challenge. Recreational fishing does not include sale of catch. *The term refers to and includes the fishery resources, fishermen, and businesses providing needed goods and services.

Recruit - An individual fish that has moved into a certain class, such as the spawning class or fishing-size class.

Recruitment - A measure of the number of fish that enter a class during some time period, such as the spawning class or fishing-size class.

Recruitment Overfishing - When fishing pressure is too heavy to allow a fish population to replace itself.

Regression Analysis - A statistical method to estimate any trend that might exist among important factors. An example in fisheries management is the link between catch and other factors like fishing effort and natural mortality.

Relative Abundance - An index of fish population abundance used to compare fish population from year to year. This does not measure the actual numbers of fish but shows changes in the population over time.

Rent - See economic rent.

S

s - See survival rate.

SPR - See spawning potential ratio.

SSBR - See spawning stock biomass per recruit.

Selectivity - The ability of a type of gear to catch a certain size or kind of fish, compared with its ability to catch other sizes or kinds.

Simulation - An analysis that shows the production and harvest of fish using a group of equations to represent the fishery. It can be used to predict events in the fishery if certain factors changed.

Size Distribution - A breakdown of the number of fish of various sizes in a sample or catch. The sizes can be in length or weight. This is most often shown on a chart.

Slot Limit - A limit on the size of fish that may be kept. Allows a harvester to keep fish under a minimum size and over a maximum size but not those in between the minimum and maximum. *Can also refer to size limits that allow a harvester to keep only fish that fall between a minimum and maximum size.

Social Impacts - The changes in people, families, and communities resulting from a fishery management decision.

Socioeconomics - A word used to identify the importance of factors other than biology in fishery management decisions. For example, if management results in more fishing income, it is important to know how the income is distributed between small and large boats or part-time and full-time fishermen.

Spawner-Recruit Relationship - The concept that the number of young fish (recruits) entering a population is related to the number of parent fish (spawners).

Spawning Potential Ratio (SPR) - *The number of eggs that could be produced by an average recruit in a fished stock divided by the number of eggs that could be produced by an average recruit in an unfished stock. SPR can also be expressed as the spawning stock biomass per recruit (SSBR) of a fished stock divided by the SSBR of the stock before it was fished

Spawning Stock Biomass - The total weight of the fish in a stock that are old enough to spawn.

Spawning Stock Biomass Per Recruit (SSBR) - *The spawning stock biomass divided by the number of recruits to the stock or how much spawning biomass an average recruit would be expected to produce.

Species - A group of similar fish that can freely interbreed.

Sport Fishery - See recreational fishery.

Standing Stock - See biomass.

Stock - A grouping of fish usually based on genetic relationship, geographic distribution, and movement patterns. *Also a managed unit of fish.

Stock-Recruit Relationship - See spawner-recruit relationship.

Stressed Area - An area in which there is special concern regarding harvest, perhaps because the fish are small or because harvesters are in conflict.

Surplus Production Model - A model that estimates the catch in a given year and the change in stock size. The stock size could increase or decrease depending on new recruits and natural mortality. A surplus production model estimates the natural increase in fish weight or the sustainable yield.

Survival Rate(s) - The number of fish alive after a specified time, divided by the number alive at the beginning of the period.

T

TAC - See total allowable catch.

TIP - See trip interview program.

Territorial Sea - The area from average low-water mark on the shore out to three miles for the states of Louisiana, Alabama, and Mississippi and out to nine miles for Texas and the west coast of Florida. The shore is not always the baseline from which the three miles are measured. In such cases, the outer limit can extend further than three miles from the shore.

Total Allowable Catch (TAC) - The annual recommended catch for a species for species group. The regional council sets the TAC from the range of the allowable biological catch.

Total Mortality (Z) - A measurement of the rate of removal of fish from a population by both fishing and natural causes. Total mortality can be reported as either annual or instantaneous. Annual mortality is the percentage of fish dying in one year. Instantaneous mortality is that percentage of fish dying at any one time. The rate of total mortality may vary from species to species.

Trip Interview Program (TIP) - *A cooperative state-federal commercial fishery dependent sampling activity conducted in the Southeast region of NMFS, concentrating on size and age information for stock assessments of federal, interstate, and state managed species. TIP also provides information on the species composition, quantity, and price for market categories, and catch-per-unit effort for individual trips that are sampled.

U

Underutilized Species - A species of fish that has potential for large additional harvest.

Unit Stock - A population of fish grouped together for assessment purposes which may or may not include all the fish in a stock.

V

VPA - See virtual population analysis.

Virgin Stock - A stock of fish with no commercial or recreational harvest. A virgin stock changes only in relation to environmental factors and its own growth, recruitment, and natural mortality.

Virtual Population Analysis (VPA) - A type of analysis that uses the number of fish caught at various ages or lengths and an estimate of natural mortality to estimate fishing mortality in a cohort. It also provides an estimate of the number of fish in a cohort at various ages.

Y

Year-Class - The fish spawned and hatched in a given year, a "generation" of fish.

Yield - The production from a fishery in terms of numbers or weight.

Yield Per Recruit - A model that estimates yield in terms of weight (but more often as a percentage of the maximum yield) for various combinations of natural mortality, fishing mortality, and time exposed to the fishery.

Z

z - See intrinsic rate of increase.

Z - See total mortality.

Z' - See disappearance.

14.2 Market Channel Survey

SPOTTED SEATROUT and FLOUNDER MARKET CHANNEL SURVEY FOR THE GULF OF MEXICO REGION

******* PLEASE RESPOND TO THE FOLLOWING QUESTIONS WITH YOUR "BEST GUESS" ESTIMATES *******

(The following questions pertain only to spotted seatrout. Please do not include other species of seatrout in your responses. Also, "flounder" is defined as Gulf or Southern flounder.

1. FROM WHOM AND WHERE DID YOUR SUPPLY COME FROM?

A. Of the total volume of whole spotted seatrout and flounder you handled in 1995, what percent (estimate) were obtained directly from each of the following sources?

	Spotted Seatrout	Flounder
1. In-state Fishermen	_______ %	_______ %
2. Out-of-state Fishermen	_______ %	_______ %
3. In-state Wholesale Distributor/Processor	_______ %	_______ %
4. Out-of-state Wholesale Distributor/Processor	_______ %	_______ %
5. Other In-state Source (please describe _______________________)	_______ %	_______ %
6. Other Out-of-state Source (please describe _______________________)	_______ %	_______ %
TOTALS ——>	100 %	100 %

B. Of the total volume of spotted seatrout and flounder you handled in 1995, what percent (estimate) of each originated from foreign sources (i.e. imported from Mexico, Costa Rica, etc). 1. Spotted Seatrout _______ % 2. Flounder _______ %

2. DID YOU CUT IT, LEAVE IT WHOLE, FREEZE IT, OR WHAT?

A. Of the total volume of whole spotted seatrout and flounder you acquired in 1995, what percent (estimate) were processed into the following product forms prior to final sale by your firm?

	Spotted Seatrout	Flounder
1. Whole form (gutted, headed, eviscerated)	_______ %	_______ %
2. Fillets	_______ %	_______ %
3. Other (please describe _______________________)	_______ %	_______ %
TOTALS ——>	100 %	100 %

B. What percent (estimate) of the spotted seatrout and flounder you handled in 1995 were sold by your firm in frozen or fresh form?

	Spotted Seatrout	Flounder
1. Fresh	_______ %	_______ %
2. Frozen	_______ %	_______ %
TOTALS ——>	100 %	100 %

3. WHO DID YOU SELL IT TO AND HOW DID THEY WANT IT?

A. Of the total volume of spotted seatrout you handled in 1995, what percent (estimate) were sold to each of the following buyers?

	Spotted Seatrout	Flounder
1. In-state Wholesale Distributor/Processor	_______ %	_______ %
2. Out-of-state Wholesale Distributor/Processor	_______ %	_______ %
3. In-state Retailer (grocery, seafood market, etc)	_______ %	_______ %
4. Out-of-state Retailer	_______ %	_______ %
5. In-state Restaurant	_______ %	_______ %
6. Out-of-state Restaurant	_______ %	_______ %
7. Retail Consumer	_______ %	_______ %
TOTALS ---->	100 %	100 %

B. For each of the following types of buyers that you sell spotted seatrout and flounder to, please indicate the percentage of each product form bought in a typical year. Also, for each type of buyer, show the percentages of fresh versus frozen purchased.

SPOTTED SEATROUT - Product Forms

Buyers	Whole	Fillets	Other	---->Total		Fresh	Frozen	--->Total
Example: Retailer	*(25%)*	*(50%)*	*(25%)*	*100%*	.	*(75%)*	*(25%)*	*100%*
Wholesale Distributor/Processors	( )	( )	( )	100%	.	( )	( )	100%
Retailers	( )	( )	( )	100%	.	( )	( )	100%
Restaurants	( )	( )	( )	100%	.	( )	( )	100%
Retail Consumers	( )	( )	( )	100%	.	( )	( )	100%
Others (please describe _____________)	( )	( )	( )	100%	.	( )	( )	100%

FLOUNDER - Product Forms

Buyers	Whole	Fillets	Other	----> Total		Fresh	Frozen	--->Total
Example: Restaurants	*(50%)*	*(50%)*	*(0%)*	*100%*	.	*(100%)*	*(0 %)*	*100%*
Wholesale Distributor/Processors	( )	( )	( )	100%	.	( )	( )	100%
Retailers	( )	( )	( )	100%	.	( )	( )	100%
Restaurants	( )	( )	( )	100%	.	( )	( )	100%
Retail Consumers	( )	( )	( )	100%	.	( )	( )	100%
Others (please describe _____________)	( )	( )	( )	100%	.	( )	( )	100%

4. WHERE ARE YOU LOCATED?

In what states do you operate fish houses where spotted seatrout and/or flounder are handled? Indicate the number operated in each of the states listed.

	Number
Texas	_________
Louisiana	_________
Mississippi	_________
Alabama	_________
Florida	_________

THAT'S IT!!

PLEASE FOLD COMPLETED QUESTIONNAIRE AND PLACE IN POSTAGE-PAID RETURN ENVELOPE IMMEDIATELY. THANKS

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